MARINE BIOLOGICAL LABORATORY

CHEMICAL HYGIENE PLAN

MARCH 2024

APPROVAL:

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1 INTRODUCTION

The Marine Biological Laboratory (MBL) is committed to providing a safe work environment for faculty, staff, students and visitors in accordance with the Occupational Safety and Health Administration (OSHA) requirements in 29CFR 1910.1450 "*Occupational Exposure to Hazardous Chemicals in Laboratories*" which is also referred to as the OSHA Laboratory Standard.

1.1 Purpose

The purpose of the Chemical Hygiene Plan (CHP) is to provide a written program to MBL laboratory personnel for working safely within the laboratory setting. The CHP complies with the requirements of the OSHA Laboratory Standard, local, state and federal regulations. This plan describes proper laboratory practices, procedures, personal protective equipment, hazard identification and exposure control.

All Centers and Divisions should maintain a current copy which is readily available to all personnel in their unit of oversight.

1.2 Scope and Applicability

The Chemical Hygiene Plan applies to all individuals at MBL who are involved in the laboratory use of hazardous materials. These individuals include the Responsible Researchers (Course Directors, Resident Faculty, Whitman Scientists, Visiting Scientists, and other Principal Investigators), Laboratory Supervisors, laboratory managers, laboratory staff, scientists, visiting scholars and students.

1.3 Chemical Hygiene Plan Review

The Chemical Hygiene Officer (CHO) shall review the CHP annually for effectiveness and update the document, as necessary. The CHO may seek advice from the Principal Investigators, Course Directors, Laboratory Supervisors, and laboratory personnel regarding the usefulness and clarity of the written CHP.

All new laboratory staff must read the CHP as part of their MBL orientation program. MBL laboratory staff should read the CHP annually and upon notice of an updated plan.

2 ROLES AND RESPONSIBILITIES

Roles and responsibilities for applicable MBL personnel for implementation, review, training, supervisory oversight, and adherence to MBL policies as stated in this Chemical Hygiene Plan are specified below.

2.1 Chemical Hygiene Officer

- Reviews the effectiveness of the CHP annually, updating as appropriate.
- Creates and revises safety policies and procedures.
- Monitors procurement, use, storage, and disposal of highly hazardous chemicals.
- Conducts annual inspections of the laboratories to identify hazards and issues of non-compliance and then makes recommendations for corrective actions.
- Assists laboratory personnel in developing laboratory specific Standard Operating Procedures (SOPs).
- Participates in investigations of accidents, incidents, and near misses involving hazardous chemicals.

2.2 Environmental, Health and Safety (EHS) Manager

- Provides assistance and support to laboratory personnel concerning appropriate storage, handling, and disposal of hazardous chemicals.
- Assists in cleanup and/or decontamination of hazardous spills.
- Advises, coordinates, and maintain records for hazardous waste disposal.
- Develops and conducts safety training specific to laboratory operations.
- Inspects safety equipment annually which includes safety showers, eyewash stations, and chemical fume hoods.

2.3 Center or Division Directors

- Responsible for laboratory personnel engaged in use of hazardous chemicals.
- Informs faculty, staff, students and visitors working in laboratories within their Divisions/Centers about MBL safety policies.
- Advise Principal Investigators, laboratory staff, visiting scholars, and students of required laboratory safety training before working with hazardous chemicals.
- Provide the Chemical Hygiene Officer with the support necessary to implement and maintain the Chemical Hygiene Plan within their Center or Division.

2.4 Responsible Researchers

- Review and understand the CHP and applicable laboratory specific SOPs before beginning work with hazardous chemicals.
- Responsible for ensuring the CHP is followed within their laboratories.
- Ensure that their staff attends laboratory specific training.
- Enforce safe laboratory practices and engineering controls are in place to minimize the potential exposure to hazardous chemicals.
- Ensure that equipment and PPE are available and functioning properly, and that appropriate training has been provided.
- Mitigate risks identified in the annual laboratory inspection conducted by the Chemical Hygiene Officer.

2.5 Laboratory Personnel

- Review and understand the CHP and laboratory specific SOPs.
- Read and understand Safety Data Sheets (SDS) for the chemicals used.
- Responsible for following all safe work practices and using proper precautions required by this CHP.
- Consult with supervisor or Safety Office when uncertain of risk or hazards.

3 HEALTH AND PHYSICAL HAZARDS OF CHEMICALS

Chemical exposures can result from inhalation, ingestion, absorption, or injection of hazardous chemicals. While the Chemical Hygiene Plan's main purpose is to prevent exposure, this plan also informs personnel of the effects of a possible exposure. Below are some of the health and physical hazards of chemicals which may be present in various laboratories in MBL. It should be noted that many chemicals exhibit multiple types of health and physical hazards.

3.1 Health Hazards

3.1.1 Corrosives

Corrosives can cause severe tissue damage. A corrosive chemical is defined as a liquid with a pH ≤ 2 or >12.5. The major classes of corrosive chemicals include strong acids (sulfuric acid, nitric acid, hydrochloric acid, and hydrofluoric acid), strong bases (sodium hydroxide, potassium hydroxide, and ammonium hydroxide), dehydrating agents (sulfuric acid, sodium hydroxide, phosphorus pentoxide, and calcium oxide), oxidizing agents (hydrogen peroxide, chlorine, and bromine), phenol and glutaraldehyde. Personnel handling corrosive chemicals should implement the appropriate controls to minimize the likelihood of exposure to a corrosive chemical.

3.1.2 Irritants

Irritants are substances that cause reversible effects (swelling or inflammation) on living tissue (skin, eyes, lungs, and mucous membranes) by chemical reaction at the site of contact. Many organic and inorganic compounds that are in powder or crystalline form are irritants. While irritants are not as hazardous as corrosives, similar care should be taken to avoid their contact.

3.1.3 Sensitizers

A sensitizer is a substance that can cause hypersensitivity and an allergic reaction in normal tissue after repeated exposure to the substance. Allergic reactions may be immediate or delayed, occurring after several hours or even days following exposure. Examples of chemicals that may cause allergic reactions include formaldehyde, phenol derivatives, latex, and isocyanates. Caution to avoid initial exposure to sensitizers should be taken, however if a

chemical hypersensitivity develops contact your supervisor or the Safety Office to discuss ways to further avoid exposure.

3.2 Particularly Hazardous Substances

Laboratories that use Particularly Hazardous Substance (PHS) should develop laboratory specific SOPs for these chemicals. The laboratory specific SOP should include procedures for establishing a designated area, safe storage, use and handling, waste handling and disposal, and emergency procedures.

3.2.1 Carcinogens

A carcinogen is a substance or a mixture of substances which can cause cancer or tumor development. Carcinogens are chronically toxic substances; where their effects may only become evident after a long latency period and may cause no immediate harmful effects. There are many different types of carcinogens in terms of regulatory definitions. Select carcinogens are substances or agents that are regulated by OSHA as carcinogens; listed under the category "*known to be carcinogens*" or "*reasonably anticipated to be carcinogens*"; in the Annual Report of Carcinogens published by the National Toxicology Program (NTP) latest edition; or listed by the International Agency for Research on Cancer (IARC) Monographs as Group 1(carcinogenic), Group 2A (probably carcinogenic) or Group 2B (possibly carcinogenic). Common examples of select carcinogens include chloroform, cobalt and nickel compounds, formaldehyde, and dichloromethane.

A subset of select carcinogens include “Regulated Carcinogens” which are chemicals regulated by OSHA under certain standards such as formaldehyde, benzene, dichloromethane, and ethylene oxide. OSHA also has ”Listed Carcinogens” that are regulated under 13 Carcinogens Standard (29 CFR 1910. 1003). These 13 carcinogens have some of the highest restrictions regarding their use, storage and disposal.

3.2.2 Reproductive Toxins

Reproductive toxins are substances which affect reproductive systems (fertility, gestation, lactation, and general reproductive performance) or can cause damage to a fetus. Many reproductive toxins cause damage after repeated exposures to low levels and then their effects manifest after long latent periods. Some reproductive toxicants found in the laboratory include ethidium bromide, toluene, and lead.

3.2.3 Highly Acutely Toxic Chemicals

Highly acutely toxic chemicals can cause immediate harm and possible death in the event of an exposure. Median lethal dose (LD50) experiments in animal models are typically reported and used to determine if a chemical has a high degree of acute toxicity. These tests are administered orally, dermally and via inhalation. Chemicals considered highly toxic have an oral LD50 less than or

equal to 50mg/kg for rats, dermal LD50 of 200 mg/kg when administered by continuous contact for 24 hours to rabbits, or median lethal concentration (LC50) of 200 ppm or 2 mg/l when administered by continuous inhalation for 1 hour to rats. Common examples include sodium cyanide, hydrofluoric acid, and carbon monoxide.

3.2.4 Select Agent Toxins

Select Agent Toxins are specific toxins of biological origin which are subject to stringent regulatory requirements under 42 CFR 73. Special precautions should be taken whenever handling concentrated forms, even in small amounts. Due to the high toxicity and restricted use, MBL's requirements are reference separately under the MBL Select Agent Toxin Policy.

3.3 Physical Hazards

3.3.1 Flammables

Flammable and combustible liquids can ignite readily and are regarded as fire hazards. A flammable chemical is a liquid with a flash point below 100 degrees Fahrenheit. A combustible liquid has a flash point between 100 and 200 degrees Fahrenheit. Flammable chemicals should be stored in areas with proper ventilation to avoid buildup of explosive concentrations of flammable vapors.

3.3.2 Pyrophorics

Exposure of pyrophoric chemicals to air can ignite which can result in serious burns. Pyrophoric chemicals are extremely reactive toward oxygen and/or water and must never be exposed to the atmosphere. Common examples of pyrophoric chemicals include sodium hydride, triethylaluminium, lithium aluminium hydride and silane. Special techniques or additional engineering controls are required to handle pyrophoric chemicals.

3.3.3 Water Reactive Chemicals

Water reactive chemicals are materials that can release a toxic or flammable gas when in contact with water. Some chemicals react so violently with water that even the humidity in the air can cause a reaction. Laboratory chemicals that are water reactive include lithium, trichlorosilane, and sodium hydride. Laboratory specific handling and training is required for that handling of water reactive chemicals.

3.3.4 Potentially Explosive Chemicals

Research laboratories in MBL do not generally handle explosive chemicals such as trinitrotoluene (TNT). However, some laboratories regularly handle and store chemicals that may become explosive upon decomposition, polymerization, oxidation or drying out. A common potentially explosive chemical is picric acid which is extremely sensitive to detonation when it

becomes dry. Also very common are peroxide forming chemicals. These chemicals can form explosive crystals after being exposed to air. These chemicals must be dated when they are received and when they are opened. All potentially explosive chemicals require tracking and monitoring.

3.3.5 Compressed Gases

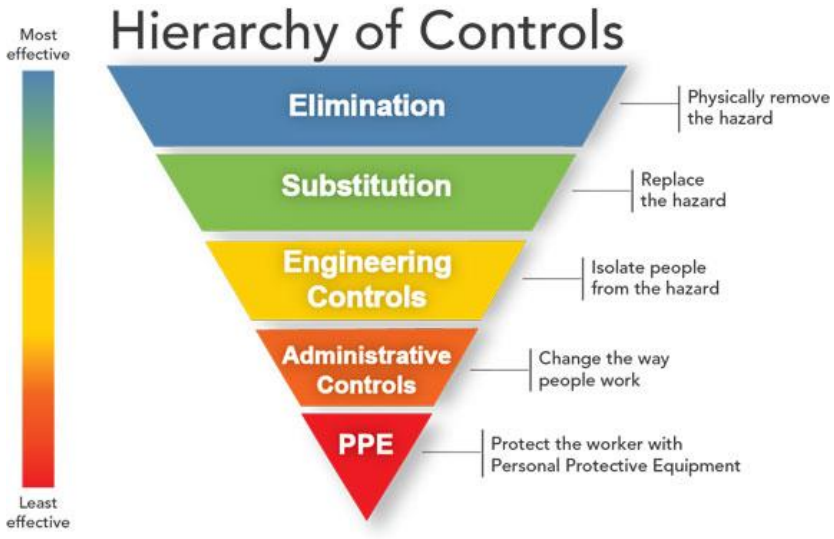
Compressed gas cylinders present both physical and chemical hazards. Mechanical damage, excessive heat or faulty valves/regulators may result in rapid uncontrolled release of the cylinder contents. This release could result in fire, explosion, asphyxiation, or frost bite. For example, frost bite can result from improper handling of liquid nitrogen which is a cryogenic liquid stored in Dewars. Precautions must be taken to prevent cryogenic material from coming into contact with the skin. Handling of compressed gas cylinders requires laboratory specific training.

3.3.6 Oxidizers

Oxidizers can initiate or promote combustion in other materials through a chemical reaction. This chemical reaction can cause a fire or explosion. Oxidizers such as nitric acid, osmium tetroxide, pure oxygen (gas or liquid), potassium permanganate, and hydrogen peroxide (concentrations ≥ 30%) should be carefully stored and handled to avoid accidental mixing with flammables or other incompatible chemicals.

4 CONTROL MEASURES FOR HAZARDOUS CHEMICALS

Elimination, substitution, engineering controls, administrative controls, and personal protective equipment (PPE) are basic principles used to control hazards and minimize exposure to hazardous chemicals. Before the proper controls can be selected, a hazard assessment of the process, activity, or material should be conducted.



Source: http://www.cdc.gov/niosh/topics/hierarchy/images/hierarchycontrols.jpg

4.1 Elimination and Substitution

Elimination is the most effective control as it removes the hazard completely. Unfortunately, it is not plausible for most hazards in a laboratory. Most commonly this would include removing a chemical that is no longer used or eliminating a hazardous process.

Substitution is also effective at reducing the hazard, by switching the chemical or process with one that is similar. This could mean using a chemical that is less toxic or a form of the chemical that is less hazardous. A common example would include using SYBR Safe or SYBR green instead of ethidium bromide for staining DNA gels.

4.2 Engineering Controls

Engineering controls are pieces of equipment designed to reduce exposure to hazardous chemicals or other research hazards. Engineering controls include isolation, source modification and ventilation.

4.2.1 Isolation

For an engineering control, isolation works by inserting a barrier between a hazard and those who might be affected by that hazard. Separating personnel from a hazardous operation, process, equipment, or environment using a physical barrier (interlock system for lasers or equipment) or even distance may provide the necessary reduction of exposure.

4.2.2 Source Modification

Source modification involves changing a hazard source to make it less hazardous. For example, lowering the temperature of hazardous volatile liquids will reduce off-gassing and vaporization.

4.2.3 Ventilation (Chemical Fume Hood)

The most common engineering control used in a laboratory is a chemical fume hood. As general room ventilation may not provide adequate protection against hazardous vapors, performing work in a chemical fume hood will. Fume hoods work by drawing air into the hood through the front sash and out through the top and back of hood where it is exhausted to the outside. All work with toxic or hazardous substances shall be conducted only in a properly functioning chemical fume hood.

The following are guidelines for performing work in a chemical fume hood:

- Verify whether the chemical fume hood has been certified within the last year (check sticker with date).
- Assess whether the hazardous chemical can be used in the fume hood.

- Conduct experimental procedures at least 6 inches behind the plane of the sash.
- Never put your head inside a fume hood to check on experiment.
- Work with the sash as low as possible to protect your face and body.
- Minimize human traffic in front of the fume hood while performing procedures inside the hood.
- Minimize storing bottles, chemicals, or equipment in fume hood. Excess materials will restrict proper airflow and reduce the workspace.
- When not in use, the fume hood should be kept closed with vertical sash down. Closing the hood helps to prevent the spread of a fire, spill, or other hazards into the laboratory.
- Immediately report any suspected fume hood mechanical failure to the Safety Office at x7424 or the Plant Operations & Maintenance (POM) Manager at x7771.

4.3 Administrative Controls

Administrative controls are changes in work procedures such as written safety guidelines, rules, supervision, schedules, signs, labels, SDSs, and training to reduce employee exposure to hazardous chemicals. At MBL, training is one of the more heavily emphasized administrative controls for all laboratory staff.

Laboratory personnel shall follow the administrative controls listed below:

- Complete the required safety training (see section 5) and participate in laboratory specific trainings.
- Review and document adherence to laboratory specific SOPs.
- Use the smallest amount of the hazardous material that is feasible.
- Select, use and maintain Personal Protective Equipment.
- Do not eat, drink, chew gum or apply cosmetics in the laboratory.
- Remove gloves and wash hands and arms with soap and water before leaving the work area or handling common items like phones, keyboards and doorknobs.
- Properly manage and dispose of all hazardous chemicals and wastes.
- Keep all work areas clean and neat.
- Report any unsafe conditions to the Responsible Research/Laboratory Supervisor or Safety Office.

4.4 Personal Protective Equipment

Personal Protective Equipment (PPE) shall be made available to laboratory personnel who are working with hazardous materials. PPE may include, safety glasses, laboratory coats, protective safety gloves, face shield and/or splash aprons. The purpose of the PPE is to provide a barrier between the wearer and the hazard. PPE is the least effective method of hazard control as it is highly

dependent on the user to make sure it fits properly, is in good working condition, and is compatible with the hazards present.

4.4.1 Body and Foot Protection

While working in the laboratory, personnel should wear pants or appropriate clothing that covers the lower extremities to the ankles. For footwear, closed-toed shoes must be always worn in the laboratory. Open toed-shoes, sandals or flip-flops are prohibited in the laboratory. Laboratory coats are recommended to be always worn while working in the laboratory. When working with hazardous chemicals, laboratory coats are required. Depending on the type of work, additional PPE such as aprons may be necessary. Laboratory coats and/or aprons must be removed before leaving the laboratory.

4.4.2 Hand Protection

Hands are the most likely parts of the body to come into contact with chemicals. Skin contact with chemicals may cause irritation, burns, or absorption of the chemical into the blood stream.

Chemical resistant gloves should be worn whenever handling hazardous chemicals or whenever there is a possibility of contact with hazardous materials. Gloves should be selected on the basis of the materials being handled, the particular hazard involved, and their suitability for the operation being conducted. Nitrile examination gloves offer better chemical protection than either latex or vinyl gloves. All laboratories that use chemicals are strongly encouraged to stock and use nitrile gloves. Laboratory gloves must be removed before leaving the laboratory.

4.4.3 Eye and Face Protection

The eye protection chosen for specific work situations depends upon the nature and extent of the hazard, the circumstances of exposure, other protective equipment used, and personal vision needs. Eye protection should be fit to an individual or adjustable to provide appropriate coverage. Personal protective eyewear includes, safety glasses, splash goggles and face shields. Safety glasses should be worn in all laboratories and must be worn for work with hazardous chemicals. Chemical splash goggles shall be used if a splash hazard exists in any operation involving hazardous chemicals. Face shields are required for high hazard operation such as potentially explosive or chemicals with a high degree of dermal toxicity.

4.4.4 Respiratory Protection

The use of air-purifying respirators for routine laboratory work is not recommended. Exposure to potentially hazardous chemicals should be minimized through engineering controls (fume hoods) and administrative controls.

Any personnel that are required to wear a respirator must comply with the provisions of the OSHA Respiratory Protection Standard (29 CFR 1910.134). This Standard specifies medical evaluation, training, fit testing and selection guidelines for proper use of respirators. Do not use respiratory protective equipment until you have met all elements of a written Respiratory Protection Program. Contact the Safety Office at x7424 before considering using respiratory protection.

4.5 Laboratory Safety Equipment

Safety equipment at MBL includes eyewash stations, safety showers, fire extinguishers and first aid kits. Responsible Researchers are responsible for ensuring all laboratory personnel are aware of the location of the nearest safety shower and eyewash station and how to use the safety equipment. Laboratory staff must ensure that safety showers and eyewash stations are free from obstruction. The Safety Office will inspect and test eyewash stations and safety showers annually. Plant Operations & Maintenance (POM) personnel oversee maintenance of all fire safety equipment installed at MBL with fire extinguishers evaluate yearly by an outside vendor.

4.5.1 Eyewash Stations

Eyewash stations are available to rinse contaminants from eyes in the event of an exposure to hazardous substances. An eyewash station is located inside the laboratory or in the connecting hallway which is within 10 seconds travel time from the hazard. These locations are marked with a highly visible “EYEWASH” sign. The eyewash stations provide a continuous, soft stream of tepid water simultaneously to both eyes. To activate either push handle away or pull-down eyewash fixture, position eyes in full stream, and continue flushing for at least 15 minutes. Each laboratory should evaluate on a weekly basis that eyewash station is functioning properly and there are no obstructions for use.

4.5.2 Safety Showers

Safety showers are available to rinse contaminants from the body in the event of an exposure to hazardous substances. Safety showers also can serve to extinguish a fire on a person. Safety showers are located inside the laboratory or in the connecting hallways which is within 10 seconds of travel time from the hazard. Safety showers provide at least 20 gallons of water per minute of tepid water. Upon exposure to body, remove outer clothing (laboratory coat), activate shower by simply pulling down handle and remain under shower for recommended 15 minutes. The Safety Office performs annual inspections which includes flushing and regularly observes that stations are not obstructed.

4.5.3 Fire Extinguishers

Fire extinguishers are easily accessible in hallways and/or laboratories by all personnel at MBL. Fire extinguishers are generally mounted either near an exit or at the back of the laboratory. There should be at least one extinguisher in each laboratory. MBL provides laboratory areas with multi-purpose, dry chemical (ABC) and carbon dioxide (BC) extinguishers. Before considering using a fire extinguisher, pull the nearest fire alarm, call for Fire Department dialing 9-911 and MBL Security at x7911 to report a fire. Only trained employees should attempt to put out a fire (Refer to MBL Fire Plan). All extinguishers are inspected annually by POM or outside vendor. An inspection tag is attached to each extinguisher, indicating the date of the last inspection.

4.5.4 First Aid Kits

First aid kits should be accessible, and their location known to laboratory personnel. Items should be in good condition and unexpired. Supplies include bandages, burn cream, antiseptic ointment, absorbent compress, and tape. Laboratories which contain chemicals requiring special treatment for exposure, must have antidote within laboratory.

5 LABORATORY SAFETY TRAINING

Laboratory safety training will be provided for laboratory personnel prior to starting work in the laboratory; before working with newly introduced hazards chemicals; before use on new or altered equipment; and when any changes are made to the laboratory specific SOPs or the Chemical Hygiene Plan.

All laboratory staff working in a laboratory shall be trained on the contents of the Chemical Hygiene Plan and all applicable SOPs that are pertinent to a procedure, experiment, or task. Training shall include but is not limited to:

- Provisions of the Chemical Hygiene Plan.
- Hazards in the laboratory.
- OSHA regulated substances or recommended exposure limits.
- Signs and symptoms associated with exposures to hazardous chemicals.
- Safe handling, storage, and disposal of hazardous chemicals.
- How to read a Safety Data Sheet.
- Selection and use of personal protective equipment.

The Responsible Researchers/Laboratory Supervisor will provide the following information to laboratory personnel prior to working with any chemical:

- The availability and location of the MBL's Chemical Hygiene Plan.
- Access to Safety Data Sheets (SDS) for all hazardous chemicals used by the employee.

- Location and availability of any laboratory specific SOPs for operations the employee will conduct.

5.1 General Laboratory Safety Training

MBL's Safety Office shall provide general laboratory safety training and orientation to MBL policies. This training covers general laboratory safety, safe work practices, chemical safety, and emergency procedures.

The Safety Office will provide initial training to new employees either through a lecture or by online training. Similarly, the Safety Office will provide a required annual refresher training which is consistent with the information provided in the CHP by lecture or online.

5.2 Laboratory Specific Safety Training

All laboratory staff shall receive training on laboratory specific operations, experiments or procedures by the Responsible Researcher or another experienced laboratory staff member. The training should address the specific chemical hazards and emergency procedures specific to the laboratory.

Responsible Researchers/Laboratory Supervisors shall provide training related to laboratory specific hazards and SOPs prior to commencing with applicable procedures.

5.3 Recordkeeping

The Responsible Researcher/Laboratory Supervisor shall keep a copy of the outline of the topics covered in laboratory specific safety training. All training records shall be kept on file and then held for at least 3 years after an employee or student leaves the MBL.

The Safety Office shall maintain records for employee laboratory safety training (Chemical Hygiene Plan and general training), employee exposure monitoring (when applicable) and compliance records.

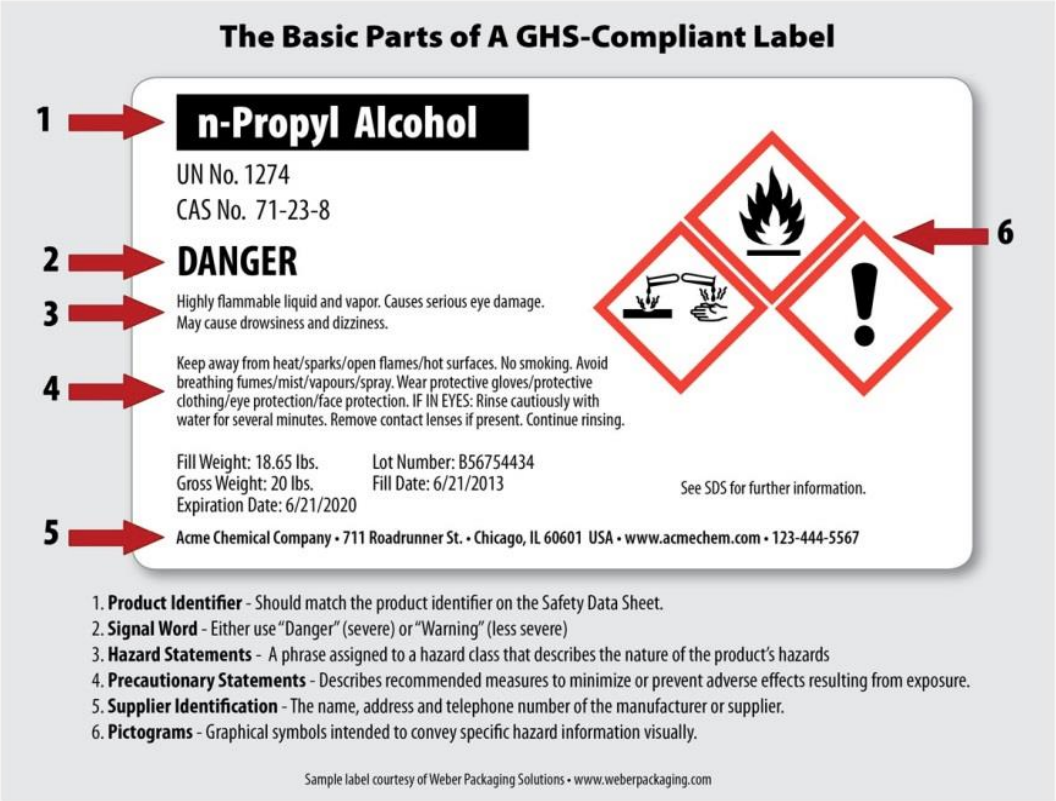
6 Hazard Communication in Laboratories

The effective communication of hazards present in the laboratory is not only necessary for the safety of the researchers/students, but also for the safety of the support staff and emergency personnel. Therefore, MBL emphasizes and encourages all laboratory staff to learn and understand the labeling of chemicals, the updated Globally Harmonized System of Classification (GHS) and information provided within a Safety Data Sheet (SDS).

6.1 Labeling of Chemicals

All chemical containers must be labeled with the chemical contents and hazard associated with the chemical. All containers into which chemicals are transferred should be legibly labeled in English and must include the chemical name(s) and hazard warnings (abbreviations or chemical formulas are not allowed). Labeling of all chemical containers enables laboratory personnel and emergency responders in identifying potential hazards in an emergency situation, such as chemical spill, fire or personnel exposure.

Labels on purchased containers must not be removed or defaced (unless container has been emptied and sufficiently rinsed). Manufacturers and importers of chemicals must provide a label that includes a signal word (DANGER, WARNING), pictogram(s), hazard statement(s), and precautionary statement(s) based on the hazard classification and category of the chemical. The elements that make a label GHS compliant is described in the figure below.



MBL strongly encourages the practice of dating containers with both date received and date opened. Dating chemicals is particularly vital for chemicals with a short shelf life, such as peroxide formers (potential for explosion).

When containers are located without appropriate labeling, this unknown solution of potentially hazardous chemicals becomes an expensive cost for disposal. All laboratory personnel who are leaving MBL are responsible for identifying and properly disposing of the unwanted chemicals and chemical waste in their laboratory.

6.2 GHS Pictograms

The Globally Harmonization System (GHS) uses standardized pictograms to convey the various health and physical hazards of chemicals. These pictograms are found on chemical labels (as shown above) and can be found on many other documents and warnings that describe chemical hazards. Please refer to the figure below with the GHS approved pictograms and their meanings.

Health Hazard  Carcinogen Mutagenicity Reproductive Toxicity Respiratory Sensitizer Target Organ Toxicity Aspiration Toxicity	**Flame**  Flammables Pyrophorics Self-Heating Emits Flammable Gas Self-Reactives Organic Peroxides	**Exclamation Mark**  Irritant (skin and eye) Skin Sensitizer Acute Toxicity Narcotic Effects Respiratory Tract Irritant Hazardous to Ozone Layer (Non-Mandatory)
Gas Cylinder  Gases Under Pressure	**Corrosion**  Skin Corrosion/Burns Eye Damage Corrosive to Metals	**Exploding Bomb**  Explosives Self-Reactives Organic Peroxides
Flame Over Circle  Oxidizers	**Environment** (Non-Mandatory)  Aquatic Toxicity	**Skull and Crossbones**  Acute Toxicity (fatal or toxic)

6.3 Chemical Inventory

Each laboratory shall maintain an accurate and current chemical inventory for all chemicals stored or used within that laboratory. The Responsible Researcher or designee shall review and update the chemical inventory at least annually to ensure accuracy and completeness.

The Safety Office shall provide a template to each laboratory for creating or updating their chemical inventory. Each laboratory shall keep a copy of the chemical inventory in the laboratory and make available to the Safety Office upon request.

6.4 Safety Data Sheets (SDS)

A Safety Data Sheet (SDS) is a document created by the chemical manufacturer. It summarizes safety and health information for a hazardous substance or material. Information found on an SDS includes chemical and physical characteristics, handling procedures, storage and disposal information, and signs and symptoms of exposure.

The OSHA Hazard Communication Standard requires accessibility to up to date SDSs for each hazardous chemical. The Responsible Researcher or designee is responsible for obtaining the SDSs for chemicals used and stored within their laboratory. Laboratories are strongly encouraged to maintain copies of SDSs for the laboratory's most hazardous chemicals. These SDSs should be maintained in a central location within each laboratory that is accessible to all laboratory personnel. If an SDS is not included in the shipment for the chemical, the person receiving the shipment shall contact the chemical manufacturer or vendor to request the SDS. The Safety Office will provide assistance in obtaining a SDS for any chemical handled or stored at MBL**.**

MBL has purchased the rights to access MSDSOnline (an electronic inventory system for SDSs) which stores SDSs applicable to MBL. Faculty, staff and students at MBL can readily access SDSs online through this vendor. The Safety Office highly recommends laboratory staff to put the link below on their desktop for easy access.

https://msdsmanagement.msdsonline.com/company/AB2792A1-E462-4073-A176-A44BF345AD1E.

Below are the different sections as required by GHS.

Section 1	**Identification** includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.
Section 2	**Hazard(s) identification** includes all hazards regarding the chemical; required label elements.
Section 3	**Composition/information on ingredients** includes information on chemical ingredients; trade secret claims.
Section 4	**First-aid measures** includes important symptoms/ effects, acute, delayed; required treatment.
Section 5	**Fire-fighting measures** lists suitable extinguishing techniques, equipment; chemical hazards from fire.

Section 6 **Accidental release measures** lists emergency procedures; protective equipment; proper methods of containment and cleanup.
Section 7 **Handling and storage** lists precautions for safe handling and storage, including incompatibilities.
Section 8 **Exposure controls/personal protection** lists OSHA's Permissible Exposure Limits (PELs); ACGIH Threshold Limit Values (TLVs); and any other exposure limit used or commended by the chemical manufacturer, importer, or employer preparing the SDS where available as well as appropriate engineering controls; personal protective equipment (PPE).
Section 9 **Physical and chemical properties** lists the chemical's characteristics.
Section 10 **Stability and reactivity** lists chemical stability and possibility of hazardous reactions.
Section 11 **Toxicological information** includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.
Section 12 Ecological information.
Section 13 Disposal considerations.
Section 14 Transport information.
Section 15 Regulatory information.
Section 16 **Other information,** includes date of preparation or last revision.

6.5 Laboratory Safety Placards

A hazard and emergency information sign (laboratory safety placard) should be posted on the main laboratory entrance door (facing the hallway). The placard will alert any individual entering the room with pertinent hazards and specify required personal protective equipment to be worn in room when engaging in the handling and use of chemicals. In addition, the placard serves to notify emergency response personnel of these hazards during an emergency.

The sign identifies the chemical hazards classes using applicable pictograms which may include: Corrosive, Flammable, Compressed Gas, Carcinogen, or Biohazard. The placard will also include applicable administrative controls such as No Food or Drink and No Smoking Allowed using appropriate pictograms. In addition, the Responsible Researcher and other designated personnel are listed with contact information in the event of an emergency (accident, chemical spill, fire, or personal injury).

The Responsible Researcher/Laboratory Supervisor should review the signs at least annually or whenever relevant information on the sign changes. Contact the Safety Office at x7424 with placard updating or with any questions.

6.6 Visiting Scientists at MBL

Prior to a Visiting Scientist beginning work in a laboratory at MBL, they will complete a MBL online safety training course which includes the following topics: chemical safety, use of PPE, waste disposal, spill response and emergency protocols.

MBL is responsible for obtaining information from Visiting Scientists on all hazardous chemicals used while at MBL. Any hazardous chemicals brought to the MBL must comply with the following requirements; provide an inventory of the hazardous chemicals with availability of SDSs, ensure all chemical containers are properly labeled, remove all unused chemicals after their work is complete (or contact safety for onsite storage), and arrange for proper disposal of all hazardous and non-hazardous wastes by contacting the Safety Office at 508-289-7424 or safety@mbl.edu.

6.7 Contractors Working at MBL

Prior to a contractor commencing work at MBL, MBL is responsible for providing contractors with the following information; a list of hazardous chemicals to which the contractor's employees may be exposed, information about the labeling system, any protective measures pertinent to area of work, location of SDS, and the provisions of the MBL Chemical Hygiene Plan.

MBL is responsible for obtaining information from contractors on all hazardous chemicals to which MBL employees may be exposed as a result of the contractor's work at the MBL premises. Contractors who bring hazardous chemicals on-site at the MBL must comply with the following requirements; provide an inventory of the hazardous chemicals with copies of SDSs to the Plant Operations & Maintenance (POM) Manager, ensure all chemical containers are properly labeled, remove all unused chemicals after the project is complete, and arrange for proper disposal of all hazardous and non-hazardous wastes by contacting the Safety Office at 508-289-7424 or safety@mbl.edu.

7 GENERAL LABORATORY SAFETY PRACTICES

7.1 Housekeeping

Often laboratories will have numerous researchers and will require the sharing of common chemicals and equipment. As such it is good to establish, communicate, and document laboratory specific rules that extend beyond those listed in this Chemical Hygiene Plan. The rules and suggestions discussed here are for safety and compliance.

- Keep all aisles, doorways, and areas around emergency equipment (safety eyewash, safety shower, fire extinguishers) clear. In case of an emergency, personnel will need to safely evacuate or have access to emergency equipment.
- Chemicals should be stored in appropriate cabinets and designated storage rooms. This will allow laboratory workers to easily find chemicals, prevent incompatible storage, and maintain compliant volumes of chemicals. Storage of corrosive chemicals on upper shelves is restricted to prevent accidental exposure to the eyes. All chemical storage above eye level should be discouraged.
- Secondary containers made out of a chemically compatible material (plastic tubs) are to be used to store corrosives, particularly hazardous substances, and liquid hazardous wastes. Secondary containers are also suitable to segregate incompatible chemicals. These containers should be able to hold at least 110% of the volume of the largest container in case of spill or bottle breakage.
- Refrigerators or freezers storing flammable chemicals must be UL Listed as being acceptable for the storage of flammables. Any refrigerators or freezers in the laboratory not UL Listed as acceptable for the storage of flammables should have a sign indicating “No Flammable Storage.” Also, no food or drink is permitted inside the laboratory refrigerators or freezers which should be clearly labeled “Not for Human Consumption.” Laboratory-use ice machines should also clearly be labeled “Not for Human Consumption.”
- Laboratory personnel should keep their benches and workspaces (including fume hoods) clean and clear of excessive clutter. There should be no sign of spill or contamination present. Clean benches and workspaces minimize the possibility of contamination of personnel and experiments. Excessive clutter can also be a research quality and safety issue. In particular, excessive storage in fume hoods can impede the air flow and should be avoided.
- Remove gloves before leaving the laboratory or when working on computers where glove usage is not universally followed. Cross-contamination from gloves touching commonly used items such as door handles and elevator buttons is unacceptable. An appropriate method when going between laboratories is to take one glove off and using the ungloved hand for items such as door handles and elevator buttons.
- Keep an accurate inventory and review it at least annually. Annual review can discover chemicals that can become unstable over time before they become extremely hazardous (and expensive) to handle. Annual inventory can also promote the disposal of chemicals no longer needed. Inventories are important for the laboratory and can prevent costly purchases of chemical already in their possession. Storage of extra chemicals becomes difficult as laboratory space is limited.
- When possible, purchase in small quantities. Ordering larger quantities of a chemical than needed causes difficulty finding an acceptable storage location and might lead to the expiration or deterioration of a chemical.

7.2 Personal Hygiene

When working in a laboratory personal hygiene is very important. Laboratory personnel should always wash their hands after handling chemicals, before leaving for lunch, and at the end of the workday. Long hair and loose clothing should be confined to prevent accidental contamination or entanglement. Laboratories should not have any food or drink stored and absolutely no consumption of food or drink is allowed. Finally, cosmetics including lotion and lip balm should not be used in the laboratory.

7.3 Transporting Chemicals

Chemicals may have to be transported from one laboratory to another or picked up from a stockroom. Always transport chemical containers in an appropriate secondary container to prevent the spread of a leak or spill. Do not transport incompatibles inside the same secondary container. Laboratories should use a non-metal cart that has lips on all four sides for spill prevention when transporting larger quantities of chemicals. Proper PPE including eye protection, laboratory coat, and gloves should be in possession when transporting chemicals.

7.4 Chemical Storage

Chemicals must be stored safely and properly to prevent accidental mixing, adverse reactions, and the spread of fire in an emergency. Proper chemical storage first involves the segregation of incompatible materials. Common incompatibles include flammables with oxidizers, acids with bases, inorganic acids with organic acids, and water reactive chemicals with aqueous solutions and alcohols. Please review the chemical Safety Data Sheet for specific incompatibilities. Incompatibles can be segregated by use of a secondary container. The secondary container should be chemically compatible and be able to hold 110% of the largest container. Chemicals should not be stored on the ground without secondary containment and away from where they can become a trip hazard. Please contact the Safety Office at x7424 or safety@mbl.edu with questions or concerns.

7.5 Working Alone in the Laboratory

Working in a laboratory alone with hazardous chemicals, procedures or equipment that may result in serious injury, illness or death is strongly discouraged. This information should apply to all laboratory spaces including shared facilities and teaching labs.

Any laboratory personnel (faculty, staff, or student) who intends to work alone in the laboratory using hazardous chemicals (pyrophoric materials, highly reactive materials, highly acutely toxic chemicals etc.) must discuss the task with their PI or Laboratory Supervisor prior to conducting the work alone.

The Responsible Researcher/Laboratory Supervisor should conduct a risk assessment to determine whether the risk of working alone can be effectively mitigated under the specific conditions. If determined that the risk cannot be minimized to an acceptable level, then the individual shall only perform work while others are present.

Any laboratory personnel who plan to work alone in the laboratory shall:

- Inform the Responsible Researcher/Laboratory Supervisor that they will be working alone and during what time period.
- Describe the scope of the experimental procedure.
- Assess the risks associated with the experimental procedure and equipment.
- Outline safety measures needed to minimize the risk such as engineering controls, appropriate PPE, and laboratory specific SOPs.
- Review the emergency response procedures.
- Review the Safety Data Sheet for specific hazardous chemical.

8 HAZARDOUS WASTE

The Safety Office will pick up hazardous chemical waste from the laboratories and provide for disposal in accordance with local, state, and federal hazardous waste regulations. The EH&S Manager will regularly monitor and arrange for pick-up for the Satellite Accumulation Areas (SAA) and disposal for the Main Accumulation Area (MAA) of hazardous waste.

8.1 Hazardous Waste Management

Hazardous waste chemicals regulated by the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection must be collected, labeled, packaged, and disposed of according to federal and state hazardous waste regulations.

Hazardous waste is any solid, liquid, sludge or containerized gas that is discarded, has served its intended use and shows any of the following characteristics:

a. Ignitable
b. Toxic
c. Corrosive
d. Reactive

The waste generator is responsible for adhering to proper waste management and disposal policies. Hazardous waste shall be collected in an appropriate container and stored in the SAA located in each laboratory, pending transfer to the MAA or pickup by a licensed third-party hazardous waste contractor.

8.2 Hazardous Waste Disposal

All laboratories shall use Satellite Accumulation Areas (SAA) for disposing of hazardous waste. SAAs are located at or near the point of generation and remain under the control of the person generating the waste. For smaller laboratories at MBL, the SAAs are located in general use laboratories.

- SAAs must be posted with the sign "**Satellite Accumulation AREA**".
- Hazardous waste in laboratory must be stored in the designated SAA.
- Containers storing hazardous waste must be in good condition to prevent leaks.
- Containers must be compatible with hazardous waste stored within them.
- Hazardous waste containers must be labeled with Hazardous Waste Labels provided by the Safety Office. The labels must include:

    a. Words "**Hazardous Waste**" (as included on MBL labels).
    b. Hazardous waste identified in words, such as Acetone or Toluene. Abbreviations or chemical formula are not allowed.
    c. Associated hazard(s) checked - Ignitable, Toxic, Corrosive, Reactive.
    d. Building, room number and name of Responsible Researcher where waste originated.
    e. The date when container became full.

- Except when waste is being added, containers must be closed at all times.
- Once dated, the hazardous waste container must be removed from the SAA to the MAA within three business days.
- SAAs must be inspected weekly by laboratory personnel to ensure containers are properly labeled and in good condition.

8.3 Expired, Obsolete or Unwanted Chemicals

Obsolete, expired or unwanted chemicals should not be kept in the laboratory's chemical stock area. They should be appropriately labeled with a hazardous waste label, dated and moved to the SAA for pick-up. For clean out of multiple chemicals, contact the Safety Office at x7424 for extra secondary containment bins and removal.

8.4 Biological Waste

Biological waste includes animal carcasses, contaminated needles, and syringes (sharps), cell culture wastes (liquid waste) and any biologically contaminated solid waste (dry waste). Biological waste must properly disposed as follows:

- Animal carcasses should be placed in appropriately sized plastic bags, tied up or zip-locked closed, labeled with Manager Name and Date and then placed in frozen storage located at Loeb room G11 or Rowe room 107.

- Dry waste shall be placed in an autoclave bag inside a bin marked with the universal biohazard symbol. Then properly treated (autoclaved) and disposed in outside dumpster (see MBL Autoclave SOP).
- Liquid waste can either be treated with a 10% bleach solution prior to drain disposal or autoclaved in appropriate container before drain disposal (see MBL Autoclave SOP).
- Sharps for disposal must be disposed in a red sharps container labeled with the universal biohazard symbol. Sharps containers are provided by the Safety Office. Contact Safety Office when container is filled at x7424.

8.5 Broken Glass Disposal

Glass bottles or broken glass shall be disposed in cardboard boxes marked "BROKEN GLASS ONLY'. These boxes are available through the Safety Office. Broken glass shall not be disposed in regular trash bins, recycling bins or in biohazard bags.

- Glass containers for empty non-hazardous chemicals can be disposed in the broken glass boxes.
- Glass containers for empty hazardous chemicals should be labeled and placed into Satellite Accumulation Areas. Alternatively, containers can be tripled rinsed (collecting rinsed waste as hazardous waste), label defaced and then disposed in a broken glass box.
- When close to full, seal the top of the box and notify Safety Office for pick-up.

9 CHEMICAL SPILLS AND ACCIDENTS

Chemical spills should only be cleaned up by trained, knowledgeable and experienced personnel. For chemical spills involving highly hazardous material outside of a fume hood or for a large spill of hazardous material, immediately contact Security at x7911.

9.1 Major Chemical Spill

A major chemical spill includes the following situations:

- A chemical spill involves a highly hazardous (highly toxic) material outside of the fume hood.
- When a chemical spill includes an individual being exposed to a highly hazardous material.
- A large quantity of hazardous material has been spilled exceeding a 1-liter volume.
- Available Spill Kit supplies are not sufficient for cleaning up spill.

In the event of a major chemical spill, after removing contaminant from individual, immediately contact Security at x7911. For immediate medical attention call 9-

911. Laboratory area should be evacuated, laboratory door closed and access to laboratory restricted until individuals trained to handle hazard arrive.

9.1.1 Hazardous Chemical Spill on Individual

If a hazardous chemical is spilled on an individual:

- Remove clothing and/or shoes in contact with clothing.
- Leave the contaminated area immediately.
- Wash off chemical in emergency shower or eyewash station for 15 minutes.
- Review SDS or applicable SOP for first aid guidance.

9.2 Minor Chemical Spill

A minor chemical spill includes the following situations:

- The chemical spill has a low to moderate hazard.
- A chemical spill involves a highly hazardous material confined within the fume hood.
- Spill involves a minimum exposure to a hazardous chemical which is confined to clothing.
- Individual is aware of the chemicals hazards and trained to properly clean up the spill.
- Available Spill Kit supplies are sufficient for cleaning up spill.

9.2.1 Chemical Spill on Individual

If a chemical is spilled on an individual:

- Remove clothing in contact with clothing.
- As necessary, wash off chemical in emergency shower or eyewash station.
- As necessary, seek assistance from Safety Office at x7424 or MBL Security at x7911.
- Once personal contamination has been controlled, proceed with clean-up.

9.2.2 Cleaning Up a Minor Chemical Spill

Follow these procedures for a minor chemical spill using MBL's Spill Kit which are stored in a labeled 5-gallon bucket in each hallway adjacent to a laboratory:

1. Understand the chemical's hazards before proceeding with clean up. If unsure, contact Safety Office at x7424 with questions or assistance.

2. Put on appropriate Personal Protective Equipment (PPE) before attempting spill clean-up (may include gloves, safety glasses & dust mask that are provided within Spill Kit).
3. For large spills, place Safety Sorbent particulate around the spill to prevent liquid from spreading.
4. Cover spill with pads or Safety Sorbent to reduce vapors. Turn pads over to completely saturate. Replace as needed until bulk of spill is absorbed.
5. Apply Safety Sorbent directly on the spill area and agitate in a circular motion with provided hand broom.
6. Sweep up Sorbent with broom and dustpan. Repeat step #5 if necessary to thoroughly dry surface.
7. Place used pads, gloves and/or Sorbent into plastic bag, seal bag completely, apply a completed Hazardous Waste Label and place bag into the nearest Satellite Accumulation Area.
8. Notify the Safety Office by dialing x7424 or email safety@mbl.edu to report incident. Provide your name, chemical spilt, specific location of spill and location of bag containing waste.

9.2.3 Chemical Spill Kit Contents

All MBL laboratories shall have access to a chemical spill control kit, which contains the following items: Absorbent Pads, Broom and Dustpan, Dust Mask, Hazardous Waste Labels, Nitrile Gloves, Plastic Bags, Safety Glasses and Safety Sorbent (2.5 lb).

9.3 Mercury Spills

If a mercury spill occurs, usually in the form of a broken light bulb or thermometer, leave the area immediately and notify others in the room to leave with you. Those near the spill must remove their shoes before leaving the immediate area to be sterilized. On the way out open all windows and shut all doors. Notify Environmental Health and Safety Immediately for clean-up: (508)289-7424.

To assess if you have had a mercury spill consider the following requirements. Thermometers may contain liquid mercury; light bulbs may contain powdered mercury. Liquid mercury can be found in many thermometers. If the liquid inside is silver, the source is most likely mercury and should be treated as such. If the liquid is another color, commonly red, it does not contain mercury and is instead alcohol based. Powdered mercury can be found in many types of light bulbs including fluorescent, black light, ultraviolet and neon. Any bulbs produced after 2003 that do contain mercury will be appropriately marked with “Hg” near the socket. If you believe that your bulb may be older than 2003 (therefor unmarked) and is a type of bulb that mercury is commonly found in, treat the break as a mercury spill.

9.4 If the mercury amount spilled is over 2 tablespoons (or a standard thermometer) a call to the national resource center is mandatory: 1(800)424-8802. Accidents/Incidents, Injuries and Medical Emergencies

Accidents, incidents, injuries, and medical emergencies in the laboratory require immediate attention. For medical emergencies call 9-911 immediately. For all other emergencies call MBL Security at x7911. As soon as possible, all incidents must be discussed with the Responsible Researcher or Laboratory Supervisor. All emergencies involving personal injury must be reported using the MBL Accident Report Form. The Accident Report Form is available through Human Resources or the Safety Office.

10 MEDICAL CONSULTATION AND EVALUATION

All laboratory personnel who have been or believe they may have been exposed to a hazardous chemical have the right to receive an employer provided medical examination. This examination is at no cost to the employee or student.

Exposure monitoring is supported by the Safety Office. The use of certain chemicals may require periodic exposure monitoring. Also some medical conditions will warrant exposure monitoring. Employees are given the right to observe the testing, sampling, monitoring, or measure of employee exposure as well as given the opportunity to review the results and discuss them with a medical professional.

10.1 Medical Examination

All laboratory personnel shall be provided an opportunity to receive an appropriate medical examination performed by a licensed physician at a reasonable time and place, at no cost, and without loss of pay, under the following circumstances:

- At any time, laboratory personnel believe they have been significantly exposed to hazardous materials.
- Whenever laboratory personnel develop signs or symptoms associated with a hazardous chemical to which they may have been exposed in the laboratory.
- If an event takes place in the work area (spill, leak, explosion or other occurrence) resulting in the likelihood of a hazardous exposure.
- Where exposure monitoring reveals an exposure level above the action level for an OSHA regulated substance.
- When medical surveillance for OSHA regulated substances are required.
- When there are special concerns about hazardous chemicals such as reproductive toxins.

10.2 Information Provided to the Physician

In the event of an individual seeking medical evaluation, MBL shall provide the following information to the physician:

- The identity of the hazardous chemical(s) to which laboratory personnel may have been exposed and a copy of the SDS for the hazardous substance.
- A description of the conditions under which the exposure occurred including quantitative exposure data, if available.
- A description of the signs and symptoms of exposure that laboratory personnel are experiencing, if any.

10.3 Physician's Written Opinion

In the event of a medical evaluation from a physician, MBL shall obtain a written opinion from the examining physician which shall include the following:

- The results of the medical examination and any associated tests.
- Any medical condition which may be revealed during the examination which may place laboratory personnel at increased risk as a result of exposure to a hazardous chemical or use of PPE.
- A statement that the laboratory personnel has been informed by the physician of the results and any medical condition that may require further examination or treatment.
- The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.

10.4 Medical Recordkeeping

All medical examination and consultation records, including test results and physician's written opinions, shall be kept in an appropriate confidential manner by the Human Resource Department. Employee exposure records, including sampling results, SDSs or other chemical-specific information, shall be maintained in the laboratory's department files. These records shall be maintained in accordance with 29 CFR 1910.1020H "*Access to Employee Exposure and Medical Records*".

APPENDIX A

GENERAL HAZARD STANDARD OPERATING PROCEDURES

The following SOPs represent best practices and provide a broad overview of the information necessary for the safe operation of laboratories that utilize potentially hazardous chemicals and other physical hazards found in the lab. It is not intended to be all-inclusive. It is important to note that many chemicals have numerous hazards associated with them. Always refer to a chemical's Safety Data Sheet (SDS) and consult the Responsible Researcher/Laboratory Supervisor and/or the Safety Office, if you have questions. Please refer to Section 7, GENERAL LABORATORY SAFETY PRACTICES for additional general rules for working in a chemical laboratory.

Any laboratory at MBL engaged in work with potentially hazardous chemicals that have unusual characteristics or are otherwise not sufficiently covered below must supplement the CHP with their own SOPs. Please contact the Safety Office with questions or for a SOP Template.

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MARINE BIOLOGICAL LABORATORY
FLAMMABLE AND COMBUSTIBLES

1.0 Purpose

This Standard Operating Procedure (SOP) establishes guidelines for appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which contain an inventory of flammable and combustible chemicals. This SOP is not intended to be all-inclusive as many chemicals have numerous hazards. Always refer to a chemical specific Safety Data Sheet (SDS) and consult the Responsible Researcher/Laboratory Supervisor and/or the Safety Office if you have questions.

2.0 Hazard Description

Flammable and combustible liquids can ignite and cause severe burns or death. Flammable liquids are defined as having a flash point below 100 ºF and combustible liquids have a flash point between 100-200 ºF. These liquids have a variety of uses inside a laboratory as solvents, reagents, and cleaning solutions. Some flammable and corrosive liquids require chemical or laboratory specific SOPs. Please contact the Safety Office at safety@mbl.edu, if you have questions.

3.0 Engineering Controls

3.1 At minimum, adequate general laboratory ventilation must be provided to prevent the accumulation of flammable or combustible vapors and maintain exposure below any regulatory and lower explosive limits. Trace amount of flammables can be used in Biosafety Cabinets ducted to building ventilation system. Never manipulate flammable or combustible liquids in recirculating Biosafety Cabinets.

3.2 Whenever substantial quantities of flammable substances are transferred from one container to another, a fume hood should be used.

3.2 Some flammable and combustible liquids that are also carcinogens, acute toxicants, and reproductive toxicants require the use of a chemical fume hood.

3.3 If Permissible Exposure Limits are anticipated to be exceeded then a chemical fume hood or other engineering controls will be required.

4.0 Administrative Controls

4.1 Do not heat flammable liquids with an open flame.

4.2 Avoid ignition sources such as (but not limited to) heat guns, static electricity, Bunsen burners, etc.

4.3 Avoid using equipment with exposed wiring.

4.4 If metal containers are used, ensure that they are properly grounded.
4.5 Fire extinguishers should be readily available.
4.6 Wash hands thoroughly after handling flammable and combustible liquids.

5.0 Personal Protective Equipment

5.1 At minimum long pants (or the equivalent) and closed toed shoes are required. The area of skin between the shoe and ankle should not be exposed.
5.2 ANSI approved safety glasses or goggles must be worn.
5.3 A properly fitting laboratory coat is required when handling flammable or combustible chemicals.
5.3 Flame-resistant laboratory coats should be worn when working with flammable liquids in large amounts or when any amount is used near an ignition source.
5.4 Protective gloves that are appropriate for the chemical being handling must be worn.
5.5 Additional PPE may be required if the chemical has additional hazards associated.

6.0 Handling and Storage

6.1 Keep containers closed when not in use.
6.2 Flammables must be used in well ventilated areas to help prevent the buildup of flammable vapors.
6.3 Thoroughly wash hands after handling.
6.4 Flammable storage cabinets must be used in areas where combined volumes of flammables are greater than 10 gallons **(**approximately 40 liters).
6.5 Only the amounts needed for the current procedure should be kept on bench tops.
6.6 Packing material and other combustible materials should be discarded and kept away from flammable and combustible liquids.
6.7 Refrigerators and freezers storing flammable liquids must be designed to store flammable liquids with all electrical equipment that meets the requirements for Class I, Division I Electrical Safety Code (NPFA 45 and 70).
6.8 Flammable and combustible liquids must be kept away from oxidizers and other incompatible materials.
6.9 Do not store flammable liquids on the floor, unless protected by secondary containment.
6.10 Consult the SDS for chemical-specific storage recommendations.

7.0 First Aid

Please see the Chemical Hygiene Plan (current version) section 4.5 Laboratory Safety Equipment for additional information.

8.0 Chemical Spill

Please see the Chemical Hygiene Plan (current version) Section 10 Chemical Spills and Accidents for additional information.

9.0 Waste Disposal

Please see the Chemical Hygiene Plan (current version) Section 7 Hazardous Waste Management for additional information.

MARINE BIOLOGICAL LABORATORY
OXIDIZERS

1.0 Purpose

This Standard Operating Procedure (SOP) establishes guidelines for appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which contain an inventory of chemical oxidizers. This SOP is not intended to be all-inclusive as many chemicals have numerous hazards. Always refer to a chemical specific Safety Data Sheet (SDS) and consult the Responsible Researcher/Laboratory Supervisor and/or the Safety Office, if you have questions.

2.0 Hazard Description

An oxidizer is a chemical that initiates or promotes the combustion in other materials. This can either cause fire itself or through the release of oxygen or other gases. This class of chemicals includes peroxides, chlorates, perchlorates, nitrates, and permanganates. Some oxidizers require chemical or laboratory specific SOPs. Please contact the Safety Office at safety@mbl.edu, if you have questions.

3.0 Engineering Controls

3.1 At minimum, adequate general laboratory ventilation must be provided to maintain exposure below any regulatory limits. Trace amount of oxidizers can be used in Biosafety Cabinets ducted to building ventilation system. Never manipulate oxidizers in recirculating Biosafety Cabinets.

3.2 Some oxidizers that are also carcinogens, acute toxicants, and reproductive toxicants require the use of a chemical fume hood.

3.3 If Permissible Exposure Limits are anticipated to be exceeded then a chemical fume hood or other engineering controls will be required.

4.0 Administrative Controls

4.1 Containers should be in good condition and compatible with the material.

4.2 Consult with PI/Laboratory Supervisor/Course Director before mixing oxidizing agents with flammable or combustible materials.

4.3 Fire extinguishers should be readily available.

4.4 Wash hands thoroughly after handling oxidizers

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5.0 Personal Protective Equipment

5.1 At minimum, long pants (or the equivalent) and closed toed shoes are required. The area of skin between the shoe and ankle should not be exposed.
5.2 ANSI approved safety glasses or goggles must be worn.
5.3 A properly fitting laboratory coat are required to handle oxidizers.
5.4 Protective gloves that are appropriate for the chemical being handling must be worn.
5.5 Flame-resistant laboratory coats should be worn if mixing oxidizing agent with flammables or combustibles.
5.6 Depending on risk assessment a face shield and/or blast shield may be appropriate.
5.7 Additional PPE may be required if the chemical has additional hazards.

6.0 Handling and Storage

6.1 Keep containers closed when not in use.
6.2 Store away from flammable and combustible materials.
6.3 Consult the SDS for chemical-specific storage recommendations.

7.0 First Aid

Please see the Chemical Hygiene Plan (current version) section 4.5 Laboratory Safety Equipment for additional information.

8.0 Chemical Spill

Please see the Chemical Hygiene Plan (current version) section 10 Chemical Spills and Accidents for additional information.

9.0 Waste Disposal

Please see the Chemical Hygiene Plan (current version) section 7 Hazardous Waste Management for additional information.

MARINE BIOLOGICAL LABORATORY
CORROSIVES

1.0 Purpose

This Standard Operating Procedure (SOP) establishes guidelines for appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which contain an inventory of corrosive liquids, solids or gases. This SOP is not intended to be all-inclusive as many chemicals have numerous hazards. Always refer to a chemical specific Safety Data Sheet (SDS) and consult the Responsible Researcher/Laboratory Supervisor and/or the Safety Office, if you have questions.

2.0 Hazard Description

A corrosive chemical can cause destruction of living tissue by chemical action at the site of contact. Corrosives can also damage other substances such as metals. Corrosives are commonly found in research laboratories and used for multiple purposes. Some corrosives require chemical or laboratory specific SOPs. Please contact the Safety Office at safety@mbl.edu, if you have questions.

EXAMPLES OF COMMON CORROSIVE CHEMICALS	
STRONG (MINERAL) ACIDS:	**STRONG BASES**
• Hydrochloric acid	• Ammonia hydroxide
• Nitric acid	• Calcium hydroxide
• Phosphoric acid	• Potassium hydroxide
•	• Cesium hydroxide
WEAK (ORGANIC) ACIDS	• Lithium hydroxide
• Acetic acid (glacial)	• Sodium hydroxide
• Perchloric acid	
STRONG DEHYDRATING AGENTS	**STRONG OXIDIZING AGENTS**
• Calcium oxide	• Hydrogen peroxide (≥30%)
• Phosphorus pentoxide	• Sodium hypochlorite
• Sulfuric acid	
CORROSIVE SOLIDS	**CORROSIVE GASES**
• Phenol	• Ammonia
• Phosphorous	• Chlorine

3.0 Engineering Controls

3.1 At minimum, adequate general laboratory ventilation must be provided to maintain exposure below any regulatory limits.
3.2 Some corrosives that are also carcinogens, acute toxicants, and reproductive toxicants require the use of a chemical fume hood.
3.3 If Permissible Exposure Limits are anticipated to be exceeded then a chemical fume hood or other engineering controls will be required.

4.0 Administrative Controls

4.1 Containers should be in good condition and compatible with the material.
4.2 When diluting, add acid or base to water.
4.3 Wash hands thoroughly after handling corrosives.

5.0 Personal Protective Equipment

5.1 At minimum, long pants (or the equivalent) and closed toed shoes are required. The area of skin between the shoe and ankle should not be exposed.
5.2 ANSI approved safety glasses or goggles must be worn.
5.3 A properly fitting laboratory coat is required when handling corrosives.
5.4 Protective gloves that are appropriate for the chemical being handling must be worn.
5.5 When a splash potential exists, a face shield and/or chemical splash apron should be worn.
5.6 Additional PPE may be required if the chemical has additional hazards.

6.0 Handling and Storage

6.1 Keep containers closed when not in use.
6.2 Store corrosives below eye level.
6.3 Segregate acids from bases.
6.4 Segregate inorganic acids from organic acids.
6.5 Segregate all acids from reactive metals (e.g. sodium potassium, magnesium).
6.6 Segregate all acids from azides and cyanides to prevent adverse reactions.
6.7 Corrosive cabinets should be used in areas where combined volumes of concentrated liquid acids and bases are greater than 10 gallons.
6.8 Concentrated liquid corrosives require secondary containment.
6.9 Consult the SDS for chemical specific storage recommendations.

7.0 First Aid

If corrosive chemical comes into contact with skin, flush area for 15 minutes using a safety shower when necessary.

For eye exposure, IMMEDIATELY flush eyes using nearest eyewash for at least 15 minutes.

Please see the Chemical Hygiene Plan (current version) section 4.5 Laboratory Safety Equipment for additional information.

8.0 Chemical Spill

As available, a neutralizing agent can be used to neutralize a corrosive spill.

Please see the Chemical Hygiene Plan (current version) section 10 Chemical Spills and Accidents for additional information.

9.0 Waste Disposal

Corrosive material which has a pH of 5.5 – 9.5 and do not exhibit any other hazards, may be disposed down the drain (non-hazardous).

Please see the Chemical Hygiene Plan (current version) section 7 Hazardous Waste Management for additional information.

MARINE BIOLOGICAL LABORATORY
PYROPHORICS

1.0 Purpose

This Standard Operating Procedure (SOP) establishes guidelines for appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which contain an inventory of pyrophoric chemicals. This SOP is not intended to be all-inclusive as many chemicals have numerous hazards. Always refer to a chemical specific Safety Data Sheet (SDS) and consult the Responsible Researcher/Laboratory Supervisor and/or the Safety Office, if you have questions.

2.0 Hazard Description

A pyrophoric chemical is a substance that is liable to ignite within 5 minutes after coming into contact with air. As such they must be handled in an inert atmosphere by trained personnel only. All pyrophorics must be stored and handled in buildings that are equipped with emergency sprinkler systems. SDSs should be consulted and followed to ensure appropriate storage for these chemicals. Refrigerators and freezers storing pyrophoric liquids must be designed to store flammable liquids with all electrical equipment that meets Class I, Division I requirements. Pyrophorics require chemical or laboratory specific SOPs. Please contact the Safety Office at safety@mbl.edu, if you have questions.

3.0 Engineering Controls

3.1 At minimum, adequate general laboratory ventilation must be provided to maintain exposure below any regulatory limits. Never handle pyrophorics in Biosafety Cabinets.

3.2 Some pyrophoric chemicals that are also carcinogens, acute toxicants, and reproductive toxicants require the use of a chemical fume hood.

3.3 If Permissible Exposure Limits are anticipated to be exceeded then a chemical fume hood or other engineering controls will be required.

3.4 Pyrophoric chemicals may require the use of glove boxes and/ or other air and water free techniques for use and handling.

4.0 Administrative Controls

4.1 A laboratory specific SOP should be written for the use of pyrophoric chemicals.
4.2 Laboratory specific training and documentation of training must be completed before the personnel can use pyrophoric chemicals. This may be incorporated into the SOP.
4.3 Pyrophoric chemicals must not be handled while working alone.
4.4 Containers should be in good condition.
4.5 Inspect any air free seal on containers with highly reactive and unstable chemicals.
4.6 Wash hands thoroughly after handling pyrophoric chemicals.

5.0 Personal Protective Equipment

5.1 At minimum, long pants (or the equivalent) and closed toed shoes are required. The area of skin between the shoe and ankle should not be exposed.
5.2 ANSI approved safety glasses or goggles must be worn.
5.3 A properly fitting laboratory coat is required when handling pyrophorics.
5.4 Flame-resistant laboratory coats should be worn when working with pyrophorics.
5.5 Protective gloves that are appropriate for the chemical being handling must be worn. The likelihood of fire should also be considered when selecting appropriate gloves.
5.6 Depending on risk assessment a face shield and/or chemical splash apron may be appropriate.
5.7 Additional PPE may be required if the chemical has additional hazards.

6.0 Handling and Storage

6.1 Keep containers closed when not in use.
6.2 Pyrophorics must be stored and handled under an inert atmosphere.
6.3 Pyrophoric gases must be stored in an appropriate gas cabinet.
6.4 Refrigerators and freezers storing pyrophorics must be designed to store flammable liquids with all electrical equipment that meets the requirements for Class I, Division I Electrical Safety Code (NPFA 45 and 70).
6.5 Never return unused quantities back to the original container.
6.6 Segregate pyrophorics in a secondary container away from incompatibles.
6.7 Consult the SDS for chemical-specific storage recommendations.

7.0 First Aid

Please see the Chemical Hygiene Plan (current version) section 4.5 Laboratory Safety Equipment for additional information.

8.0 Chemical Spill

Please see the Chemical Hygiene Plan (current version) section 10 Chemical Spills and Accidents for additional information.

9.0 Waste Disposal

Please see the Chemical Hygiene Plan (current version) section 7 Hazardous Waste Management for additional information.

MARINE BIOLOGICAL LABORATORY
WATER REACTIVE CHEMICALS

1.0 Purpose

This Standard Operating Procedure (SOP) establishes guidelines for appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which contain an inventory of water reactive chemicals. This SOP is not intended to be all-inclusive as many chemicals have numerous hazards. Always refer to a chemical specific Safety Data Sheet (SDS) and consult the Responsible Researcher/Laboratory Supervisor and/or the Safety Office, if you have questions.

2.0 Hazard Description

A water reactive chemical is a substance that will react with water to produce a toxic or flammable gas. These chemicals must be kept away from water and aqueous solutions. Also avoid storing near or underneath sinks, safety showers, or emergency eye wash stations. Some water reactive chemicals require chemical or laboratory specific SOPs. Please contact the Safety Office at safety@mbl.edu, if you have questions.

3.0 Engineering Controls

3.1 At minimum, adequate general laboratory ventilation must be provided to maintain exposure below any regulatory limits. Never manipulate water reactive chemicals in Biosafety Cabinets.

3.2 Some water reactive chemicals that are also carcinogens, acute toxicants, and reproductive toxicants require the use of a chemical fume hood.

3.3 If Permissible Exposure Limits are anticipated to be exceeded then a chemical fume hood or other engineering controls will be required.

3.4 Water reactive chemicals may require the use of glove boxes and/ or other air and water free techniques for use and handling.

4.0 Administrative Controls

4.1 Containers should be in good condition and compatible with the material.

4.2 Inspect any air free seal on containers with highly reactive and unstable chemicals.

4.3 Chemical specific or laboratory specific SOP may be required along with laboratory specific training.

5.0 Personal Protective Equipment

5.1 At minimum, long pants (or the equivalent) and closed toed shoes are required. The area of skin between the shoe and ankle should not be exposed.
5.2 ANSI approved safety glasses or goggles must be worn.
5.3 A properly fitting laboratory coat is required when handling water reactive chemicals.
5.4 Protective gloves that are appropriate for the chemical being handling must be worn.
5.5 Depending on risk assessment a face shield and/or chemical splash apron may be appropriate.
5.6 Additional PPE may be required if the chemical has additional hazards.

6.0 Handling and Storage

6.1 Keep containers closed when not in use.
6.2 Water reactive chemicals must be stored away from water, aqueous solutions, alcohols, sinks, and showers.
6.3 Never return unused quantities back to the original container.
6.4 Store water reactive chemical containers inside appropriate secondary containers.
6.5 Consult the SDS for chemical specific storage recommendations.

7.0 First Aid

Please see the Chemical Hygiene Plan (current version) section 4.5 Laboratory Safety Equipment for additional information.

8.0 Chemical Spill

Please see the Chemical Hygiene Plan (current version) section 10 Chemical Spills and Accidents for additional information.

9.0 Waste Disposal

Please see the Chemical Hygiene Plan (current version) section 7 Hazardous Waste Management for additional information.

MARINE BIOLOGICAL LABORATORY
POTENTIALLY EXPLOSIVE CHEMICALS

1.0 Purpose

This Standard Operating Procedure (SOP) establishes guidelines for appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which contain an inventory of potentially explosive chemicals / peroxide forming chemicals. This SOP is not intended to be all-inclusive as many chemicals have numerous hazards. Always refer to a chemical specific Safety Data Sheet (SDS) and consult the Responsible Researcher/Laboratory Supervisor and/or the Safety Office, if you have questions.

2.0 Hazard Description

A peroxide forming chemical (PFC) is a substance that may form potentially explosive organic peroxides. Many of these chemicals are common solvents and care must be taken for solutions containing PFCs. A common practice is the addition of stabilizers (e.g. hydroquinone and BHT) that inhibit the chain reaction of peroxide formation. Some peroxide forming chemicals require chemical or laboratory specific SOPs. Please contact the Safety Office at safety@mbl.edu, if you have questions.

There are four classes of PFCs which have different storage requirements. All peroxide forming chemicals must be disposed within 12 months from the open date or before a stamped expiration date whichever is sooner. Any uninhibited peroxide forming chemical must be disposed or used within 3 months of opening. All Class 1 PFCs must be disposed within 3 months from opening. Inhibited Class 2 and 3 PFC must be disposed or used within 12 months of opening.

Class 1 PFCs

Class 1 chemicals form peroxides after prolonged storage. These must be disposed or used within 3 months of opening.

Isopropyl ether	Potassium amide	Vinylidene chloride
Divinyl acetylene	Potassium metal	
Divinyl ether	Sodium amide	

Class 2 PFCs

This group of chemicals will readily form peroxides when they become concentrated (e.g., via evaporation or distillation). The concentration process defeats the action of most auto-oxidation inhibitors. As a result, these chemicals should be disposed of within 12 months of opening for bottles with an inhibitor, and 3 months if uninhibited.

Acetaldehyde	Diethyl ether	4-Methyl-2-pentanone
Cumene	1,4-Dioxane	Tetrahydrofuran
Cyclohexene	Dimethoxyethane (glyme)	Tetrahydronaphthalene
Cyclopentene	Furan	Vinyl ethers
Diacetylene	Propyne	
Dicyclopentadiene	Methylcyclopentane	

Class 3 PFCs

This group of chemicals will form peroxides that can initiate polymerization. When stored in a liquid state, the peroxide forming potential dramatically increases. These chemicals should be disposed of or used within 12 months of opening for bottles with an inhibitor, and 3 months if uninhibited.

Acrylic acid	Chlorotrifluoroethylene	Vinyl acetate
Acrylonitrile	Methyl methacrylate	Vinylacetylene
Butadiene	Styrene	2-Vinylpyridine
Chlorobutadiene	Tetrafluoroethylene	
Vinyl chloride (chloroethene)	1,1-Dichloroethene	

3.0 Engineering Controls

3.1 At minimum, adequate general laboratory ventilation must be provided to maintain exposure below any regulatory limits.

3.2 Some peroxide forming chemicals that are also carcinogens, acute toxicants, and reproductive toxicants require the use of a chemical fume hood.

3.3 If Permissible Exposure Limits are anticipated to be exceeded then a chemical fume hood or other engineering controls will be required.

4.0 Administrative Controls

4.1 Containers should be in good condition and compatible with the material.

4.2 Inspect any air free seal on containers with highly reactive and unstable chemicals.

4.3 All peroxide forming chemicals should be marked with the receiving and opening date.

4.4 All peroxide forming chemicals must be disposed of within 18 months of receiving or before any stamped expiration date whichever is sooner.
4.5 All uninhibited peroxide forming chemicals must be disposed of or used within 3 months of opening.
4.6 Class 1 peroxide forming chemicals should be disposed or used within 3 months of opening.
4.7 Class 2, and Class 3 peroxide forming chemicals must be disposed or used within 12 months from opening.
4.8 Wash hands thoroughly after handling peroxide forming chemicals.

5.0 Personal Protective Equipment

5.1 At minimum, long pants (or the equivalent) and closed toed shoes are required. The area of skin between the shoe and ankle should not be exposed.
5.2 ANSI approved safety glasses or goggles must be worn.
5.3 A properly fitting laboratory coat is required when handling peroxide forming chemicals.
5.4 Protective gloves that are appropriate for the chemical being handling must be worn.
5.5 Depending on risk assessment a face shield and/or chemical splash apron may be appropriate.
5.6 Additional PPE may be required if the chemical has additional hazards.

6.0 Handling and Storage

6.1 Keep containers closed when not in use.
6.2 Peroxide forming chemicals should be stored in airtight containers in a dark, cool, and dry place.
6.3 The containers should be labeled with the date received and the date opened. This information, along with the chemical identity should face forward to minimize container handling.
6.4 Avoid evaporation or distillation, as distillation defeats the stabilizer added to the solvents.
6.5 Ensure that containers are tightly sealed to avoid evaporation and that they are free of exterior contamination or crystallization.
6.6 Never return unused quantities back to the original container and clean all spills immediately.
6.7 Minimize the quantity of peroxide forming chemicals stored in the laboratory and dispose of peroxide forming chemicals before peroxide formation.
6.8 Consult the SDS for chemical-specific storage recommendations.

7.0 First Aid

Please see the Chemical Hygiene Plan (current version) section 4.5 Laboratory Safety Equipment for additional information.

8.0 Chemical Spill

Please see the Chemical Hygiene Plan (current version) section 10 Chemical Spills and Accidents for additional information.

9.0 Waste Disposal

If old containers of peroxide forming compounds are discovered in the laboratory (greater than two years past the expiration date or if the date of the container is unknown), do not handle the container. If crystallization is present in or on the exterior of the container, do not handle the container. Secure location and immediately contact MBL Security at x7911 and the Safety Office at x7424.

Please see the Chemical Hygiene Plan (current version) section 7 Hazardous Waste Management for additional information.

MARINE BIOLOGICAL LABORATORY
COMPRESSED GAS

1.0 Purpose

This Standard Operating Procedure (SOP) establishes guidelines for appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which contain compressed gases. This SOP is not intended to be all-inclusive as many chemicals have numerous hazards. Always refer to a chemical specific Safety Data Sheet (SDS) and consult the Responsible Researcher/Laboratory Supervisor and/or the Safety Office, if you have questions.

2.0 Hazard Description

Compressed gas cylinders can pose both physical and health hazards. Gas cylinders are pressurized vessels that pose a physical hazard if the pressure is released suddenly and violently. Many compressed gases also posed the health hazard of asphyxiation. Compressed gases can also present moderate (ammonia) to severe (fluorine gas) health and chemical reactivity hazards.

Numerous gases are required for different reasons in the laboratory. Some gases have additional hazards such as flammability, toxicity, and/or pyrophoricity. Some compressed gases require chemical or laboratory specific SOPs. Please contact the Safety Office at safety@mbl.edu, if you have questions.

3.0 Engineering Controls

3.1 Use and store in a well ventilated area.

3.2 At a minimum, adequate general laboratory ventilation must be provided to maintain exposure below any regulatory limits.

3.3 Some compressed gases that are also carcinogens, acute toxicants, and reproductive toxicants require the use of a chemical fume hood or a gas cabinet.

3.4 If Permissible Exposure Limits are anticipated to be exceeded then a chemical fume hood or other engineering controls will be required.

3.5 In some cases, oxygen monitors may be required to prevent the risk of asphyxiation.

4.0 Administrative Controls

4.1 Properly secure all gas cylinders.
4.2 Ensure that gas cylinders and regulators are in good condition.
4.3 Always use an appropriate regulator that is compatible with the gas being used.
4.4 Frequently check for leaks using a dilute detergent/soap solution.
4.5 Gas lines should also be compatible with the gas being used.
4.6 Flammable and oxidizing gases must be stored at least 20 feet apart.

5.0 Personal Protective Equipment

5.1 At a minimum, long pants (or the equivalent) and closed toed shoes are required. The area of skin between the shoe and ankle should not be exposed.
5.2 ANSI approved safety glasses or goggles must be worn when working with compressed gases.
5.3 A properly fitting laboratory coat is required when handling compressed gases.
5.4 Protective gloves that are appropriate for the chemical being handling must be worn.
5.5 Additional PPE may be required if the chemical has additional hazards.

6.0 Handling and Storage

6.1 Do not subject cylinders to temperature extremes.
6.2 Compressed gas cylinders must be stored with the safety cap when not in use.
6.3 Gas cylinders must be secured with a chain or cart.
6.4 Separate storage of flammable and oxidizing cylinders by at least 20 feet or with a fire resistant barrier at least five feet high and having a fire rating of at least one hour.
6.5 Do not secure more than four cylinders in any one row.
6.6 Store gas cylinders in a vertical position.
6.7 Only transport gas cylinders safely secured on a suitable hand truck.
6.8 Only transport with safety cap on.
6.9 Use a freight elevator when available.
6.10 Mark used cylinders as “Empty”.
6.11 Consult the SDS for chemical specific storage recommendations.

7.0 First Aid

Please see the Chemical Hygiene Plan (current version) section 4.5 Laboratory Safety Equipment for additional information.

8.0 Chemical Spill

Due to the nature of a gas leak or accidental release attempt to close the gas valve if possible, otherwise evacuate area and immediately contact MBL Security at x7911.

9.0 Waste Disposal

To return a compressed gas cylinders used within a laboratory, contact Laboratory Operations (Lab Ops) and request a pick-up.

For small empty cylinders, label cylinder and place into a Satellite Accumulation Area. Please see the Chemical Hygiene Plan (current version) section 7 Hazardous Waste Management for additional information.

MARINE BIOLOGICAL LABORATORY
CRYOGENIC LIQUIDS

1.0 Purpose

This Standard Operating Procedure (SOP) establishes guidelines for appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which use cryogenic liquids. This SOP is not intended to be all-inclusive as many chemicals have numerous hazards. Always refer to a chemical specific Safety Data Sheet (SDS) and consult the Responsible Researcher/Laboratory Supervisor and/or the Safety Office, if you have questions.

2.0 Hazard Description

Cryogenic liquids can pose both physical and health hazards. Cryogenic liquids can cause frostbite and these liquids often have large volume expansion factors when they boil. As such cryogenic liquids also pose the health hazard of asphyxiation. Cryogenic liquids are typically stored in tanks also called Dewars. Common cryogenic liquids found in laboratories include liquid nitrogen and helium.

3.0 Engineering Controls

3.1 Cryogenic liquids must only be used and stored in a well ventilated area.
3.2 At a minimum, adequate general laboratory ventilation must be provided to maintain exposure below any regulatory limits.
3.3 If Permissible Exposure Limits are anticipated to be exceeded then a chemical fume hood or other engineering controls will be required.
3.4 In some cases, oxygen monitors may be required to prevent the risk of asphyxiation.

4.0 Administrative Controls

4.1 Ensure that Dewar flasks and regulators are in good condition.
4.2 Always use an appropriate regulator that is compatible with the specific gas.
4.3 Always use an appropriate pipe for connecting with or dispensing into Dewars.
4.4 Confirm that the cryogenic tank's safety relief valves have not been modified.
4.5 Under normal conditions, these containers will periodically vent product. Do not plug, remove, or tamper with any pressure relief device.
4.6 Personnel working with the materials must receive detailed training on the hazards, safe use and emergency procedures.

5.0 Personal Protective Equipment

5.1 At minimum, long pants (or the equivalent) and closed toed shoes are required. The area of skin between the shoe and ankle should not be exposed.

5.2 ANSI approved safety glasses or goggles must be worn.
5.3 A properly fitting laboratory coat is required when handling cryogenic liquids.
5.4 Cryogenic gloves should be worn when handling cryogens.
5.5 Based on risk assessment a face shield may be appropriate when handling cryogenic liquids.
5.6 Additional PPE may be required if the chemical has additional hazards.

6.0 Handling and Storage

6.1 Never allow any unprotected part of the body to come in contact with un-insulated pipes or equipment that contains cryogenic product.
6.2 Do not store cryogenic liquid containers in a horizontal position.
6.3 Do not store in a confined space.
6.4 Only transport cryogenic liquids secured and with suitable hand truck.
6.5 Do not drop, tip, or roll containers on their sides.
6.6 Only transfer cryogenic liquids into an appropriate container.
6.7 Consult the SDS for chemical-specific storage recommendations.

7.0 First Aid

Please see the Chemical Hygiene Plan (current version) section 4.5 Laboratory Safety Equipment for additional information.

8.0 Chemical Spill

Due to the nature of a gas leak or accidental release attempt to close the gas valve if possible, otherwise evacuate area and immediately contact MBL Security at x7911.

9.0 Waste Disposal

To return Dewar used within a laboratory, contact Lab Ops and request a pick-up.

MARINE BIOLOGICAL LABORATORY
PARTICULARLY HAZARDOUS SUBSTANCES

1.0 Purpose

This Standard Operating Procedure (SOP) establishes guidelines for appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which contain an inventory of Particularly Hazardous Substances (PHS). This SOP is not intended to be all-inclusive as many chemicals have numerous hazards. Always refer to a chemical specific Safety Data Sheet (SDS) and consult the Responsible Researcher/Laboratory Supervisor and/or the Safety Office, if you have questions.

2.0 Hazard Description

Substances that pose such significant threats to human health are classified as "particularly hazardous substances" (PHSs). The OSHA Laboratory Standard (29 CFR 1910.1450) require that special provisions be established to prevent the harmful exposure of researchers to PHSs, including the establishment of designated areas for their use. Common examples include sodium azide, toluene, chloroform, dichlormethane, formaldehyde, and ethidium bromide.

Particularly hazardous substances fall under one of three categories.

a. Acute Toxicant
b. Reproductive Toxicant
c. Carcinogen

Acute toxicants are defined as: Substances that have a high degree of acute toxicity are interpreted by OSHA as being substances that "may be fatal or cause damage to target organs as the result of a single exposure or exposures of short duration." These chemicals, associated chemical waste, and storage containers must be handled with care to prevent cross contamination of work areas and unexpected contact. These chemicals will have LD_{50}s that are at or lower than:

1. Oral $LD_{50} \leq 50mg/kg$ in albino rats
2. Dermal $LD_{50} \leq 200mg/kg$ in albino rabbits
3. Inhalation $LD_{50} \leq 200ppm$ or 2mg/L for a 1 hour exposure in albino rats

These chemicals must be labeled as “Toxic.” Examples include cyanide salts, hydrofluoric acid, and sodium azide.

Reproductive toxicants are defined as: Any chemical that may affect the reproductive capabilities, including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

Reproductive toxins can affect the reproductive health of both men and women if proper procedures and controls are not used. For women, exposure to reproductive toxins during pregnancy can cause adverse effects on the fetus; these effects include embryolethality (death of the fertilized egg, embryo or fetus), malformations (teratogenic effects), and postnatal functional defects. For men, exposure can lead to sterility.

Examples of embryotoxins include thalidomide and certain antibiotics such as tetracycline. Women of childbearing potential should note that embryotoxins have the greatest impact during the first trimester of pregnancy. Because a woman often does not know that she is pregnant during this period of high susceptibility, special caution is advised when working with all chemicals, especially those rapidly absorbed through the skin (e.g., formamide, DMSO). Pregnant women and women intending to become pregnant should consult with their PI/Laboratory Supervisor/Course Director, Safety Office, and/or their personal before working with substances that are suspected to be reproductive toxins.

Carcinogens are defined as: Chemical or physical agents that cause cancer. Generally they are chronically toxic substances; that is, they cause damage after repeated or long-duration exposure, and their effects may only become evident after a long latency period. Carcinogens are particularly insidious because they may have no immediately apparent harmful effects. These materials are separated into two classes:

a. Select Carcinogens
b. Regulated Carcinogens

Select Carcinogens are materials which have met certain criteria established by the National Toxicology Program or the International Agency for Research on Cancer regarding the risk of cancer via certain exposure routes. (See definition Select Carcinogen.) It is important to recognize that some substances involved in research laboratories are new compounds and have not been subjected to testing for carcinogenicity. The following references (links provided) are used to determine which substances are select carcinogens by Cal/OSHA's classification:

- OSHA Carcinogen List (https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10007&p_table=standards)
- Annual Report on Carcinogens (http://ntp.niehs.nih.gov/pubhealth/roc/roc13/index.html) published by the National Toxicology Program (NTP), including all of the substances listed as "known to be carcinogens" and some substances listed as "reasonably anticipated to be carcinogens"

- International Agency for Research on Cancer (IARC, http://monographs.iarc.fr/ENG/Monographs/PDFs/index.php) including all of Group 1 "carcinogen to humans" by the International Agency for Research on Cancer Monographs (IARC) (Volumes 1-48 and Supplements 1-8); and some in Group 2A or 2B, "reasonably anticipated to be carcinogens" by the National Toxicology Program (NTP, http://www.niehs.nih.gov/research/atniehs/dntp/assoc/roc/), and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria: (i) after inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m3; (ii) after repeated skin application of less than 300 mg/kg of body weight per week; or (iii) after oral dosages of less than 50 mg/kg of body weight per day

  Regulated Carcinogens fall into a higher hazard class and have extensive additional requirements associated with them. The regulations associated with these carcinogens can be found in 29CFR 1910 Subpart Z (https://www.osha.gov/SLTC/carcinogens/standards.html). The use of these agents may require personal exposure sampling based on usage. When working with Regulated Carcinogens, it is particularly important to review and effectively apply engineering and administrative safety controls as the regulatory requirements for laboratories that may exceed long term (8 hour) or short term (15 minutes) threshold values for these chemicals are very extensive.

3.0 Engineering Controls

3.1 At minimum, a chemical fume hood or other containment device is required.
3.2 If the process does not permit the handling of such materials in a fume hood, contact the Safety Office at x7424 or safety@mbl.edu for reviewing suitability of ventilation controls.

4.0 Administrative Controls

4.1 Containers should be in good condition and compatible with the material.
4.2 When working with PHS, a sign must be posted at the fume hood which provides notice of a chemical hazard. **"WARNING! HAZARDOUS MATERIALS IN USE!"**
4.3 Wash hands thoroughly after handling Particularly Hazardous Substances.
4.4 Chemical or laboratory specific SOPs may be required. Please contact the Safety Office at safety@mbl.edu, if you have questions.

5.0 Personal Protective Equipment

5.1 At minimum, long pants (or the equivalent) and closed toed shoes are required. The area of skin between the shoe and ankle should not be exposed.
5.2 ANSI approved safety glasses or goggles must be worn.
5.3 A properly fitting laboratory coat is required when handling particularly hazardous chemicals.

5.4 Protective gloves that are appropriate for the chemical being handling must be worn.
5.5 If splash potential exists, a face shield and/or chemical splash apron may be appropriate.
5.6 Additional PPE may be required if the chemical has additional hazards. In specific situations, respirators may be required which required specific training which includes a fit test and medical evaluations, contact the Safety Office at x7424.

6.0 Handling and Storage

6.1 Keep containers closed when not in use.
6.2 Store Particularly Hazardous Substances in secondary containers.
6.3 Store and use only in Designated Areas only.
6.4 Decontaminate Designated Areas immediately after using Particularly Hazardous Substances.
6.5 Consult the SDS for chemical specific storage recommendations.

7.0 First Aid

SDS must be readily available in the laboratory for Particularly Hazardous Substances for first aid reference.

Please see the Chemical Hygiene Plan (current version) section 4.5 Laboratory Safety Equipment for additional information.

8.0 Chemical Spill

Please see the Chemical Hygiene Plan (current version) section 10 Chemical Spills and Accidents for additional information.

9.0 Waste Disposal

Decontaminate bench top, fume hood or other contaminated equipment before removing them from the designate area. Soap and water may be used for decontamination. Decontamination materials should be bagged and labeled for hazardous waste disposal.

Please see the Chemical Hygiene Plan (current version) section 7 Hazardous Waste Management for additional information.

MARINE BIOLOGICAL LABORATORY
TOXIC CHEMICALS

1.0 Purpose

This Standard Operating Procedure (SOP) establishes guidelines for appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which contain an inventory of toxic chemicals. This SOP is not intended to be all-inclusive as many chemicals have numerous hazards. Always refer to a chemical specific Safety Data Sheet (SDS) and consult the Responsible Researcher/Laboratory Supervisor and/or the Safety Office, if you have questions.

2.0 Hazard Description

Toxic chemicals can refer to chemicals with acute toxicity or chromic toxicity. In addition, toxicity may target a specific organ. This SOP is only for toxic chemicals with an acute toxicity LD_{50} greater than those outlined in the Particularly Hazardous Substance SOP above. Also covered in this SOP are hepatotoxins, nephrotoxins, neurotoxins, and hematotoxins.

3.0 Engineering Controls

3.1 At minimum, adequate general laboratory ventilation must be provided to maintain exposure below any regulatory limits.
3.2 Some toxic chemicals that are also carcinogens, acute toxicants, and reproductive toxicants require the use of a chemical fume hood.
3.3 If Permissible Exposure Limits are anticipated to be exceeded then a chemical fume hood or other engineering controls will be required.

4.0 Administrative Controls

4.1 Wash hands thoroughly after handling toxic chemicals.

5.0 Personal Protective Equipment

5.1 At minimum, long pants (or the equivalent) and closed toed shoes are required. The area of skin between the shoe and ankle should not be exposed.
5.2 ANSI approved safety glasses or goggles must be worn.
5.3 A properly fitting laboratory coat is required when handling toxic chemicals.

5.4 Protective gloves that are appropriate for the chemical being handling must be worn.
5.5 Additional PPE may be required if the chemical has additional hazards.

6.0 Handling and Storage

6.1 Keep containers closed when not in use.
6.2 Consult the SDS for chemical-specific storage recommendations.

7.0 First Aid

Please see the Chemical Hygiene Plan (current version) section 4.5 Laboratory Safety Equipment for additional information.

8.0 Chemical Spill

Please see the Chemical Hygiene Plan (current version) section 10 Chemical Spills and Accidents for additional information.

9.0 Waste Disposal

Decontaminate bench, fume hoods, and other equipment while wearing proper PPE. Typically soap and water can be used for effective decontamination, but please consult the SDS.

Please see the Chemical Hygiene Plan (current version) section 7 Hazardous Waste Management for additional information.

MARINE BIOLOGICAL LABORATORY
SENSITIZERS AND IRRITANTS

1.0 Purpose

This Standard Operating Procedure (SOP) establishes guidelines for appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which contain chemical sensitizers and irritants. This SOP is not intended to be all-inclusive as many chemicals have numerous hazards. Always refer to a chemical specific Safety Data Sheet (SDS) and consult the Responsible Researcher/Laboratory Supervisor and/or the Safety Office, if you have questions.

2.0 Hazard Description

A sensitizer (allergen) is 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. An irritant is a chemical other than a corrosive that can cause a reversible inflammatory effect on living tissue by chemical action at the site of contact.

3.0 Engineering Controls

3.1 At minimum, adequate general laboratory ventilation must be provided to maintain exposure below any regulatory limits.

3.2 Some sensitizers and irritants that are also carcinogens, acute toxicants, and reproductive toxicants require the use of a chemical fume hood.

3.3 If Permissible Exposure Limits are anticipated to be exceeded then a chemical fume hood or other engineering controls will be required.

4.0 Administrative Controls

4.1 Handling processes should minimize the potential for incidental contact.

4.2 Once chemical hypersensitivity is detected any contact with the chemical should be avoided.

4.3 Wash hands thoroughly after handling sensitizers and irritants.

5.0 Personal Protective Equipment

5.1 At minimum, long pants (or the equivalent) and closed toed shoes are required. The area of skin between the shoe and ankle should not be exposed.
5.2 ANSI approved safety glasses or goggles must be worn.
5.3 A properly fitting laboratory coat is required when handling sensitizers and irritants.
5.4 Protective gloves that are appropriate for the chemical being handling must be worn.
5.5 Additional PPE may be required if the chemical has additional hazards.

6.0 Handling and Storage

6.1 Keep containers closed when not in use.
6.2 Consult the SDS for chemical-specific storage recommendations.

7.0 First Aid

Please see the Chemical Hygiene Plan (current version) section 4.5 Laboratory Safety Equipment for additional information.

8.0 Chemical Spill

Please see the Chemical Hygiene Plan (current version) section 10 Chemical Spills and Accidents for additional information.

9.0 Waste Disposal

Decontaminate bench, fume hoods, and other equipment while wearing proper PPE. Typically soap and water can be used for effective decontamination, consult the SDS.

Please see the Chemical Hygiene Plan (current version) section 7 Hazardous Waste Management for additional information.

APPENDIX B

CHEMICAL SPECIFIC STANDARD OPERATING PROCEDURES

The following SOPs represent chemical specific standard operating procedures. Always refer to a chemical's Safety Data Sheet (SDS) and consult the Responsible Researcher/Laboratory Supervisor and/or the Safety Office, if you have questions. Please refer to Section 7, GENERAL LABORATORY SAFETY PRACTICES for additional general rules for working in a chemical laboratory.

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MARINE BIOLOGICAL LABORATORY
POTASSIUM AND SODIUM CYANIDE SOP

1.0 Purpose

This Standard Operating Procedure (SOP) establishes appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which contain an inventory of Potassium Cyanide or Sodium Cyanide.

2.0 Hazard Description

Sodium cyanide and potassium cyanide are highly toxic compounds when ingested, inhaled or absorbed through the skin. Though all routes, exposure to cyanide can be fatal. These compounds react with water or acid to produce hydrogen cyanide gas, a lethal compound when inhaled.

2.1 Acute Effects

2.1.1 Poisoning can occur by inhalation of mists of cyanide solutions and by inhalation of hydrogen cyanide produced by the reaction of metal cyanides with acids and with water.

2.1.2 Exposure to cyanide at high levels for a short period may result in irritation of the eyes, nose and throat; headache, shortness of breath, damage to the central nervous system, the respiratory system, the cardiovascular system, and may quickly lead to death.

2.1.3 Ingestion of cyanide may cause tissue anoxia, characterized by weakness, headache, dizziness, confusion, cyanosis (bluish skin due to deficient oxygenation of the blood), weak and irregular heartbeat, collapse, unconsciousness, convulsions, coma and death.

2.2 Chronic Effects

2.2.1 Prolonged or repeated skin contact may cause dermatitis, skin necrosis and/or ulceration of the skin.

2.2.2 Chronic exposure to small amounts of cyanide compounds may cause loss of appetite, headache, weakness, nausea, dizziness, and irritation to upper respiratory tract and eyes.

3.0 Engineering Controls

3.1 All experimental procedures involving cyanides must be conducted inside a chemical fume hood that is functioning properly and has been certified with the past 12 months.

3.2 Use and ABC fire extinguisher to put out a fire involving potassium or sodium cyanide. Do not use a carbon dioxide extinguisher.

3.3 Eyewash station must be available in laboratories where cyanides are used.

3.4 Emergency safety shower must be available within 10 seconds travel time.

4.0 Administrative Controls

4.1 Individuals may not work alone when working with concentrated potassium cyanide or sodium cyanide.

4.2 When working with cyanides, a sign must be posted at the fume hood which provides notice of a chemical hazard. "**WARNING! HAZARDOUS MATERIAL IN USE!"**

4.3 All laboratory procedures involving the use of potassium cyanide or sodium cyanide must be approved by the Principal Investigator, Course Director or a faculty member.

4.4 Purchase the smallest amount of cyanide feasible for a specific task.

4.5 All containers of sodium or potassium cyanide must be stored in locked cabinets.

5.0 Personal Protective Equipment (PPE)

5.1 At minimum, long pants (or the equivalent) and closed toed shoes are required. The area of skin between the shoe and ankle should not be exposed.

5.2 ANSI approved safety glasses or goggles must be worn.

5.3 A properly fitting laboratory coat is required when handling cyanides.

5.4 A double layer of nitrile gloves must be worn with the outer layer changed often.

5.5 Depending on risk assessment a face shield and/or chemical splash apron may be appropriate.

6.0 Storage and Handling

6.1 Cyanide compounds are not compatible with oxidizing agents (e.g.,

perchlorates, peroxides, permanganates, chlorates, nitrates, chlorine, bromine, and fluorine); amines; calcium hydroxide; caustic ammonia; sodium carbonate; iron and magnesium.

6.2 Store cyanides separately from all strong acids such as hydrochloric, sulfuric and nitric acids; nitrites, nitrates, water, steam, heat, chlorates, and strong bases (e.g., sodium, potassium and ammonium hydroxides). Reaction between these chemicals and cyanide salts produces highly toxic and flammable hydrogen cyanide gas.

6.3 Store cyanides in a sealable secondary container.

6.4 Have a copy of the SDS and emergency procedures ready before beginning work involving cyanides.

6.5 Wash hands thoroughly with soap and water after handling cyanides.

7.0 First Aid Procedures

7.1 Understand the location of the nearest emergency safety shower and eyewash.

7.2 For all exposures, dial 9-911 for immediate medical attention and then call MBL Security at x7911 and Safety at x7424.

7.3 Inhalation

7.3.1 Remove the affected person from the contaminated area to fresh air.

7.4 Eye Contact

7.4.1 Flush the eyes at eyewash station for at least 15 minutes.

7.5 Skin Contact

7.5.1 Remove all contaminated clothing.

7.5.2 Immediately flush affected area at emergency shower for 15 minutes.

7.6 Ingestion

7.6.1 Requires medical attention using a Cyanide Antidote Kit.

7.6.2 First inhalation of Amyl Nitrate.

7.6.3 Followed by intravenous sodium nitrite.

7.6.5 Followed by intravenous of sodium thiosulfate.

8.0 Chemical Spill

8.1 Small Spill

8.1.1 If a small spill (less than 1 gram) of cyanide compound occurs inside a fume hood, then laboratory personnel should proceed with clean up.

8.1.2 Alert other people in the immediate area of the spill.

8.1.3 Wear appropriate personal protective equipment (PPE) including nitrile gloves, laboratory coat, safety glasses.

8.1.4 Confine spill to small area with absorbent material if needed.

8.1.5 Sweep up solid material with dustpan and broom. Clean surfaces with buffer solution (pH 10) and dilute bleach solution.

8.1.6 Collect residue into a plastic ziplock bag including dustpan and broom and other contaminated material. Label the container and dispose of as hazardous waste.

8.2 Large Spill / Spill Outside Fume Hood

8.2.1 Call Safety Office at x7424 and MBL Security on x7911.

8.2.2 Evacuate the spill area.

8.2.3 Restrict individuals from entering area.

8.2.4 Wait for the emergency personnel to arrive and provide them with information on the chemicals involved.

9.0 Waste Disposal

9.1 Cyanide (soluble cyanide salts) is an EPA Acutely Hazardous Waste (P-Listed). All items contaminated with P-Listed compounds must be disposed of as regulated hazardous waste.

9.2 Sodium or potassium cyanide solutions must be discarded as hazardous waste.

9.3 All items contaminated with cyanides such as the original container, weighing boats, pipette tips and adsorbent pads must be handled as hazardous waste.

9.4 Segregate cyanide waste from all other laboratory wastes.

9.5 Keep cyanide waste in a closed and properly labeled container in the Satellite Accumulation Area (SAA).

9.6 Contact Safety Office at x7424 for pickup of the hazardous waste.

MARINE BIOLOGICAL LABORATORY
FORMALDEHYDE, FORMALIN AND PARAFORMALDEHYDE SOP

1.0 Purpose

This Standard Operating Procedure (SOP) establishes appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which contain an inventory of Formaldehyde, Formalin or Paraformaldehyde.

2.0 Hazard Description

Formaldehyde is classified by OSHA as a Particularly Hazardous Substance with the following potential health effects: an *animal carcinogen*; classified as a *known human carcinogen* by IRAC and as a probable human carcinogen by the U.S. Environmental Protection Agency; and a sensitizer that can cause allergic skin reactions and asthma-like respiratory symptoms. Formalin and paraformaldehyde solutions can release formaldehyde gas, a known carcinogen. Working with paraformaldehyde powder can expose employees to paraformaldehyde dust, which is a strong irritant/sensitizer.

2.1 Health Hazards

2.1.1 Formaldehyde, Formalin or Paraformaldehyde may be harmful if inhaled. The substance is extremely destructive to the tissue of the mucous membranes and upper respiratory tract.

2.1.2 These chemicals are toxic if absorbed through skin. Exposure can result in skin burns.

2.1.3 Exposure to the eyes can result in eye burns.

2.1.4 These chemicals are toxic if swallowed.

3.0 Engineering Controls

3.1 All operations involving formaldehyde, formalin or paraformaldehyde (powder, granules, and flakes) must be conducted in a properly operating and certified chemical fume hood.

3.2 Safety shower and emergency eyewash should be easily accessible from the work areas where formaldehyde is used.

4.0 Administrative Controls

4.1 Formaldehyde is a chemical listed on the Department of Homeland Security's "Chemicals of Interest" List. An accurate and up-to-date inventory of this chemical must be maintained.

4.2 Designated area(s) for use and storage of formaldehyde, formalin, and paraformaldehyde must be established. This may be specific work benches or chemical fume hoods.

4.3 Formaldehyde, formalin, and paraformaldehyde stock solutions must be kept in secondary containment with proper warning signs.

4.4 Hazard warning labels that identify if the product contains formaldehyde shall be placed on the containers. Sign wording must state the following: "DANGER! POTENTIAL CANCER HAZARD".

4.5 Access to the designated area shall be restricted to persons who have been trained to recognize the hazards of formaldehyde and to work safely using PPE.

4.6 Prior to conducting any work with formaldehyde, the PI/Lab Supervisor must provide training to laboratory personnel about the hazards associated with formaldehyde, the means to protect themselves against exposure and procedures to follow in the event of an emergency.

5.0 Personal Protective Equipment (PPE)

5.1 At minimum, long pants (or the equivalent) and closed toed shoes are required. The area of skin between the shoe and ankle should not be exposed.

5.2 ANSI approved safety glasses or goggles must be worn.

5.3 A properly fitting laboratory coat is required when handling formalin, formaldehyde or paraformaldehyde.

5.4 Chemical resistant nitrile gloves must be used when working with formalin, formaldehyde or paraformaldehyde.

5.5 Change gloves frequently and immediately replace with new gloves when contaminated.

5.6 When a splash potential exists, a face shield and/or chemical splash apron should be worn.

5.7 Wash hands with soap and water after working with formaldehyde.

6.0 Handling and Storage

6.1 Avoid contact with skin and eyes. Avoid inhalation of vapor or mist.

6.2 Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

6.3 Laboratory specific written SOPs are recommended for formalin, formaldehyde and paraformaldehyde.

6.4 Segregate formaldehyde from incompatible materials (oxidizing agents, reducing agents, strong acids or bases, alkalis, alkali metals, amines, ammonia or formaldehyde).

6.5 Use the smallest practical quantities for the experiment being performed.

6.6 Transport formaldehyde solutions in secondary containment, preferably a polyethylene or other non-reactive acid/solvent bottle carrier.

7.0 First Aid Procedures

7.1 Understand the location of the nearest emergency safety shower and eyewash.

7.2 For all exposures, dial 9-911 for immediate medical attention and then call MBL Security at x7911 and Safety at x7424.

7.3 Inhalation

7.3.1 Remove the affected person from the contaminated area to fresh air.

7.4 Eye Contact

7.4.1 Flush the eyes at eyewash station for at least 15 minutes.

7.5 Skin Contact

7.5.1 Remove all contaminated clothing.

7.5.2 Immediately flush affected area at emergency shower for 15 minutes.

7.6 Ingestion

7.6.1 If swallowed, do not induce vomiting.

7.6.2 Never give anything by mouth to an unconscious person.

7.6.3 Rinse mouth with water.

8.0 Chemical Spill Procedures

8.1 Small Spill (less than 1000 mL)

8.1.1 Evacuate the spill area. Avoid breathing vapors.

8.1.2 Notify others of the formaldehyde spill and confine the spill to a small area using absorbent material from Spill Kit. Restrict others from entering contaminated area.

8.1.3 Wear appropriate PPE which includes double nitrile gloves, chemical splash goggles and laboratory coat.

8.1.4 Carefully apply spill absorbent material to absorb the spilled material.

8.1.5 Collect all spilled material and clean up material and place into an appropriate waste container or plastic bag. Label the bag or container with a Hazardous Waste label.

8.1.6 Wash the spill area with soap and water.

8.1.7 Contact Safety Office at x7424 to arrange for hazardous waste pick-up.

8.2 Large Spill (greater than 1000 mL)

8.2.1 Immediately alert all people in the vicinity and evacuate spill area.

8.2.2 Close doors to the spill area.

8.2.3 Call MBL Security on 7-911 and Safety at x7424.

8.2.4 Keep others from entering spill area until Security or Safety arrives.

8.2.5 Provide responders with information on the hazardous chemical involved.

9.0 Waste Disposal Procedures

9.1 All formaldehyde, formalin and paraformaldehyde solutions, solids and contaminated material must be disposed of as hazardous waste.

9.2 Keep hazardous waste in a closed and properly labeled container and in a secondary containment at the Satellite Accumulation Area (SAA).

9.3 Contact Safety Office at x7424 or safety@mbl.edu for pickup of the hazardous waste.

MARINE BIOLOGICAL LABORATORY
HYDROFLUORIC ACID SOP

1.0 Purpose

This Standard Operating Procedure (SOP) establishes appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which contain an inventory of Hydrofluoric Acid (HF).

2.0 Hazard Description

Exposure to Hydrofluoric Acid is a life-threatening emergency. Delay in first aid or medical treatment may result in serious tissue damage or even death. Hydrofluoric acid is extremely corrosive, and can cause severe burns to tissues. In addition, HF is a powerful poison, once absorbed into blood through the skin it reacts with blood calcium and may cause cardiac arrest.

3.0 Engineering Controls

3.1 All procedures involving the use of Hydrofluoric Acid must be performed in a properly functioning and certified fume hood.

3.2 Because of its high reactivity toward glass and moderate reactivity toward many metals, Hydrofluoric Acid must be stored in plastic containers.

4.0 Administrative Controls

4.1 Individuals may not work alone when working with concentrated Hydrofluoric Acid.

4.2 When working with HF, a sign must be posted at the fume hood which provides notice of a chemical hazard. "**WARNING! HAZARDOUS MATERIAL IN USE!"**

4.3 All laboratory procedures involving the use of Hydrofluoric Acid must be approved by the Principal Investigator, Course Director or a faculty member.

4.4 Wash hands thoroughly with soap and water after handling Hydrofluoric Acid.

5.0 Personal Protective Equipment (PPE)

5.1 Safety goggles and full face shield (if handling outside of hood) must be worn.

5.2 Long pants or appropriate clothing that covers the body to the ankles and closed-toe shoes must be worn.

5.3 A laboratory coat and a chemical resistant apron must be worn.

5.4 A double layer of nitrile gloves must be worn with the outer layer changed often.

6.0 Handling and Storage

6.1 Always keep Hydrofluoric Acid stored in a plastic container which is tightly sealed in a dry and well-ventilated place. Storage must include secondary containment.

6.2 Hydrofluoric Acid reacts with many materials therefore avoid contact with glass, concrete, metals, water, oxidizers, reducers, alkalis, combustibles, organics and ceramics.

6.3 Access to HF should be limited to only trained individuals who have read this SOP, laboratory specific SOP and the SDS.

6.4 Always wear required PPE when handling Hydrofluoric Acid.

6.5 Wash hands thoroughly with soap and water after handling Hydrofluoric Acid.

7.0 First Aid

7.1 All labs using or storing Hydrofluoric Acid must have the following antidote kits readily available:

7.1.1 Calcium Gluconate Gel (2.5%) for skin contact.

7.1.2 Calcium Gluconate Sterile Solution (1%) for eye contact.

7.2 Understand the location of the nearest emergency safety shower and eyewash.

7.3 For all exposures, dial 9-911 for immediate medical attention and then call MBL Security at x7911 and Safety at x7424.

7.4 Inhalation

7.4.1 Remove the affected person from the contaminated area to fresh air.

7.5 Eye Contact

7.5.1 Flush the eyes at eyewash station for at least 15 minutes.

7.5.2 Apply Calcium Gluconate (1%) saline repeatedly to irrigate the eye.

7.6 Skin Contact

7.6.1 Remove all contaminated clothing.

7.6.2 Immediately flush affected area at emergency shower for 15 minutes.

7.6.3 Apply Calcium Gluconate Gel (2.5%) to the affected area.

7.7 Ingestion

7.7.1 Immediately drink large amounts of water. Preferably milk, if available.

7.7.2 Do not induce vomiting.

8.0 Chemical Spill

8.1 Small Spill

8.1.1 Alert other people in the vicinity of the spill.

8.1.2 Wear safety goggles, laboratory coat, apron and double layer of nitrile gloves.

8.1.3 Neutralize spill by covering with acid neutralizer/sodium bicarbonate, and absorb with absorbents pads provided in Spill Kit. Do not use absorbent material provided within Spill Kit.

8.1.4 Collect material into a plastic bag with hazardous waste label. Place bag into a Satellite Accumulation Area.

8.1.5 Call Safety at x7424 to report release.

8.2 Large Spill / Spill Outside Fume Hood

8.2.1 Immediately alert all people in the vicinity and evacuate spill area.

8.2.2 Close doors to the spill area.

8.2.3 Call MBL Security on 7-911 and Safety at x7424.

8.2.4 Keep others from entering spill area until Security or Safety arrives.

8.2.5 Provide responders with information on the hazardous chemical involved.

9.0 Waste Disposal

9.1 Do not discard Hydrofluoric Acid down the drain.

9.2 Hydrofluoric Acid is an Environmental Protection Agency “P-Listed” Acutely Toxic compound.

9.3 All items contaminated with HF (paper towels, pipette tips, etc.) must be collected and disposed as hazardous waste. Collect dry material into a plastic bag.

9.4 Waste Hydrofluoric acid solutions and spent solutions must be collected into plastic containers, tightly capped and disposed as hazardous waste.

9.5 Segregate Hydrofluoric Acid waste from all other incompatible wastes.

9.6 Store properly labeled waste containers in the Satellite Accumulation Area (SAA).

9.7 Call Safety Office at x7424 for pickup of the hazardous waste.

MARINE BIOLOGICAL LABORATORY
PHENOL SOP

1.0 Purpose

This Standard Operating Procedure (SOP) establishes appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which contain an inventory of phenol.

2.0 Hazard Description

The major hazard of phenol is its ability to penetrate the skin rapidly, causing severe burns. Toxic and even fatal amounts of phenol can be absorbed through relatively small areas of skin. Due to its local anesthetizing properties, skin burns may be painless. Phenol may be fatal if swallowed, inhaled or absorbed through the skin. Acute overexposure by any route may lead to nausea, vomiting, muscle weakness and coma.

2.1 Health Hazards

2.1.1 Phenol is a very toxic mutagen. Target organs include the central nervous system, kidney, liver, pancreas and spleen.

2.1.2 Phenol is corrosive and toxic, and can cause irritation with contact.

2.1.3 Phenol causes burns and risk of serious damage to eyes, including blindness.

2.1.4 Phenol is toxic if inhaled because it is extremely destructive to the tissue of the mucous membranes and upper respiratory tract. It can cause upper respiratory irritation, lung damage, and central nervous system impairment.

3.0 Engineering Controls

3.1 All operations involving phenol must be conducted in a properly operating and certified chemical fume hood.

3.2 Safety shower and emergency eyewash should be easily accessible within the immediate work environment in areas where phenol is used.

4.0 Administrative Controls

4.1 Designate areas where phenol is stored or handled.

4.2 Purchase in the smallest shatter-resistant container that is practical for laboratory use.

4.3 Laboratories using phenol (or reagents containing phenol such as TRIzol) should have polyethylene glycol (PEG-300 or PEG-400) available in the event of dermal exposure.

5.0 Personal Protective Equipment (PPE)

5.1 At minimum, long pants (or the equivalent) and closed toed shoes are required. The area of skin between the shoe and ankle should not be exposed.

5.2 ANSI approved safety glasses or goggles must be worn.

5.3 A properly fitting laboratory coat is required when handling phenol.

5.4 Chemical resistant nitrile gloves must be used when working with phenol. Two pairs of disposable nitrile gloves covering the wrists are recommended when working with phenol.

5.5 Change gloves frequently and immediately replace with new gloves when contaminated.

5.6 When a splash potential exists, a face shield and/or chemical splash apron should be worn.

5.7 Wash hands with soap and water after working with phenol.

6.0 Handling and Storage

6.1 Keep container tightly closed and sealed until ready for use.

6.2 Use in the smallest quantities and lowest concentration practicable for the experiment being performed.

6.3 Store phenol in a cool, dry, ventilated area away from sources of heat or ignition.

6.4 Segregate phenol from reactive metals (e.g., aluminum, magnesium, sodium, potassium, lithium, lead and zinc).

6.5 Store phenol in secondary containment away from strong oxidizers, strong bases, plastics, rubber, nitric acid, and water.

6.6 Transport phenol in secondary containment such as polyethylene or other non-reactive acid/solvent bottle carrier.

6.7 Keep away from heat, flames and ignition sources. Hot liquid phenol will

attack aluminum, magnesium, lead and zinc metals.

6.8 After work with phenol is complete, wipe down work area with soap and water solution.

7.0 First Aid Procedures

7.1 Persons administering first aid should take precautions to avoid contact with phenol. Phenol can penetrate leather on shoes or clothing.

7.2 Understand the location of the nearest emergency safety shower and eyewash.

7.3 For all exposures, dial 9-911 for immediate medical attention and then call MBL Security at x7911 and Safety at x7424.

7.4 Inhalation

7.4.1 Remove the affected person from the contaminated area to fresh air.

7.5 Eye Contact

7.5.1 Flush the eyes at eyewash station for at least 15 minutes.

7.6 Skin Contact

7.6.1 Remove all contaminated clothing.

7.6.2 Immediately flush affected area at emergency shower for 15 minutes.

7.6.3 Avoid rubbing or wiping affected area to prevent worsening irritation.

7.6.4 Apply polyethylene glycol (PEG-300 or PEG-400) to the affected area, if available.

7.7 Ingestion

7.7.1 If swallowed, do not induce vomiting.

7.7.2 Never give anything by mouth to an unconscious person.

7.7.3 Rinse mouth with water.

8.0 Chemical Spills

8.1 Small Spill (less than 1000 mL)

8.1.1 Evacuate the spill area. Avoid breathing vapors.

8.1.2 Notify others of the phenol spill and confine the spill to a small area using absorbent material from Spill Kit.

8.1.3 Keep others from entering contaminated area.

8.1.4 Wear appropriate PPE which includes double nitrile gloves, chemical splash goggles and laboratory coat.

8.1.5 Carefully apply spill absorbent material to absorb the spilled material.

8.1.6 Collect all spilled material and clean up material and place into an appropriate waste container or plastic bag. Label the plastic bag or container with a Hazardous Waste label.

8.1.7 Wash the spill area with soap and water.

8.1.8 Contact Safety Office at x7424 to arrange for hazardous waste pick-up.

8.2 Large Spill (greater than 1000 mL)

8.2.1 Immediately alert all people in the vicinity and evacuate spill area.

8.2.2 Close doors to the spill area.

8.2.3 Call MBL Security on 7-911 and Safety at x7424.

8.2.4 Keep others from entering spill area until Security or Safety arrives.

8.2.5 Provide responders with information on the hazardous chemical involved.

9.0 Waste Disposal Procedures

9.1 Phenol, phenol solutions and phenol contaminated materials must be disposed of as hazardous waste.

9.2 Do not dispose of phenol solutions by pouring them down a sink or discarding in regular trash containers.

9.3 Keep phenol waste in a closed and properly labeled container and in a secondary containment in the Satellite Accumulation Area (SAA).

9.4 Contact Safety Office at x7424 for pickup of the hazardous waste.

MARINE BIOLOGICAL LABORATORY
PICRIC ACID SOP

1.0 Purpose

This Standard Operating Procedure (SOP) establishes appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which contain an inventory of Picric Acid.

2.0 Hazard Description

Picric acid is usually sold moistened with ≥ 30% water. When appropriately moistened and maintain moist, Picric Acid can be safely handled. Picric acid poses a potential explosion hazard when dried out. The yellow crystals of picric acid are shock-sensitive and may readily detonate if the chemical is allowed to dry. Picric acid is a more powerful explosive than TNT and must be handled with extreme care.

2.1 Health Hazards

2.1.1 Picric acid is toxic if swallowed, inhaled, or absorbed through the skin.

2.1.2 Inhalation of dust may cause lung damage.

2.1.3 Chronic exposure may cause liver or kidney damage.

2.2 Physical Hazards

2.2.1 Dry picric acid is extremely sensitive to heat, shock and friction.

2.2.2 Contact with copper, zinc, iron, mercury and lead can form picrate salts that are more shock-sensitive and explosive than the pure picric acid itself.

2.2.3 Unstable salts may also be formed with concrete, ammonium, calcium, and bases.

2.2.4 If dry crystals are present inside the container or cap threads, the friction from removing the cap may be sufficient to detonate the container.

3.0 Engineering Controls

3.1 Use picric acid in a certified fume hood to reduce risk of inhalation.

3.2 Use ABC dry chemical extinguisher to put out a fire involving picric acid.

3.3 Ensure the nearest emergency safety shower/eyewash is accessible.

4.0 Administrative Controls

4.1 Substitution with less hazardous materials is strongly recommended. Evaluate other alternatives such as premixed stains or 1% solution of picric acid in stain preparation.

4.2 Purchase and store only the minimum quantity of picric acid feasible for your research work.

4.3 Label all containers of picric acid with the “DATE RECEIVED” and “DATE FIRST OPENED”.

4.4 Maintain a log for regular inspection of picric acid container(s) usage, and the dates of receipt and opening. Log will be periodically reviewed by the Safety Office.

5.0 Personal Protective Equipment (PPE)

5.1 At minimum, long pants (or the equivalent) and closed toed shoes are required. The area of skin between the shoe and ankle should not be exposed.

5.2 ANSI approved safety glasses or goggles must be worn.

5.3 A properly fitting laboratory coat is required when handling picric acid.

5.4 Chemical resistant nitrile gloves must be used when working with picric acid. Change gloves frequently and immediately replace with new gloves when contaminated.

5.6 When a splash potential exists, a face shield and/or chemical splash apron should be worn.

5.7 Wash hands with soap and water after working with picric acid.

6.0 Storage and Handling Procedures

6.1 After each use, clean/wipe bottleneck, cap and threads with a damp cloth before closing the container of picric acid.

6.2 Label picric acid container with date of last hydration. Maintain an inventory of picric acid and dates of hydration.

6.3 Periodically review date of receipt. When the date exceeds 2 years, contact the Safety Office at x7424 or safety@mbl.edu for removal.

6.4 Do not store picric acid (solution or solid) in containers with metal caps; these are especially susceptible to the formation of highly sensitive picrate salts.

6.5 Do not use metal spatulas when manipulating picric acid. Only wooden or plastic spatulas are safe to use.

6.6 Picric acid is incompatible with oxidizers, reducing agents, inorganic salts, metals, alkaloids and albumin.

6.7 Store picric acid in a cool, dry, well-ventilated area, away from sources of heat.

6.8 Prior to handling, visually inspect bottle cap and threads of container for presence of picrate crystals. Contact Safety Office immediately at x7424 is observed.

7.0 First Aid Procedures

7.1 Understand the location of the nearest emergency safety shower and eyewash.

7.2 For all exposures, dial 9-911 for immediate medical attention and then call MBL Security at x7911 and Safety at x7424.

7.3 Inhalation

7.3.1 Remove the affected person from the contaminated area to fresh air.

7.4 Eye Contact

7.4.1 Flush the eyes at eyewash station for at least 15 minutes.

7.5 Skin Contact

7.5.1 Remove all contaminated clothing.

7.5.2 Immediately flush affected area at emergency shower for 15 minutes.

7.6 Ingestion

7.6.1 If swallowed, do not induce vomiting.

7.6.2 Never give anything by mouth to an unconscious person.

7.6.3 Rinse mouth with water.

8.0 Chemical Spills

8.1 Small Spill (less than 30 mL)

8.1.1 Evacuate the spill area. Avoid breathing vapors.

8.1.2 Notify others of the picric acid spill and confine the spill to a small area using absorbent material from Spill Kit.

8.1.3 Keep others from entering contaminated area.

8.1.4 Wear appropriate PPE which includes double nitrile gloves, chemical

splash goggles and laboratory coat.

8.1.5 Carefully apply spill absorbent material to absorb the spilled material.

8.1.6 Collect all spilled material and clean up material and place into an appropriate waste container or plastic bag. Label the plastic bag or container with a Hazardous Waste label.

8.1.7 Wash the spill area with soap and water.

8.1.8 Contact Safety Office at x7424 to arrange for hazardous waste pick-up.

8.2 Large Spill (greater than 30 mL)

8.2.1 Immediately alert all people in the vicinity and evacuate spill area.

8.2.2 Close doors to the spill area.

8.2.3 Call MBL Security on 7-911 and Safety at x7424.

8.2.4 Keep others from entering spill area until Security or Safety arrives.

8.2.5 Provide responders with information on the hazardous chemical involved.

9.0 Waste Disposal Procedures

9.1 All picric acid solutions and contaminated material must be disposed of as hazardous waste.

9.2 Keep hazardous waste in a closed and properly labeled container and in a secondary containment at the Satellite Accumulation Area (SAA).

9.3 Contact Safety Office at x7424 or safety@mbl.edu for pickup of the hazardous waste.

MARINE BIOLOGICAL LABORATORY
SODIUM AZIDE SOP

1.0 Purpose

This Standard Operating Procedure (SOP) establishes appropriate handling, storage, spill response, waste disposal and first aid procedures for any research or academic laboratory at the Marine Biological Laboratory (MBL) which contain an inventory of Sodium Azide.

2.0 Hazard Description

Sodium azide is a colorless crystalline solid and is readily soluble in water. It is used as a preservative for biological samples and stock solutions in research laboratories. Sodium azide is considered a Particularly Hazardous Substance because of its reactivity and acute toxicity. It is highly acutely toxic by all routes of exposure; inhalation, skin absorption, ingestion, skin and/or eye contact. Exposure can be fatal. Sodium azide can cause hypotension, hypothermia, headache, shortness of breath, faintness, convulsions and death. Sodium azide rapidly hydrolyzes in water to form hydrazoic acid, a highly toxic and explosive gas.

2.1 Acute Effects

2.1.1 Exposure to the skin can cause irritation, redness, blisters. Sodium azide can readily absorbed through skin and may be fatal.

2.1.2 Ingestion of Sodium Azide can cause irritation of the digestive tract, abdominal pain, low blood pressure, rapid heartbeat, nausea, sweating, vomiting, diarrhea.

2.1.3 Exposure by inhalation can cause severe irritation of the respiratory tract with sore throat, coughing, nasal stuffiness, blurred vision, shortness of breath and delayed lung edema.

2.2 Chronic Effects

2.2.1 Chronic exposure to sodium azide may result in liver and kidney damage.

2.2.2 Sodium Azide may cause mutagenic effects and development of tumors.

2.3 Physical Hazards

2.3.1 Sodium azide can form explosive compounds when it comes into contact with or dries on metal surfaces (metal spatulas).

2.3.2 Sodium azide can react with metal pipes (copper, lead, brass, or solder) in laboratory sinks, traps and drains to form highly explosive compounds (copper azide, lead azide).

2.3.3 Sodium azide is thermally unstable and can undergo violent decomposition if it is heated to temperatures ≥ 275 degrees Celsius.

2.3.4 Sodium azide rapidly hydrolyzes in water to form hydrazoic acid, a highly toxic and explosive gas.

3.0 Engineering Controls

3.1 A properly functioning and certified chemical fume hood must be used when handling sodium azide (powder and solutions).

3.2 Use ABC dry chemical extinguisher to put out a fire involving sodium azide.

3.3 Eyewash station must be readily available in laboratories where sodium azide is stored or used.

3.4 Emergency safety shower must be available within 10 seconds travel time.

4.0 Administrative Controls

4.1 Do not work alone whenever handling sodium azide powder or concentrated solutions (≥ 5% w/v). A second person must be available to provide assistance in the event of an emergency (injury, illness or chemical spill).

4.2 When working with cyanides, a sign must be posted at the fume hood which provides notice of a chemical hazard. "**WARNING! HAZARDOUS MATERIAL IN USE!"**

4.3 All laboratory procedures involving the use of sodium azide must be approved by the Principal Investigator, Course Director or a faculty member.

4.4 Purchase the smallest amount of sodium azidefeasible for a specific task.

4.5 All containers of sodium azide must be stored in controlled area.

5.0 Personal Protective Equipment (PPE)

5.1 At minimum, long pants (or the equivalent) and closed toed shoes are required. The area of skin between the shoe and ankle should not be exposed.

5.2 ANSI approved safety glasses or goggles must be worn.

5.3 A properly fitting laboratory coat is required when handling sodium azide.

5.4 Chemical-resistant nitrile gloves must be worn. Gloves must be inspected before use. Wearing two pairs of nitrile gloves is strongly recommended when working concentrated solutions (greater than 5%).

5.5 Depending on risk assessment a face shield and/or chemical splash apron may be appropriate.

6.0 Handling and Storage

6.1 Store sodium azide in a tightly closed container in a cool, well-ventilated area away from heat, air, light and moisture.

6.2 Clearly label all sodium azide stock solutions with warning signs: "**DANGER: TOXIC / FATAL!"**

6.3 Do not store sodium azide on metal shelves or use metal items (metal spatulas).

6.4 Store sodium azide away from metals, acids, carbon disulfide, bromine, sulfuric acid, nitric acid, hydrazine and dimethyl sulfate.

6.5 Alert others in the vicinity when you are working with sodium azide.

6.6 Have a copy of the SDS ready before beginning work with sodium azide.

7.0 First Aid Procedures

7.1 Understand the location of the nearest emergency safety shower and eyewash.

7.2 For all exposures, dial 9-911 for immediate medical attention and then call MBL Security at x7911 and Safety at x7424.

7.3 Inhalation

7.3.1 Remove the affected person from the contaminated area to fresh air.

7.4 Eye Contact

7.4.1 Flush the eyes at eyewash station for at least 15 minutes.

7.5 Skin Contact

7.5.1 Remove all contaminated clothing.

7.5.2 Immediately flush affected area at emergency shower for 15 minutes.

8 Chemical Spill

8.3 Small Spill

8.3.1 If a small spill (less than 1 gram) of sodium azide occurs inside a fume hood, then laboratory personnel should proceed with clean up.

8.3.2 Alert other people in the immediate area of the spill.

8.3.3 Wear appropriate personal protective equipment (PPE) including nitrile gloves, laboratory coat, safety glasses.

8.3.4 Confine spill to small area with absorbent material if needed.

8.3.5 Sweep up solid material with dustpan and broom. Clean surfaces with buffer solution (pH 10) and dilute bleach solution.

8.3.6 Collect residue into a plastic ziplock bag including dustpan and broom and other contaminated material. Label the container and dispose of as hazardous waste.

8.4 Large Spill / Spill Outside Fume Hood

8.4.1 Call Safety Office at x7424 and MBL Security on x7911.

8.4.2 Evacuate the spill area.

8.4.3 Restrict individuals from entering area.

8.4.4 Wait for the emergency personnel to arrive and provide them with information on the chemicals involved.

9.0 Waste Disposal Procedures

8.5 Sodium Azide is listed as an ACUTELY TOXIC material [P-Listed] by the Environmental Protection Agency (EPA). All items contaminated with “P-Listed” compounds must be disposed of as regulated hazardous waste.

8.6 Sodium azide solutions and stock materials must be collected as hazardous waste.

8.7 Do not discard sodium azide down the drain.

8.8 Collect all contaminated items (original container, weighing boats, pipette tips, adsorbent pads etc.) as hazardous waste.

8.9 Segregate sodium azide waste from all other lab wastes.

8.10 Keep sodium azide waste in a closed and properly labeled container in the Satellite Accumulation Area (SAA).

8.11 Contact Safety Office at x7424 for pickup of the hazardous waste.