BOSTON UNIVERSITY

Boston University Chemical Hygiene Plan

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Version	Summary of Changes	Effective Date
2020 Annual Review	Minor changes for clarity; added appendixes; updates to phone numbers and hyperlinks; updates to roles and responsibilities;	2/10/2021
2021 Annual Review	Minor changes for clarity, updated hyperlinks, updated ROHP information, added HHC Guidance document as Appendix	2/26/2022
2022 Annual Review	Minor formatting edits	03/01/2023

1.0 Introduction

Purpose

Boston University (BU) is committed to the safe and compliant use of chemicals in the laboratory. The Chemical Hygiene Plan (CHP) sets forth the policies, procedures and guidelines in place to protect laboratory workers (and those supporting laboratories at BU), from the health hazards associated with hazardous chemical use in the laboratory. The CHP has been developed by Environmental Health and Safety (EHS), in collaboration with the Laboratory Safety Committee (LSC), and is reviewed annually by EHS and the LSC, or more frequently as needed.

The CHP fulfills the requirements set forth in U.S. Department of Labor Occupational Safety and Health Administration's (OSHA) regulations "Occupational Exposure to Hazardous Chemicals in Laboratories" (29 CFR 1910.1450), referred to as the Laboratory Standard within this document.

According to the Laboratory Standard, the CHP must include:

- Standard Operating Procedures (SOPs) relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;
- Criteria to determine and implement specific control measures to reduce employee exposure to hazardous chemicals, such as engineering controls and PPE;
- A requirement that an ongoing program be developed to ensure that fume hoods and other engineering controls are functioning properly and specific measures are taken to ensure proper and adequate performance of such equipment;
- Information and training requirements to ensure employees are apprised of the hazards of chemicals present in their work area;
- Circumstances under which a particular laboratory function will require "prior approval" before implementation;
- Provisions for medical consultation and medical exams for all employees who work with hazardous chemicals;
- Designation of personnel responsible for implementation of the CHP, including assignment of Chemical Hygiene Officer (CHO) and if appropriate, establishment of Chemical Hygiene Committee; and
- Provisions for additional employee protection for work with select carcinogens, reproductive toxins, and substances that have a high degree of acute toxicity.

Scope and Applicability

This CHP applies to every laboratory or related facility at BU that uses or stores chemicals. This CHP also applies to every research laboratory or related research facility at or under the jurisdiction of Boston Medical Center (BMC); and does not cover non-research activities at BMC, such as clinical operations, which operate under a separate chemical hygiene plan administered by BMC. Questions about the CHP or the safe use of chemicals should be directed to the Laboratory Safety Coordinator, the Principal Investigator (PI), Research Core Director (RCD), Instructor/Lecturer, the LSC, or EHS.

In addition to the LSC, several other committees have authority to regulate certain aspects

of work in laboratories. These committees may include the Radiation Safety Committee (RSC), the Institutional Biosafety Committee (IBC), and the Institutional Animal Care and Use Committee (IACUC). This document does not preempt any of the policies or procedures issued by the aforementioned committees. In cases where the jurisdictions of two committees overlap, the more stringent policy or procedure applies.

This CHP must be made available to all laboratory workers prior to the commencement of laboratory duties. In addition to the CHP, laboratory workers must be familiar with and adhere to all laboratory safety guidelines and procedures developed by their laboratory supervisor, EHS and other University departments, and any federal, state, or municipal regulatory agencies. This information must be provided by the PI, Research Core Director, Instructor/Lecturer at the time of an employee's initial assignment to a work area where hazardous chemicals are present, and prior to assignments involving new exposure situations. This information should include the following:

- Permissible exposure limits (PELs), as specified in 29 CFR part 1910, subpart Z, for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard and;
- The signs and symptoms associated with exposure to the hazardous chemicals used in the laboratory; and
- The location and availability of reference material, including access to Safety Data Sheets (SDS) on hazards, safe handling, storage, and disposal.

Definitions

Hazardous chemical means any chemical that is classified as a health hazard or simple asphyxiant in accordance with the Hazard Communication Standard (§1910.1200).

Health hazard means a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals that are carcinogens, toxic or highly toxic agents, reproductive toxicants, irritants, corrosives, sensitizers, hepatotoxicants, nephrotoxicants, neurotoxicants, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes.

Highly Hazardous Chemical (HHC) means a chemical that has any health, physical or environmental hazards that require additional safety or environmental practices beyond those of a typical laboratory setting (i.e., requiring greater protection for personnel than standard PPE and/or engineering controls can provide), as required by existing regulations or upon review of the hazards by EHS, relevant oversight committees, or other institutional entities

Reproductive toxins are defined as chemicals that affect the reproductive capabilities including adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on the development of the offspring. Chemicals classified as reproductive toxins in accordance with Appendix A – Health Hazard Criteria (Mandatory) of the Hazard Communication Standard (§1910.1200) shall be considered reproductive toxins for purposes of this section.

Select carcinogen means any substance which meets one of the following criteria:

(i) It is regulated by OSHA as a carcinogen; or

(ii) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or

(iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or

(iv) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

(A) 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/m^3;

(B) After repeated skin application of less than 300 (mg/kg of body weight) per week; or

(C) After oral dosages of less than 50 mg/kg of body weight per day.

General Principles

To promote the safe handling of chemicals, the below principles apply:

Minimization of Chemical Exposure and Risks: Work should be conducted under conditions that minimize risks from known and unknown hazardous substances, including:

- Identification of chemicals to be used, how they will be used, and their quantities;
- Evaluation of the hazards associated with the chemicals to be used and consideration of laboratory conditions that could increase these hazards. The evaluation should include toxic, physical, reactive, flammable, explosive, radiation, and biological hazards as well as other potential hazards;
- Consultation of resources, including the SDS and seeking guidance from EHS personnel and experienced personnel to ensure the risk assessment is informed;
- Selection of appropriate controls (engineering, administrative, and personal protective equipment) to minimize risk and protect laboratory workers from hazards. Controls must ensure that PELs are not exceeded.
- Ensuring that procedures are in place to safely respond to accidents and emergencies

Avoidance of the Underestimation of Risk: Even for substances with no known significant hazards, exposure should be minimized. Unless otherwise known, it should be assumed that any mixture will be more toxic than its most toxic component. All substances of unknown toxicity should be considered toxic.

Provision of Adequate Ventilation: The best way to prevent exposure to airborne substances is to prevent their escape into the working environment by using chemical fume hoods and other appropriate ventilation devices.

Assumption of Personal Responsibility: Follow the CHP and seek guidance as needed.

Individuals who work with chemicals are responsible for their own safety, the safety of colleagues, and of the general public.

Observation of Permissible Exposure Limits and Threshold Limit Values: OSHA's PELs cannot be exceeded. The American Conference of Governmental Industrial Hygienists Threshold Limit Values should also not be exceeded. When a regulatory standard does not exist, recommended exposure limits should be followed.

2.0 Roles and Responsibilities

The chief element in this section is the designation of authority and responsibility for implementation of the CHP. The following parties are responsible for implementing the requirements of the CHP:

Laboratory Safety Committee (LSC)

The LSC serves as BU's Chemical Hygiene Committee.

The scope of BU's LSC extends to all laboratories affiliated with, served by, owned or controlled by Boston University and the research laboratories at BMC. The LSC is comprised of faculty members and representatives from administrative departments that have laboratories working with or storing hazardous chemicals. The committee also includes members of EHS, Office of the Provost, Research Occupational Health Program (ROHP), Campus Planning and Operations (CPO), and other University departments that support laboratories at the University.

The committee meets on a quarterly basis. The duties of the committee include, but are not limited to:

- Annual review of the CHP;
- In collaboration with the CHO and EHS, implementation of the CHP;
- Support general chemical safety efforts for laboratory workers covered under the CHP and students in teaching laboratories;
- In collaboration with EHS, define highly hazardous chemicals used in research and teaching laboratories at BU;
- Review HHC SOPs, as necessary;
- Review of written guidelines and training programs, as necessary;
- Discuss laboratory safety issues and incidents; and
- Recommend, develop, and/or review policies and practices regarding laboratory safety issues, in collaboration with EHS.

Environmental Health and Safety (EHS)

EHS responsibilities include, but are not limited to, the following:

- Design safety training programs;
- Development of SOPs;
- Conduct safety training programs that are not site-specific;
- Conduct site or topic specific trainings, as requested or required;
- Conduct laboratory safety inspections on a routine basis and by request;
- Conduct periodic and requested inspections of engineering controls;

- Make recommendations for corrective actions in cases of noncompliance;
- Oversee the hazard assessment and development of lab-specific SOPs, in consultation with the LSC as necessary;
- Investigate cases of suspected or reported exposure or exposure due to accident;
- Provide chemical spill response as needed;
- Maintain laboratory safety training records and ensure, in collaboration with the PI, that all laboratory workers complete the annual Laboratory Safety Training;
- Assist the PI and laboratory workers with compliance with all aspects of this Plan;
- Communicate to each PI, Research Core Director, Instructor/Lecturer any relevant safety information or concerns pertaining to their laboratory;
- Maintain incident reports; and
- Manage the hazardous waste program.

Chemical Hygiene Officer (CHO)

The CHO is a staff member of EHS, as well as a member of the LSC. Responsibilities of the CHO include, but are not limited to:

- Ensure that the CHP is readily accessible to all employees, either as a paper copy, as an electronic copy online, or other readily available means;
- Establishes exposure monitoring programs including initial and periodic monitoring;
- Assists the CSO, with monitoring, procurement, use, storage, and disposal of chemicals;
- The Chemical Hygiene Officer provides technical guidance in the development and implementation of the Chemical Hygiene Plan;
- Develop and implement appropriate laboratory safety policies, practices and procedures in collaboration or consultation with the PI, Research Core Director (RCD), Instructor/Lecturer with final recommendation or approval by the LSC;
- Assists laboratory supervisors in developing appropriate engineering controls for new and/or existing facilities;
- Seeks ways to improve the Chemical Hygiene Program.

Chemical Safety Officer (CSO)

The CSO is a staff member of EHS. Responsibilities of the CSO include, but are not limited to:

- Lead or participate with the development, implementation, maintenance, and management of chemical safety programs to promote a healthy and safe work and educational environment for the university and its research and teaching community;
- Work with the Chemical Hygiene Officer develop chemical safety standards, policies, and procedures that are compliant with applicable regulations and followed by laboratories;
- Manage and provide technical guidance, develop trainings, and conduct risk analysis of laboratory processes that involve Highly Hazardous Chemicals (HHC), hazardous gasses, and other hazardous chemicals, including the screening and approval of chemical purchases by labs; development, and updates of SOPs for HHC chemicals identified;

- Review and approve submitted HHC SOPs in consultation with faculty reviewers;
- Consult and provide technical assistance to technical safety committees and laboratories;
- Conduct risk assessments of chemical processes and provide guidance for working with hazardous chemicals including recommend appropriate PPE, procedures, and safety equipment;
- Implement and manage the hazardous gas program;
- Manage and maintain the University's adherence with the Homeland Securities CFATS requirements for Chemicals of Interest (COI).

Principal Investigator (PI), Research Core Director (RCD), Instructor/Lecturer

The responsibility for ensuring that all laboratory work is safe and compliant rests with the PI/RCD/Instructor/Lecturer and EHS. In Research Core Facilities, the RCD is the PI equivalent and has equivalent responsibilities under this CHP. In teaching laboratories, the Instructor/Lecturer is the PI equivalent and has equivalent responsibilities under this CHP. When a PI uses a Core Facility, both the PI and RCD are responsible for facilitating a shared understanding of the chemicals being used and procedures utilized.

The PI is responsible for work being conducted by their laboratory workers in Core Facilities, and the RCD is responsible for the work being performed by the Facility workers. When an Instructor/Lecturer is using a shared laboratory space such as a Core Facility or teaching laboratory, they are responsible for work being conducted by their laboratory workers or instructional staff.

The PI designation refers to the faculty member responsible for work in a specific laboratory facility. This person, in collaboration with EHS, must develop laboratory-specific SOPs to be followed in his/her/their laboratory. When a laboratory space is used by more than one PI, all PIs utilizing that space are responsible for ensuring that work is safe and compliant. The PI can assign duties to a Laboratory Supervisor, but the PI is ultimately responsible for the safe and compliant conduct of work in his or her laboratory.

PI duties also include, but are not limited to, oversight and maintenance of the following:

- Identify and designate work areas where chemicals will be used;
- Ensure that an up-to-date inventory of chemicals is maintained and provided to EHS through BioRAFT;
- Assist EHS and the CHO in defining all hazardous operations, alerting employees to hazards, and establishing safe procedures for these operations by identifying suitable engineering controls and PPE;
- Ensure, in collaboration with EHS, that all new laboratory workers complete training requirements before working unsupervised in the laboratory/facility and that all workers complete this training annually thereafter;
- Ensure that all laboratory workers receive instruction in: safe work practices; are trained on specific SOPs for use of highly hazardous chemicals as appropriate; proper use of PPE; spill clean-up; and emergency procedures;
- Ensure that all laboratory workers have read and are familiar with the CHP and know how to access it;
- Designate a Laboratory Safety Coordinator for the laboratory/facility, as appropriate;

- Provide access to safety information and specific training to laboratory workers for the hazardous chemicals with which they work (which may include training when the worker's exposure changes or when new workers start in the laboratory/facility);
- Develop and establish SOPs for safe handling and operations applicable to the hazardous chemicals as needed;
- Provide, in collaboration with EHS, all appropriate and required PPE to laboratory workers;
- Assist the CHO or EHS personnel in fulfillment of their duties with respect to his or her laboratory/facility;
- Correct deficiencies identified during inspections, as appropriate;
- Report all accidents and near misses (which are unplanned events that did not result in injury, illness, or damage but had the potential to do so) that occur in their laboratory/facility and take corrective measures to prevent recurrence;
- Ensure proper disposal of all laboratory waste, including hazardous waste, biological waste, and sharps waste from his or her laboratory/facility;
- Inform visitors, vendors and non-laboratory personnel of hazards before accessing the laboratory/facility;
- Ensure that the laboratory provides access to SDS for hazardous chemicals used in the laboratory/facility;
- Maintain relevant safety information for the laboratory/facility in BioRAFT and appropriate safety logbooks in a designated Safety Center within the laboratory; and
- Comply with the Boston University's Policy on Minors in Laboratories.

Laboratory Safety Coordinators

The Laboratory Safety Coordinator is assigned by the PI/RCD/Instructor/Lecturer to assist with safety and compliance efforts in the laboratory, as appropriate. When designated by the PI/RCD/Instructor/Lecturer, the Laboratory Safety Coordinator is authorized to represent the PI/RCD/Instructor/Lecturer in matters related to the implementation of safe laboratory work practices however, ultimate responsibility resides with the PI/RCD/Instructor/Lecturer. The duties of the Laboratory Safety Coordinator include, but are not limited to:

- Participate in specialized Laboratory Safety Coordinator training and discussions sponsored by EHS;
- Assist PI/RCD/Instructor/Lecturer efforts to maintain and promote laboratory compliance;
- Serve as the primary laboratory contact with EHS for issues related to safety (i.e., biological, chemical, fire & general safety, controlled substances, etc.);
- Take positive actions to help reduce the potential for accidents and incidents associated with laboratory operations;
- Inform laboratory workers of the safety hazards associated with their work and instruct laboratory workers in safe work practices;
- Assist other laboratory workers with reporting all accidents, near misses, or safety concerns to the PI/RCD/Instructor/Lecturer and EHS;
- Work with EHS to determine safe work practices and procedures;
- Work with EHS to ensure that laboratory workers complete all required safety trainings in a timely manner;

- Ensure that all deficiencies identified by EHS or outside regulatory inspectors are addressed and corrected per a schedule for correction;
- Participate in the incident review process;
- Stop operations that are in clear violation of the safety requirements, approved SOPs, or that may potentially result in injuries or potential exposures; and
- Maintain relevant safety information for the laboratory in the BioRAFT and appropriate safety logbooks in a designated Safety Center within the laboratory.

Laboratory Workers

Individuals who work in laboratories, including visiting scholars, where hazardous chemicals are used or stored are responsible for performing their work in accordance with the CHP. Responsibilities of laboratory workers include, but are not limited to:

- Follow all University, Federal, State, and local health and safety standards, rules and regulations, as they apply to the laboratory;
- Maintain up-to-date training;
- Report all hazardous conditions to their PI/RCD/Instructor/Lecturer and EHS;
- Review the SDS prior to work with hazardous chemicals;
- Consult with the PI or appropriate designee before conducting any changes in protocol or using any new chemicals, particularly if highly hazardous or highly reactive;
- Inform the PI/RCD/Instructor/Lecturer or appropriate designee of any unapproved changes in protocol or the unapproved use of new chemicals in the laboratory;
- Wear and use prescribed PPE;
- Follow all appropriate SOPs necessary for the safe operation of laboratory work, and if no such SOP currently exists, contact and work with EHS and the LSC to develop the necessary SOP and obtain approval from the LSC;
- Report any suspected job-related injuries, exposures or illnesses to the immediate supervisor and ROHP and seek treatment immediately;
- Do not operate equipment or instruments that may pose a hazard without the proper instruction, training and authorization;
- Remain aware of chemical hazards in the laboratory; and
- Request information and training when unsure of how to handle a hazardous chemical or procedure.

Laboratory Visitors

Laboratory Visitors are individuals who do not normally work in a laboratory but may need to visit a laboratory to perform assigned work or accompany a laboratory worker as a guest (See Visitor Policy). This category includes Facilities maintenance and custodial staff, vendors, contractors, and any other person who enters a laboratory but does not meet the definition of laboratory worker. Responsibilities of laboratory visitors include, but are not limited to:

- Review the laboratory safety placard posted at the entrance to the laboratory and comply with all PPE and work practices listed;
- Do not disturb any laboratory equipment on benchtops or in chemical fume hoods or biological safety cabinets;
- Direct any questions to a person working in the laboratory if available;
- Report unsafe conditions to a person working in the laboratory, supervisor, or the

emergency numbers listed on the laboratory safety placard.

3.0 Training

All individuals who work in laboratories must be apprised of the hazards associated with chemicals present in their work area. This information must be provided by the PI/ RCD/ Instructor/Lecturer before initial assignment and before new potential exposure situations. It is the shared responsibility of the PI/RCD/Instructor/Lecturer and EHS to ensure that all laboratory workers have been properly trained. EHS verifies training compliance as part of their routine inspection process.

The training program for all laboratory workers consists of training administered by EHS, and site-specific training conducted by the PI/RCD/Instructor/Lecturer or their designee.

Laboratory and Chemical Safety Training

All laboratory workers who participate in laboratory activities that utilize chemicals or biological media or generate or handle hazardous waste must participate in this training. All laboratory workers must complete either the classroom Laboratory Safety Training or the online Laboratory and Chemical Safety Training before conducting laboratory work without direct supervision and annually thereafter. Additional training may also be required depending on the nature of and hazards associated with the proposed work (e.g., Biosafety Training, Bloodborne Pathogens Safety Training, etc.) Detailed information is available on the Training website. EHS maintains training records for those individuals who complete this training in BioRAFT. The PI or their designee can verify the training records in BioRAFT. These trainings are focused on the following laboratory safety topics:

- The University's CHP
- Emergency Procedures
- Medical Consultations and Examinations
- OSHA's Laboratory Standard
- Hazard Recognition
- Safety Data Sheets (SDS)
- Safety Equipment
- Engineering Controls
- PPE
- Chemical Management, Inventory, Labeling and Storage
- Hazardous Waste Management, Storage and Disposal
- Highly Hazardous Chemical Program
- Nanotechnology

Site-Specific Training

Site-specific training consists of the details of local engineering and administrative controls within laboratories, as well as laboratory-specific policies and procedures. For hazardous chemicals, it is at the discretion of EHS, the PI, the Laboratory Safety Coordinator, or Laboratory Worker when site-specific training is necessary. At minimum, hazard communication should be addressed with all laboratory-related personnel. For use of highly hazardous chemicals, workers must receive training specific to the nature of the hazard and the procedures defined in the LSC approved SOP.

The PI is responsible for oversight of laboratory procedures and ongoing assessment of the need for site-specific training from EHS before a laboratory worker uses a new hazardous chemical or conducts a new potentially hazardous procedure.

4.0 Signs and Symptoms of Chemical Exposure

It is critically important that laboratory workers are aware of and recognize the signs and symptoms of chemical exposure. Prior to work, the chemicals SDS should be reviewed for associated signs and symptoms.

If a lab-related exposure, injury or incident is suspected or is known to have occurred, it *must* be reported to ROHP and Environmental Health and Safety. See Appendix B: *Emergency Procedures and Reporting* for more information.

EMPLOYEES after reporting an incident to ROHP should contact Conduent, an injury/incident intake service available 24/7. Employees should also notify their supervisor as soon as possible. When a near miss (i.e. an unplanned event that did not result in injury, illness, or damage but had the potential to do so) an EHS Near Miss Report should be filed within 24 hours of the incident.

Signs and symptoms of chemical exposure may include (these symptoms may also be associated with conditions other than chemical exposure):

- Skin that has become dried, whitened, reddened, swelled, blistered, and itchy or exhibits a rash;
- A chemical odor. Many chemicals can be smelled at concentrations below harmful levels. Harmful levels may also be present for some chemicals without a detectable odor. Consult the SDS;
- A chemical taste;
- Tearing or burning of the eyes;
- Burning sensations of the skin, nose or throat;
- Cough, headache or dizziness.

5.0 Medical Services and Surveillance

Laboratory personnel working with hazardous chemicals may receive medical attention if needed. Medical attention, including any follow-up examination and treatment recommended by the examining health care provider, must be offered as described below:

ROHP serves BU and Boston Medical Center (BMC) laboratory researchers and those who support those research laboratories. Its client population includes faculty, staff, students, and sometimes visitors. Certain biological agents and other materials used in research labs have distinct hazards and/or special occupational health requirements. Researchers and other staff who handle animals, biological agents, or viable samples from animals and humans must be medically cleared by ROHP before handling the animal or materials. For these reasons, ROHP is the also the primary occupational healthcare provider for the following groups:

- NEIDL
- Animal Science Center (ASC)
- Researchers at BU or BMC BSL 2, 3, or 4 research laboratories, and those listed on an IBC protocol
- Environmental Health & Safety staff

A **medical consultation** to determine the need for a medical examination must be offered to any employee who is present in the work area when a spill, leak, explosion, or other accident occurs that results in a potential significant exposure to a hazardous chemical.

A **medical examination** must be provided to any employee who exhibits signs or experiences symptoms associated with exposure to a hazardous chemical used in the laboratory.

Medical surveillance will be performed by ROHP as directed by the relevant OSHA standard of the relevant hazardous agent whenever exposure of that particular agent exceeds its action level or PEL as indicated by exposure monitoring by EHS. Please refer to Section 6: *Exposure Monitoring* for more information.

Additionally, the provisions of BU's Respiratory Protection Program require that any employee required to wear a tight-fitting respirator in performance of his or her duties must undergo a medical evaluation in addition to a fit-test. Fit-testing shall be repeated annually or if changes in the person's physical condition could affect the fit of the respirator. Examples of these changes include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.

Laboratory personnel who work with biologicals and/or animals and use chemicals must complete an initial ROHP questionnaire; this must be updated annually with ROHP.
In addition, a ROHP Job Risk Assessment form should be completed in order to provide ROHP with information about work environment. This confidential questionnaire should be completed annually or sooner if your work environment changes

ROHP provides these medical services and surveillance at no charge to University employees. ROHP can be reached at **617-358-7647.**

If the events triggering the request for medical services and/or surveillance involve potential chemical exposure, the impacted individual must also contact EHS to investigate the extent of the exposure. ROHP uses the information gathered in the EHS investigation to appropriately scale their response. Any required records will be kept by ROHP and EHS, as necessary; medical records kept by ROHP will be maintained as confidential.

In the event of an injury *or near miss* in the laboratory, the Laboratory Supervisor or PI must complete and submit an Occupational Injury/Illness Report Form or an EHS Near Miss Form within 24 hours of the incident. See Appendix B: *Emergency Procedures and Reporting* for more information.

6.0 Exposure Monitoring

EHS is responsible for ensuring that a laboratory worker's exposure to hazardous chemicals does not exceed the Permissible Exposure Limits (PELs) specified by OSHA (see below).

Worker exposure determinations will be made by EHS in accordance with paragraph (d) of 29 CFR 1910.1450 or applicable OSHA standard.

Initial monitoring will be done by EHS to measure worker exposure whenever there is reason to believe that exposure levels for that substance routinely exceed the action level

(or in the absence of an action level, the PEL). Initial monitoring should also be considered whenever a substance is first introduced for proposed use, or whenever laboratory practices change in ways that exposure levels of the substance could significantly increase.

The PELs for OSHA-regulated substances can be found in 29 CFR part 1910, subpart Z as indicated below:

TABLE Z-1 Limits for Air Contaminants. - 1910.1000

TABLE Z-2 - 1910.1000

TABLE Z-3 Mineral Dusts - 1910.1000

Periodic monitoring will be conducted by EHS if the initial monitoring performed discloses worker exposure over the action level (or, in the absence of an action level, the PEL). BU will immediately comply with the exposure monitoring provisions of the relevant standard. Please refer to Section 5: *Medical Services and Surveillance* for more information.

Within fifteen (15) working days after the receipt of any monitoring results, the worker will be notified by EHS of these results in writing.

Any BU employee with a reason to believe that exposure levels for a substance exceed the action level or, in the absence of an action level, the PEL, may request monitoring through the CHO or EHS office. Monitoring may be requested at any time. EHS is responsible for coordinating exposure monitoring requests. EHS is also responsible for determining when monitoring is no longer necessary and can be terminated.

7.0 Recordkeeping

The following records must be maintained:

- Records of any measurements taken to monitor worker exposure are maintained by EHS for at least 30 years per 29 CFR 1910.1450 in accordance with 29 CFR 1910.1020;
- Records of any medical consultation and examinations are maintained by ROHP for at least the duration of employment plus 30 years per 29 CFR 1910.1450 in accordance with 29 CFR 1910.1020;
- Training records are maintained by EHS;
- Fume hood evaluations are maintained by EHS for 3 years; and
- Records of laboratory inspections are maintained by EHS.

8.0 Laboratory Design and Engineering Controls

Engineering controls should be implemented within the laboratory to minimize exposure to hazardous chemicals. Engineering controls may include the following: general laboratory ventilation, chemical fume hoods, point-source ventilation, filtered enclosures, product substitution, secondary containment, and other physical systems used to minimize exposure.

It is the responsibility of the department and Campus Planning and Operations (CPO) to inform EHS when a laboratory is selected to be renovated or redesigned. EHS will meet with the PI/RCD/Instructor/Lecturer of the laboratory to understand the nature of the work being conducted, including which hazards may be present, and to recommend appropriate engineering controls for the new laboratory. PIs are encouraged to contact EHS at any time to request an evaluation or meeting to discuss engineering controls in their laboratory.

If ventilation engineering controls are not supporting safe operations in the laboratory, the laboratory worker must cease all work with volatile and aerosol producing substances immediately, secure all chemicals and contact CPO for repair. Please note: Any modifications to existing ventilation engineering controls must be installed by CPO or a licensed HVAC contractor following approval by EHS. On the CRC, CPO's Emergency Control Desk can be contacted 24 hours per day at **617-353-2105.** On BUMC, the Control Center is available 24 hours per day at **617-638-4144.**

A common engineering control installed in laboratories is the chemical fume hood. Details of chemical fume hood use, maintenance, and annual testing can be found in Section 9: *Standard Operating Procedures*.

In addition to reviewing and approving engineering controls in new laboratory design projects, EHS is responsible for the review of laboratory design plans for compliance with applicable local, state, and federal environmental health and safety codes, regulations, and standards.

9.0 Standard Operating Procedures (SOPs)

The below policies and procedures are applicable to the use of most chemicals under most circumstances. Chemical specific SOPs may exist in the laboratory and are required for highly hazardous chemicals.

The purpose of these SOPs is to define a baseline set of procedures and practices for employees, students, visitors, or any other persons working with hazardous chemicals in a laboratory to follow to promote safe use.

9.1 Safe Work Practices

- Read and become familiar with this CHP and any SOPs developed specifically for the laboratory prior to working in the laboratory.
- Notify supervisors and ROHP of chemical sensitivities or allergies.
- Always read the SDS and label before using a chemical.
- Make others aware of special hazards associated with your work.
- Use appropriate ventilation (e.g., fume hood or local exhaust ventilation) when working with hazardous chemicals.
- In a laboratory setting, long pants or full-length skirt and proper PPE are required, including closed-toe shoes (shoes should be water-resistant or water-repellant or shoe covers should be worn). See *Section 9.8 Personal Protective Equipment*.
- Become familiar with the location and use of emergency equipment and facilities, such as:
    - eyewash and safety showers;
    - fire extinguishers;

    - fire blankets, if applicable;
    - fire alarm pull stations;
    - emergency exits; and
    - chemical spill equipment.
- Never eat, drink, smoke, chew gum, apply cosmetics, or manipulate contact lenses in the laboratory. Contact lenses may be prohibited in certain chemical laboratories, as indicated in laboratory-specific SOPs.
- Food, beverages, cups, and other drinking and eating utensils should not be stored in areas where hazardous chemicals are used or stored.
- Pipetting should never be done by mouth.
- Never leave exposed sharps, micropipettes, or broken glass on the bench or in washing facilities.
- Keep chemical containers closed unless actively in use.
- Clearly label all containers of any stored substances with the name(s) of the chemical(s). Abbreviations, chemical formulas, structures, etc. are insufficient for clear identification. If possible, include the concentration and any hazards of the substance. For small quantities of synthesized chemicals (i.e., in multi-well plates, etc.), external reference documents may be kept nearby.
- When disposing of or moving unwanted laboratory equipment, it must be decontaminated prior to disposal or removal from the laboratory. Please refer to BU's Laboratory Decontamination and Decommissioning guidance. A green "decon" sticker can also be requested from EHS.
- Remove PPE (e.g., gloves, aprons, protective footwear, and headwear) before leaving the laboratory space. Do not wear PPE in non-laboratory support areas.
- Discard, decontaminate, clean, or sanitize PPE on a regular basis.
- Always wash hands immediately after removing gloves and before leaving the laboratory.

9.2 Working Alone

Working alone with hazardous materials, chemicals, equipment, or working under conditions that may create the risk of serious injury should be avoided (and in some cases may be prohibited). Associated risks and steps taken to minimize these risks must be discussed with the PI/RDC/Instructor/Lecturer prior to working alone.

If the PI/RCD/Instructor/Lecturer determines that the risk cannot be minimized to a safe level, then the individual should only conduct work when others are present. Undergraduate students are not permitted to work alone without prior written approval from the immediate PI/RCD/Instructor/Lecturer, following a risk assessment:

- Discuss and conduct a risk assessment with the PI/RCD/Instructor/Lecturer before conducting hazardous procedures.

- The worker should inform a co-worker, friend, family member or colleague that they will be in the laboratory alone and give them information on whom to contact in the event that the worker does not contact them when leaving the laboratory.

- On BUMC, the worker can notify Public Safety at **617-414-4444**, and officers will include the laboratory on the building's walk-through, if appropriate.

- On the CRC, the BU Police Department can be reached at **617-353-2121** if non-emergency assistance is needed or to request a walkthrough.

9.3 Safety Data Sheets (SDS)

OSHA requires that SDS are available to employees working with hazardous chemicals. The SDS summarize information about the material including chemical components, hazard identification, first aid, spill, and firefighting procedures, incompatibilities, safe handling and storage requirements, and disposal guidelines. The Laboratory Supervisor, PI, and EHS are responsible for providing workers with access to SDS.

- Workers should review the SDS prior to working with a chemical. SDS should be readily available for quick response to any spills, medical emergencies, or other incidents involving a chemical.

- Hard copies of highly hazardous chemical SDS are required along with appropriate SOPs. PIs are encouraged, however, to keep SDS hard copies of all chemicals in their laboratory inventory. Hard copies can be obtained in two ways:

    - Chemical manufacturers often ship an SDS with a chemical or mail it to the laboratory separately. When a hard copy of an SDS is received in the laboratory it should be saved for future reference. New copies should replace older versions.

    - SDS is also often available online. Laboratory workers can download and print copies of SDS from manufacturers' websites and keep them in or near the laboratory.

- Digital copies of SDS are acceptable if there is immediate laboratory access either through a shared computer station and/or laboratory smart device.

9.4 Chemical Procurement

The purchasing of chemicals must be authorized by the PI or PI designee before submitting to Sourcing and Procurement. Best practices include:

- Purchasing chemicals through Sourcing and Procurement;
- Ordering the minimum amount of the chemical needed to perform the work;
- Reviewing current chemical stocks in laboratory before ordering;
- Chemicals need to be dated and added to the inventory upon receipt.

Individuals who will be receiving and using the chemical must be adequately informed and trained on proper handling, storage, and disposal. Proper PPE and plans for safe storage and handling should be in place prior to receipt. EHS is available as a resource and should be consulted as needed.

9.5 Safe handling and storage of chemicals

The PI is responsible for keeping an accurate working inventory of the chemicals stored and providing their inventory to EHS through BioRAFT. Inventories shall be updated at least annually. The Department of Homeland Security through the Chemical Facility Anti-Terrorism Standards (CFATS) have identified a number of Chemicals of Interest (COI) and developed screening threshold quantities (STQ) limiting how much of each COI may be stored at the facility.

By following the below guidelines, the risks associated with the storage and handling of chemicals in the laboratory can be considerably reduced:

- A risk assessment should be conducted by the PI/RCD/Instructor/Lecturer or PI/RCD/Instructor/Lecturer designee prior to beginning work with any highly hazardous chemicals for the first time. EHS shall review any risk assessment completed for highly hazardous chemicals.
- Read SDS and label information before using a chemical for the first time.
- Consult the SDS and keep incompatible chemicals separate during transport, storage, use, and disposal.
- Follow storage requirements as prescribed in the SDS.
- The chemical storage guidelines should be used for work with specific chemical hazards; see Section 9.6: *General Chemical Safety Guidelines*.
- Chemicals should not be stored on the floor, in areas of egress, or in areas near heat or in direct sunlight.
- Open shelves used for chemical storage should be secured to the wall and contain ¾ inch lips. Secondary containment devices should be used as necessary.
- Do not store food or beverages in the laboratory refrigerator.
- Handle hazardous chemicals with appropriate engineering controls (e.g. chemical fume hood) and appropriate PPE.
- Workers should not use hazardous chemicals or equipment if they have not been trained to do so.
- Highly hazardous chemicals should be stored in a well-ventilated and secure areas designated for that purpose.
- Maintain existing labels on incoming containers of chemicals.
- Label secondary containers that may be used for storing hazardous chemicals with chemical identification and appropriate hazard warnings.
- Laboratory doors should remain closed at all times.
- Work surfaces and laboratory furniture should be impervious to chemical spills.

9.6 General Chemical Safety Guidelines

The Chemical Segregation and Storage guidelines illustrate practical guidelines detailing the segregation of different types of chemicals. Always consult the SDS for detailed information. Please refer to the Highly Hazardous Chemicals Program for additional information on highly hazardous chemicals.

Corrosives

- Store corrosive materials below eye level.

- Segregate acids from bases and bases from acids indifferent secondary containers or cabinets.
- Store concentrated acids and bases in corrosive cabinets or secondary containers large enough to hold at least the contents of 110% of the largest container if it should break
- Use appropriate bottle carriers or a cart when transporting acid bottles.

Acids

- Store large bottles of acids in bins or trays on low shelves or in acid cabinets, or in a cabinet marked “Corrosives.”
- Segregate oxidizing acids (i.e., nitric acid) from organic acids (i.e., acetic or formic acids) and flammable and combustible materials.
- Segregate acids from active metals such as sodium, potassium, and magnesium, and other incompatible materials, including cyanides and hypochlorites.
- Segregate inorganic acids from organic acids.;
- Awareness of where spill-control pillows or acid neutralizers are available (in common areas) in the event of a spill. Do not use bases to neutralize acid spills.
- Highly hazardous hydrofluoric acid (HF) and perchloric acid ($HClO_4$) need dedicated secondary containment.

Bases

- Store large bottles of liquid bases in bins or trays in a cabinet marked “Bases” or “Corrosives.”
- Segregate bases from acids and other incompatible materials (i.e., amines and ammonium hydroxide) from hypochlorites.
- Store solutions of inorganic hydroxides in polyethylene containers.
- Know where spill-control pillows or caustic neutralizers are available (in common areas) for caustic spills. Do not use acids to neutralize base spills.

Flammables

- Bulk storage of flammable chemicals should be stored in a spark-free environment and in approved flammable-liquid containers and storage cabinets. Grounding and bonding should be used to prevent static charge buildups when dispensing solvents.
- Only store flammable liquids in a specially equipped, explosion-proof or flammable-safe refrigerator or flammables cabinet.
- Laboratory-grade, flammable-rated refrigerators and freezers should be used to store sealed chemical containers of flammable liquids that require cool storage.
- Keep flammables away from sources of ignition.
- For flammable metals, have a Class-D fire extinguisher available. See the “Fire Extinguishers” part under Section 7.8: *Laboratory Safety Equipment* for more information.
- MA fire code (527 CMR) regulates the total quantity of flammable materials that can be stored on each floor of each building. Consult EHS’s fire safety group for guidance.

Oxidizers *(e.g., Perchlorates, Nitrates, Permanganates)*

- Oxidizers can intensify and increase the flammable range for chemicals so they can ignite more readily.
- Store oxidizers in a cool, dry area.
- Store oxidizers away from flammable and combustible materials, such as paper, wood, etc.
- Oxidizers, reducing agents, and fuels should be stored separately to prevent contact in the event of an accident.

Peroxide-Forming Chemicals *(e.g., Isopropyl Ether, Tetrahydrofuran)*

- Peroxide forming chemicals shall be dated upon receipt and upon opening.
- Store these chemicals in airtight containers in a dark, cool, dry area. Store away from heat and light with tightfitting, nonmetal lids.
- **Do not open, do not touch** a bottle of liquid peroxide forming material if solid precipitates or crystals are seen in the bottle or along the bottle's cap. Immediately contact EHS to arrange disposal.
- Test for peroxides before concentrating (i.e. distilling, rotovapping, recrystallizing) peroxidizable solvents using appropriate test strips.
- Dispose of peroxide forming chemicals on or before the expiration date.
- After expiration date or one year, peroxide generating reagents must either be disposed of or tested using indicator strips on a quarterly basis, including peroxide forming solvents in solvent purification systems.
- Indicator strips may be purchased from Millipore-Sigma, Fisher, or VWR.
- A positive test indicates that the reagent should be appropriately disposed of as hazardous waste; a negative test requires quarterly testing until peroxides are detected leading to its appropriate disposal.
- Quarterly peroxide testing results should be documented by recording the date and test result on a label affixed to the container.
- BU's hazardous waste vendor will not ship peroxidizable materials with peroxides over 20ppm. If test strip indicates peroxides ≥20ppm, contact EHS to arrange for a high hazard stabilization.

Compressed Gases

- EHS must be informed prior to purchase, storage and use of hazardous (pyrophoric, toxic, corrosive and/or reactive) gases to ensure the appropriate storage conditions, ventilation, PPE and gas monitoring are in place.
- Fire code sets Maximum Allowable Quantities (MAQ) regulating the total quantity of hazardous gases that can be stored on each floor of each building. Consult EHS's fire safety group for guidance.
- Monitor compressed gas inventories and dispose of or return gases for which there is no immediate need. Maintain compressed gas inventory in BioRAFT.
- Order the smallest quantity possible in a returnable cylinder. Empty or unused gas cylinders should be returned to the supplier on a regular basis. Avoid ordering lecture bottles as they are not returnable to the gas supplier.
- Store and use hazardous gases in a ventilated space such as a chemical fume hood or certified gas cabinet.
- Store compressed gases in a secure and upright position. Secure cylinders individually with a chain or strap, 2/3 to 3/4 up the height of the cylinder from

the floor. A cylinder stand may be used to secure a small gas cylinder within a fume hood.

- Routinely inspect gas cylinder straps and chains for structural integrity. Do not use damaged straps or chains.
- Indicate the status of the cylinder: “Full” or “In Use” or “Empty”.
- When not in use, replace the valve cap.
- Use commercially-prepared liquid leak detector (i.e., “Snoop”) to leak test pressure regulator and other gas system fittings when the regulator is replaced or removed or when performing maintenance or modifications to the gas system.
- Gas regulators must be pressure tested with an inert gas prior to use.
- Pressure regulators must be used in accordance with manufacturer’s specifications. Always use the correct pressure regulator for the gas.
- Use only Compressed Gas Association (CGA) standard combinations of valves and fittings. Do not use regulator adaptors.
- Do not build or modify gas regulators.
- Remove all manifolds and regulators, secure the valve cap, and chain or strap the cylinder to a cylinder cart before moving. Only transport gas cylinders that are capped and secured to a cylinder cart.

Controlled Substances

- Requires prior approval and strict record keeping and security measures for receipt, use, storage and disposal. Please refer to the Controlled Substances Program site for more information.

9.7 Laboratory Door Labeling

The Boston Fire Department requires the National Fire Protection Association (NFPA) 704 Diamond be posted on all laboratory doors. The laboratory must inform EHS when the laboratory acquires new chemicals or gases so the door sign can be updated.

9.8 Personal Protective Equipment (PPE)

There are many different types of PPE. The type of hazard, the design of available engineering controls, and the route of exposure should all be considered when determining what constitutes appropriate PPE.

At a minimum, in accordance with BU’s Personal Protection Equipment in Laboratories Policy, the following PPE is required: long pants or full length skirts, long sleeves, closed toe shoes, long sleeve lab coat, gloves, and eye protection. The type of lab coat, gloves, and eye protection used should be matched to the hazard.

The PI, Research Core Director, Instructor/Lecturer is responsible for selecting, in collaboration with EHS, and providing the appropriate PPE for the laboratory. Laboratory workers must wear PPE as directed, remove PPE upon exiting the laboratory or laboratory support area, and notify the PI if the PPE provided is damaged or inadequate.

EHS is available to assist in the selection of appropriate PPE and to train laboratory workers on the proper use of the PPE. EHS inspects laboratories for compliance to enforce appropriate PPE use.

If the use of a respirator is needed to maintain exposure below PELs, medical clearance must be obtained by ROHP, and a respirator fit testing must be conducted by EHS.

9.9 Laboratory Safety Equipment

There may be many different types of safety equipment in laboratories at BU. The Laboratory Supervisor or PI/RCD/Instructor/Lecturer should ensure that laboratory workers are familiar with the location and proper operation of safety equipment available in the laboratory. Basic information on safety equipment is provided to researchers by EHS during Laboratory Safety Training. EHS or CPO verifies on an annual basis that safety equipment is in place and functioning properly. Common pieces of laboratory safety equipment include:

Emergency Eye Wash Station

The emergency eye wash station delivers flushing fluid to flush chemical contamination from the eyes and face.

- Per ANSI z358.1-2014, laboratory workers must flush their eye wash stations weekly to ensure clean water is available in the event of an emergency.
- Laboratory workers shall maintain a written log to document the weekly eyewash flushing has been completed.
- Eye wash stations should be clearly marked and kept free from obstructions.
- In the event of eye contamination, the laboratory worker should hold their eye open and rinse for a minimum of 15 minutes; then, they should seek medical attention (see Appendix B: *Emergency Procedures and Reporting*).

Eye wash stations are inspected semi-annually to ensure they meet appropriate standards and regulations. EHS oversees the semi-annual inspections on both the CRC and BUMC. Repairs on both campuses are conducted by CPO.

In the event that an emergency eye wash station is activated and a floor drain is not present, PI/RCD/Instructor/Lecturer or designee will contact EHS to notify EHS of the event. Should a laboratory suspect that the emergency eye wash is not operational, the PI/RCD/Instructor/Lecturer or PI/RCD/Instructor/Lecturer designee will contact EHS.

Emergency Safety Shower

The emergency safety shower delivers flushing fluid in sufficient volume to flush away gross chemical contamination from the body or to extinguish a fire on the body. Emergency safety showers should be clearly marked and kept free from obstructions.

- In the event of a fire on the body, implement the **R**escue/Remove, **A**lert/Activate, **C**onfine, **E**xtinguish (RACE) fire plan, as appropriate. The laboratory worker should activate the safety shower and stand under the water flow until the contamination is removed; then, they should seek medical attention (see Appendix B: *Emergency Procedures and Reporting).*
- In the event of gross chemical contamination on the body, the laboratory worker should remove contaminated clothing, activate the safety shower, and stand under the water for a minimum of 15 minutes; then, they should seek medical attention (see Appendix B*: Emergency Procedures and Reporting).*

Emergency safety showers are inspected semi-annually to ensure they meet appropriate standards and regulations. EHS oversees the semi-annual inspections on both the CRC and BUMC. Repairs on both campuses are conducted by CPO.

In the event that an emergency safety shower is activated and a floor drain is not present, the PI/RCD/Instructor/Lecturer or PI/RCD/Instructor/Lecturer or designee will contact EHS to notify EHS of the event. Should a laboratory suspect that the emergency safety shower is not operational, the PI/RCD/Instructor/Lecturer or PI/RCD/Instructor/Lecturer or designee will contact EHS.

Fire Blankets

Some laboratories have fire blankets. Fire blankets are not required. The laboratory is responsible for maintaining fire blankets and should have procedures in place for their use. EHS is available to assess the need for a fire blanket.

Fire Extinguishers

Fire extinguishers are provided to laboratories in the event a fire blocks a means of egress, and the laboratory worker must fight a fire to save his or her own life or to extinguish small fires if able and if the individual has been properly trained. Laboratories should have the appropriate class of extinguisher for the fire hazards in the laboratory. In general, a class BC or class ABC extinguisher is appropriate. In some instances, this extinguisher is supplemented with a class D fire extinguisher, as required. EHS can provide guidance on the selection of the appropriate fire extinguisher including its placement.

Laboratory workers are trained on basic fire extinguisher use in annual Laboratory Safety Training (see Section 3: *Training*). EHS will provide specific fire extinguisher training as requested.

Fire extinguishers are inspected annually and replaced as needed. CPO manages the installation, inspection, and replacement of fire extinguishers. Laboratory personnel should report any issues with fire extinguishers to the Control Center at **(617) 414-4144**.

Chemical Spill Containment Kits

All laboratories are required to have and maintain a Chemical Spill Containment Kit. EHS provides Chemical Spill Containment Kits in some common areas to provide laboratories with additional basic equipment to contain a chemical spill.

These kits are stocked with material to help contain a large chemical spill. Appropriate PPE must be worn. All used chemical spill clean-up materials must be disposed of as hazardous waste.

The PI, Research Core Director, Instructor/Lecturer is responsible for determining whether additional spill containment or clean-up material (appropriate to the chemicals used in the laboratory) is required, and is responsible, along with EHS, for providing that material as needed. Laboratory workers should be trained in the proper use of chemical spill kits. All chemical spills, (whether involving medical exposure or a near-miss) should be reported to EHS (see Appendix B: *Emergency Procedures and Reporting* for more information).

Chemical Fume Hoods

Chemical fume hoods are the most common engineering control to protect against the inhalation of chemicals.

EHS conducts the annual inspection of chemical fume hoods to ensure they are functioning properly. A sticker is placed on the fume hood indicating pass or fail along with the inspector's initials, date, and face velocity at the sash opening. EHS will submit a work order request to CPO for any fume hood that fails inspection. Laboratory workers are instructed not to use the fume hood until repairs are made, and proper performance has been verified by EHS.

CPO repairs chemical fume hoods that are not functioning. If a laboratory worker suspects that a chemical fume hood is not functioning properly, he/she/they should contact CPO at **617-353-2105** (CRC) or **617-638-4144**
(BUMC).

When using a chemical fume hood, laboratory workers should follow these guidelines:

- On sashes that open vertically, keep the sash as low as possible. The sash should never exceed the maximum sash height indicated on the inspection sticker.
- On horizontal sliding sashes, the sliding sash shall be between the worker and any laboratory hazards.
- Keep only what is needed for the task in the hood. Excess equipment in the hood can reduce the provided protection.
- Work as far back in the hood as possible, ideally at least 6" from the opening.

9.10 Laboratory Waste Management

Solid, non-contaminated Waste

Solid waste is waste that is not regulated for special disposal and therefore can be placed in a standard dumpster for disposal. Solid waste is removed from the laboratory by CPO staff. Examples of solid waste include, but are not limited to:

- Recyclable waste: clean, non-contaminated recyclable waste should be recycled when possible using designated receptacles. Refer to the BU Sustainability guidelines.
- Office waste: papers, plastics, and other non-contaminated trash. Office waste can be placed in a general trash receptacle.
- Glass waste: non-contaminated broken or whole glass, non-contaminated glass or plastic pipettes, or pipette tips. Glass waste should be placed in a sturdy, cardboard box with a top that is lined with a plastic bag. The box should be clearly marked "Broken Glass – Trash".
- Empty chemical containers: For non-P-listed chemicals, deface containers and dispose of as solid waste. Reference the Chemical Waste Management Guide for complete list of P-listed chemicals.

Universal Waste

- Batteries: Batteries may be collected in the laboratory's hazardous waste area. Collect in a properly labeled plastic bag. Pickup can be arranged by selecting the "Waste Pickup" link on the EHS Chemical Waste website.
- Fluorescent lamps: Fluorescent lamps may be collected in the laboratory's hazardous waste area. Do not place fluorescent lamps in the broken glass box. Collect in a properly labeled plastic bag or sturdy box. Pickup can be arranged by selecting the "Waste Pickup" link on the EHS Chemical Waste website.

Chemical Waste

- Most chemical waste is regulated as hazardous waste and must be collected for disposal through EHS. For detailed information on chemical waste management visit the EHS Chemical Waste Management Guide website.
- Expired and extraneous chemicals must be disposed of as hazardous chemical waste.
- P-listed chemicals are acutely toxic, therefore EPA regulations (40 CFR 261.32) mandate that empty P-list chemical containers be disposed of as hazardous waste. Please consult the following link to determine if you have a P-list chemical.
- Collect chemical waste in the laboratory's hazardous waste satellite accumulation area (SAA). Use the SAA signs posted at each location as a quick reference guide as a reminder to:
    - Keep containers tightly closed,
    - Make sure each container is appropriately labeled,
    - Don't duplicate containers (one per waste stream),
    - Make sure there is secondary containment for each waste container,
    - Segregate incompatible wastes into different secondary containers,
    - Contact EHS to pick up full containers as soon as they become full.

Biological Waste

- Red bag waste is collected in red bag-lined boxes by laboratory personnel, and includes solid, non-sharp wastes which are contaminated with:
    - Blood or blood products,

    - RG1 or RG2 infectious agents,
    - Recombinant or synthetic nucleic acid molecules or cells containing such molecules.
- Red bag waste containers in laboratories are sealed by the laboratory and labeled with the laboratory name. On the CRC, red bag waste is removed by request. On the Medical Campus, closed red bag boxes are removed by custodial staff.
- Plastic serological pipettes should be disposed of in red bags-lined boxes, or sharps containers
- Pathological/Animal Waste: Human tissues, animal carcasses, and animal bedding from studies where animals have been infected with biological agents or recombinant/synthetic nucleic acid molecules must be collected as red bag wastes, with the closed boxes also labeled with the yellow 'incinerate only' sticker prior to pick up.
- Liquid Biological Wastes: Must be completely inactivated, including destruction of recombinant/synthetic nucleic acid molecules, prior to disposal in a sink drain.
- Visit the Biological Waste section of the EHS website for more information.

Sharps Waste

- Sharps waste: needles, syringes, Pasteur pipettes, pipette tips, razor blades and other metal sharps, are disposed of in biological sharps containers regardless of whether they are contaminated with biohazardous materials. Sharps waste must be placed in approved sharps containers. On BUMC, sharps containers for the laboratory are available from CPO custodial staff. On BUMC, CPO staff removes full sharps containers from laboratories. On the CRC, sharps containers are provided and removed as requested through the Biological Waste Pickup Request Form.

Mercury-Containing Chemicals and Equipment

- BU discourages the use of mercury in chemicals or equipment anywhere on campus unless absolutely required for a particular use. Replacement non-mercury thermometers, barometers, manometers, and other basic equipment are available free of charge from EHS. Contact EHS for more information.

9.11 Comprehensive Risk-Based Laboratory Inspection Program

As per the Comprehensive Risk-Based Laboratory Inspection Program, EHS regularly inspects laboratories for compliance with federal, state and municipal regulations as well as health and safety guidelines outlined in this CHP and other manuals. The goal of the Laboratory Safety Inspection program is to promote safety and compliance.

Laboratory Safety Inspections are scheduled in advance with the Laboratory Supervisor or PI/RCD/Instructor/Lecturer, or their delegate. EHS conducts laboratory safety inspections either quarterly, semi-annually, or annually. Frequency is determined by performing a risk assessment for each laboratory and recording information pertaining to inventory, processes and procedures, personnel, and compliance history.

During the inspection the EHS inspector reviews a checklist to help identify areas for improvement within the laboratory. Following the inspection, the PI receives an inspection report and may be asked to correct unsatisfactory conditions as appropriate. The PI/RCD/Instructor/Lecturer should contact EHS with any questions prior to, during, or following an inspection. Details on the Comprehensive Risk-Based Laboratory Inspection Program are available online.

9.12 Laboratory Security

BU laboratories often contain valuable equipment and materials, equipment and materials that may pose a danger to public safety, and equipment and materials that may pose a danger to an untrained visitor. Given this, it is important that the laboratory is secure at all times. Some laboratories may have special precautions in place given the nature of the materials stored in the laboratory. In general, all laboratories should follow these tips to help keep the laboratory secure:

- Question visitors. Do not hesitate to contact the authorities to report a suspicious person. On the CRC, contact BUPD at **617-353-2121**. On BUMC, contact Public Safety at **617-414-4444**.
- Laboratory workers should carry or wear their BU or BMC identification.
- Always keep doors between the laboratory and hallways or other common places closed.
- Always lock the doors between the laboratory and hallways or other common places when leaving the laboratory unattended.

9.13 Laboratory Visitor Policy

Per BU's Visitor Policy *(See Section 2.0),* a laboratory visitor is any person who is not assigned to work in the laboratory space on a regular basis. To protect the visitor and reduce the risk to the University, the following guidelines for visitors to laboratories should be followed:

- No person under the age of 18 should be allowed to work in a laboratory without the expressed, written permission of EHS. Contact EHS for more information.
- All visitors must be escorted and supervised by laboratory personnel at all times while the visitor is in the laboratory.
- Visitors to the laboratory are expected to follow the same requirements as the laboratory workers in regards to such items as PPE, proper dress, food and drink, etc.
- A student or other person regularly visiting the laboratory, even if just as a volunteer, should follow the requirements for a laboratory worker laid out in this plan, including the training requirements.

9.14 Transporting and Shipping Chemicals

Laboratory workers and PIs are permitted to transfer chemicals between laboratories and buildings on the same campus provided they do not transport the chemicals in a vehicle on a public roadway. High traffic areas should be avoided. The materials themselves must be in sealed containers, clearly labeled with the

contents' name and applicable hazard(s) classification.

The sealed materials should be placed in secondary containment prior to transport. The secondary container should be sealed, break-resistant, and leak-resistant. If the container is being transported on a cart, the cart should have a lip to prevent the container from sliding off.

It is against DOT regulations to transport hazardous chemicals by vehicle under any circumstance. If chemicals must be transported between campuses or to an off-campus location by motor vehicle or airplane then EHS must be contacted for assistance in complying with applicable transport regulations.

9.15 Laboratory-Specific SOPs

It is the responsibility of the PI/RCD/Instructor/Lecturer to review procedures for all chemicals being used. If a laboratory's procedures differ from those outlined in this CHP, or if more specific or stringent SOP's are needed or required, the PI/RCD/Instructor/Lecturer and EHS are responsible for developing SOPs detailing laboratory-specific procedures, and EHS should be contacted. The process of developing laboratory-specific SOPs is intended to characterize various toxicological, regulatory, and physical criteria or to identify conditions that might require additional control measures, as well as to aid in the identification of those control measures.

9.16 Highly Hazardous Chemicals

A chemical is considered "highly hazardous" if it has any health, physical or environmental hazards that require additional safety or environmental practices beyond those of a typical laboratory setting (i.e., requiring greater protection for personnel than standard PPE and/or engineering controls can provide), as required by existing regulations or upon review of the hazards by EHS, relevant oversight committees, or other institutional entities. Details on the Highly Hazardous Chemicals Program are available online.

OSHA classifies the following list of chemicals, meeting threshold levels, as highly hazardous 1910.119 App A. BU's HHC includes the OSHA agents as well as those select carcinogens, substances with a high degree of acute toxicity, and substances that pose a high degree of physical hazard. As part of the Highly Hazardous Chemicals Program, BU's list of highly hazardous chemicals (HHCs) is reviewed and revised annually to remove HHCs no longer in use and to add HHCs not previously used.

Additional employee protection is required by the Laboratory Standard and BU for work with particularly hazardous substances. Prior approval to use and order these chemicals must be sought by the PI/RCD/Instructor/Lecturer from the LSC. Procedures for obtaining approval for use, as well as PI/RCD/Instructor/Lecturer and laboratory worker responsibilities, are provided in the HHC Guidance Document (Appendix C).

9.17 Containment Levels for Chemical Administration in Animals

The purpose of this program is to provide a designation of containment levels that outlines the requisite administrative controls, engineering controls and personal protective equipment necessary to protect researchers, BU Animal Science Center (ASC) staff, and the environment from potential exposures involving animals that have been treated with and exposed to potentially hazardous chemicals that are housed or handled in BUASC spaces. Information is available here.

Appendix A: Commonly Used Acronyms

BU	Boston University
BUMC	Boston University Medical Campus
BUPD	Boston University Police Department
CHO	Chemical Hygiene Officer
CHP	Chemical Hygiene Plan
CRC	Charles River Campus
CSO	Chemical Safety Officer
CSS	Chemical Safety Subcommittee
EHS	Environmental Health and Safety
HHC	Highly Hazardous Chemical
CPO	Campus Planning and Operations
LSC	Laboratory Safety Committee
SDS	Safety Data Sheet
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
PI	Principal Investigator
PPE	Personal Protective Equipment
RCD	Research Core Director
ROHP	Research Occupational Health Program
SAA	Satellite Accumulation Area
SOP	Standard Operating Procedure

Appendix B: Emergency Procedures and Reporting

The Emergency Response Flipchart is provided to all laboratories and should be posted by the telephone to serve as a quick reference in the event of an emergency. The Flipchart includes emergency contact numbers, response procedures, and information on incident and accident reporting.

BOSTON UNIVERSITY

EMERGENCY INSTRUCTIONS

EMERGENCY CONTACTS	CRC	BUMC
❶ Fire (Code Red)/Hazardous Material/Facilities Event	617-353-2105	617-358-4144
❷ Public Safety or Medical Incidents	617-353-2121	617-358-4444
❸ Exposures/Lab Related Medical Incident (ROHP)	Both Campuses: 617-414-ROHP (7647)	

Fire Response | Evacuation

- Upon detection of smoke or fire follow **R.A.C.E.**
  - **Rescue/Remove** person(s) from the fire scene/room.
  - **Alert/Activate** the nearest fire pull station, alert other staff, and call 911 then #1 above to report location and details.
  - **Confine** fire/smoke by closing doors and windows.
  - **Extinguish/Evacuate** Extinguish a small fire if safe to do so or to escape a large fire. Evacuate building as directed by fire alarm system or response authorities. Report to department rally point.
- Do NOT use elevators.
- Those needing special assistance should be evacuated to nearest stairwell, and notify emergency responders.
- Dept. Meeting Place: _____ (WRITE HERE)

Weather Emergencies

- Any weather-related event that may affect normal operations to the university may activate the BU Emergency Response Plan.
- Information will be relayed via BU Today | Send Word Now | BU Alert
- Speak to your supervisor about departmental coverage.

Accidents | Injuries | Medical Emergencies

- Call Public Safety at #❷ above for medical assistance
- **Exposures** | All lab-related injuries or exposures must be reported to #❸ above, Research Occupational Health Program (ROHP) | 617-414-ROHP (7647).
  72 E. Concord St., Evans 825
- **For minor injuries:**
  - Students: Student Health Services | 617-353-3575
    881 Commonwealth Ave.
  - Employees: Occupational Health Center | 617-353-6630
    930 Commonwealth Ave., #1200

Utilities Failure

- Call #❶ above.
- **Elevator:** If trapped, call #❶ above from telephone.
- **Electric:** Unplug non-essential equipment and plug in essentials to red power outlets
- **Water:** Call #❶ above. Alternate water sources will be provided as necessary

Hazardous Materials Spill | Exposure

- Notify personnel and isolate the area.
- Contain the spill if safe to do so.
- Protect nearby drains.
- To report the spill, call #❶ above.

Do not attempt to clean large spills, highly hazardous spills, spills that have migrated to drains or any spill that could result in adverse exposure.

For immediate medical assistance, call #❷ above.

To report lab exposures, call #❸ above.

Workplace Violence | Active Shooter

Follow **S.A.F.E.**

- **Secure** your area.
- **Alert** by calling #❷ above.
- **Follow** directions of emergency responders.
- **Exit** when directed.

Active Shooter - **Run, Hide, Fight**

- **Run:** Escape if possible.
- **Hide:** Find place out of sight, lock door, barricade entrance, silence phones/pagers.
- **Fight** (last resort): Act aggressively, do not hesitate.

Suspicious Package | Bomb Threat

Suspicious Package

- Do not touch or disturb object.
- Call #❷ above and provide as much information as possible.
- Prepare to evacuate.

Telephoned Bomb Threat

- Get as much information as possible - note details such as accent, sex, age, background.
- Keep caller on phone.
- Have a co-worker call #❷ above to report details.

Emergency Management Phases

- Ⓐ Alert of potential, impending or actual event handled by those on site at the time
- Ⓑ Requires other departments or resources
- Ⓒ Requires outside assistance and establishment of a Command Center

For more information, scan the QR code or visit
bu.edu/ehs/procedures/emergency-communications

Appendix C: Highly Hazardous Chemicals Program Guidance Document

1. Purpose

Boston University (BU) is committed to the safe and compliant use of highly hazardous chemicals (HHCs) in the laboratory. This document sets forth procedures and guidelines in place to protect laboratory workers, those supporting laboratories at BU, and students from the health hazards associated with highly hazardous chemical use in the laboratory. This document was developed by the former Chemical Safety Subcommittee (CSS) of the Laboratory Safety Committee (LSC) and is reviewed annually with the CHP.

A chemical is considered "highly hazardous" if it has any health, physical or environmental hazards that require additional safety or environmental practices beyond those of a typical laboratory setting (i.e., requiring greater protection for personnel than standard PPE and/or engineering controls can provide), as required by existing regulations or upon review of the hazards by Environmental Health and Safety (EHS), relevant oversight committees, or other institutional entities.

Additional employee protection is required by the Laboratory Standard and BU for work with particularly hazardous substances. Agents defined as highly hazardous include, but are not limited to, select carcinogens, substances with a high degree of acute toxicity, and substances that pose a high degree of physical hazard. As part of the Highly Hazardous Chemicals Program, BU's HHC List is reviewed at least annually and revised as needed to remove HHCs no longer in use and to add HHCs not previously used. Additional details on the Highly Hazardous Chemicals Program are available online. Please also refer to BU's Chemical Hygiene Plan (CHP) for pertinent information.

2. Covered Parties

This document applies to every laboratory or related facility at BU that uses or stores highly hazardous chemicals. Questions should be directed to the Laboratory Safety Coordinator, the Principal Investigator (PI), Research Core Director (RCD) the LSC, or EHS.

3. Defined Terms

1. **BioRAFT** – an information management system developed for tracking research compliance in laboratories at BU.
2. **Environmentally Hazardous Chemicals** – chemicals listed in 40 CFR 261 Subpart D
3. **Health hazard** – a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxicants, nephrotoxicants, neurotoxicants, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes.
4. **Highly Hazardous Chemical (HHC)** - a chemical that has any health, physical or environmental hazards that require additional safety or environmental

practices beyond those of a typical laboratory setting (i.e., requiring greater protection for personnel than standard PPE and/or engineering controls can provide), as required by existing regulations or upon review of the hazards by EHS, relevant oversight committees, or other institutional entities

5. **Chemical Containment Level (CCL)** – A containment level designated by Environmental Health and Safety (EHS) that outlines the requisite administrative controls, engineering controls and personal protective equipment to protect personnel from animals that have been treated with potentially hazardous chemicals that are being housed or handled in BUASC spaces.
6. **Physical Hazard** – means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.
7. **Safety Data Sheet (SDS)** – a safety data sheet prepared for a chemical stating specific hazards and properties of that chemical.
8. **HHC Standard Operating Procedures (SOPs)**
   - *Highly Hazardous Chemical SOP template* – a standard operating procedure template created by Environmental Health & Safety, which describes the general procedures and safety precautions for a specific HHC or groups of HHC with similar properties. The SOP template should be used by a PI to develop a laboratory-specific SOP, if necessary.
   - *Adopted Highly Hazardous Chemical SOP* – a standard operating procedure that is adopted by a lab with no deviation from recommended practices.
   - *Approved Laboratory-Specific Highly Hazardous Chemical SOP*– a standard operating procedure created by a laboratory using the SOP template developed by the LSC, which describes any significant deviation from the recommended practices approved by the LSC.

4. Use of HHC in Research and Teaching Laboratories

While the Chemical Hygiene Plan (CHP) is available to provide guidance on the general use of chemicals, an additional level of guidance is necessary to ensure the safe use of chemicals considered to be highly hazardous. Before beginning work with these chemicals review the LSC SOP templates for HHC classes located on the HHC Program website. These templates include specific information on the hazards, PPE, engineering controls, handling procedures, storage, emergency procedures and reporting, and disposal requirements. If an appropriate template is not available, the PI, RCD or Instructor/Lecturer should contact Environmental Health & Safety for assistance on developing a new SOP.

Standard Operating Procedures
Using the appropriate template, a PI, RCD or Instructor/Lecturer can:

- Adopt an SOP by adding their laboratory information and submitting the SOP to LSC@bu.edu.
- Revise an SOP with deviations from the recommended practices, add their laboratory information and submit the SOP to LSC@bu.edu via email. The email should contain a rationale for the changes.

When SOPs with deviations are received, a primary reviewer is assigned as determined by the LSC Chair in consultation with the CSO. Any suggested edits, comments, or questions will be returned to the PI, RCD or Instructor/Lecturer. Once all edits, questions and concerns have been addressed, the CSO will inform the laboratory that the SOP has been provisionally approved. The LSC will be updated on any approved HHC SOPs and the following scheduled committee meeting by way of the CSO's report.

The laboratory is responsible for ensuring that their HHC SOP has been approved prior to the use and storage of HHC. All HHC SOPs should be uploaded to the laboratory's BioRAFT profile by the PI, RCD or Lecturer/Instructor.

Training

All individuals who work in laboratories, whether they handle HHC or not, must be apprised of the hazards associated with chemicals present in their work area. This information must be provided by the PI, RCD or Instructor/Lecturer before initial assignment and before new potential exposure situations. Below are the requirements for developing a plan to work with highly hazardous chemicals:

- The PI, RCD or Instructor/Lecturer is responsible for oversight of laboratory procedures and ongoing assessment of the need for site-specific training before a laboratory worker or student uses a new hazardous chemical or conducts a new potentially hazardous procedure.
- All laboratory workers must complete basic training as required by the CHP.
- All students must participate in laboratory-specific training.
- The PI, RCD or Instructor/Lecturer and EHS will provide laboratory workers with access to both the HHC SOP and the SDS provided by the manufacturer.
- Prior to conducting any work with HHCs, the PI, RCD or Instructor/Lecturer, EHS and/or designee, must provide HHC reagent-specific training to laboratory workers and students detailing the hazards and safety precautions involved with working with the specific HHC. Training will be renewed annually.
- For research laboratories and research cores, all training records should be documented in the laboratory-specific SOP. The completed training record should be uploaded to BioRAFT.

5. Roles and Responsibilities

The safe and compliant use of highly hazardous chemicals requires partnership among all members of the BU community. The below section is provided to highlight specific roles and responsibilities.

Laboratory Safety Committee

- Conducts annual review of the CHP;
- Implements the CHP;
- Maintains and reviews the list of HHC;
- Reviews written guidelines and training programs, as necessary;
- Discusses laboratory safety issues and incidents;
- Recommends and reviews policies and practices regarding laboratory safety issues.

Environmental Health and Safety (EHS)

- Creates SOP templates as necessary;
- Assists the PI in developing the laboratory-specific SOP for HHCs;
- Advises the PI on safe handling and storage of HHCs;
- Performs an in-person laboratory assessment to determine the safe use and storage of HHCs;
- Reviews individual laboratory's chemical inventories, door placards and Chemical Safety Logbooks as part of the Comprehensive Risk-Based Laboratory Inspection Program;
- Maintains laboratory door placards to reflect the usage and/or storage of highly hazardous chemicals in the laboratory;
- Assists the laboratory with collection and removal of HHC waste and removal of unwanted HHCs;
- Periodically reviews chemical inventories in BioRAFT and chemical orders to determine if any new highly hazardous chemicals have been added to any laboratories;
- Maintains records of the locations where HHC are used;
- Periodically inspects the laboratory for compliance with institutional policies and procedures and approved SOP's;
- Maintains records from monitoring exposure assessment;
- Verifies that all users of HHC are following appropriate HHC SOPs that have been reviewed by the LSC;
- Verifies that annual chemical testing that is called for in an SOP has been carried out and documented;
- Assists in identifying and providing training resources for laboratories;
- Oversees, documents and verifies training to the laboratory workers specific to the hazards, safe handling, quenching, disposal, and emergency procedures for HHCs;
- Provides the HHC Subcommittee and LSC with information on incidents involving HHC.

The Institutional Biosafety Committee (IBC) and Institutional Animal Care and Use Committee (IACUC).

- Evaluates and verifies that an approved SOP for the use of HHC is in place and corresponds with the requirements of the Chemical Containment Level program as a part of the committee approval process.

Research Occupational Health Program (ROHP)

- Assists in the review of HHC SOP's by providing medical and technical expertise; including providing available antidote information and assisting in the development of SOPs to address the administration of these antidotes, when applicable;
- Provides lab personnel with an antidote for the HHC if available, and clears lab personnel for use of the antidote, if necessary;

- Reviews Health Questionnaire and Job risk assessment where personnel can indicate if working with a high hazard chemical that has an antidote prior to working in the laboratory.
- Provides the HHC Subcommittee and LSC with information on incidents involving HHC.

Safety and Quality Assurance Program

- Coordinates with BU committees, subcommittees, EHS, and other BU safety entities to develop, implement and revise governing documents, arrange meetings and agenda, and to address related issues.

Principal Investigator (PI), Research Core Director (RCD), and/or Lecturer/Instructor

- Evaluates the possibility of substitution of less hazardous chemicals and considers alternate processes and methods that do not require the use of HHC;
- Informs EHS before acquiring any HHC;
- Assists EHS in identifying the use of HHC within the laboratory or research core facility;
- Ensures access to SDS from the manufacturer/safety websites;
- Authorizes all HHC purchases prior to being submitted to Sourcing and Procurement;
- Uses the SOP template developed by the LSC; if lab-specific deviations are required, adds laboratory or research core information, completes the template with the specific procedures and any deviation from the recommended practices;
- Submits the HHC SOP to EHS (if adopting the SOP) or for review and approval to LSC (if amending the SOP);
- Develops safe use protocol for teratogens in consultation with EHS and ROHP;
- Maintains a copy of the yearly training record for HHCs in the laboratory and BioRAFT;
- Maintains records of the locations where HHC are used in BioRAFT;
- Posts the approved SOP in the laboratory's BioRAFT profile and provides ready access to the SOP and any applicable manufacturer-specific SDSs in the laboratory and in BioRAFT;
- Provides training to laboratory workers, teaching fellows/teaching assistants and/or students specific to the hazards, safe handling, quenching, disposal, and emergency procedures for HHCs. This training should occur prior to use of HHC, should be documented and should be renewed on a regular basis;
- Advises on the hazards of working with HHCs without the presence of other laboratory workers, and works with personnel to minimize working alone;
- Communicates and coordinates with the Animal Science Center (ASC) regarding use of HHC in animals. Participates in the Chemical Containment Level program;
- Notifies EHS of any incidents involving HHC and records incidents in BioRAFT;
- Reviews the LSC SOP template and updates the laboratory-specific SOP whenever there is a significant change in procedures;
- Notifies EHS of any changes in the personnel, usage and location of any HHC;

- Periodically reviews and updates chemical inventories in BioRAFT and removes HHC from the inventory that are no longer used or stored in the lab;
- In teaching laboratories, handles HHCs for undergraduate students or closely supervises undergraduate students when the students handle HHC.

Laboratory Workers

- Reviews the laboratory-specific SOP and SDS prior to conducting any work with HHCs;
- Completes annual Laboratory Safety Training and Chemical Safety Training provided by EHS. Refer to the CHP for details;
- Attends laboratory-specific trainings provided by PI, or designee, and completes the documentation of training in the HHC SOP;
- Informs the PI regarding any deviation of use of the HHC relative to the laboratory-specific SOP;
- Informs other personnel in the areas where work is being performed about the usage of HHC to ensure that other laboratory workers are aware of any present hazards and take necessary precautions;
- Minimizes working alone with HHC.

Teaching fellow (TF) / Teaching Assistant (TA)

- Reviews the laboratory-specific SOP and SDS prior to teaching in an undergraduate teaching laboratory involving any work with HHC;
- Attends laboratory-specific training provided by the Lecturer/Instructor prior to teaching in an undergraduate teaching laboratory involving any work with HHC.
- Maintains documentation of training;
- Completes Laboratory Safety Training and Chemical Safety Training annually and participates in any supplemental training provided by the Lecturer/Instructor prior to the commencement of work in the teaching laboratory;
- Informs the Lecturer/Instructor about any deviation of use of HHC from the SOP;
- Handles HHCs for undergraduate students or closely supervise undergraduate students when the students handle HHC.

Undergraduate Students

- Reviews the laboratory-specific SOP and SDS prior to conducting any work with HHC;
- Attends laboratory-specific training provided by the Lecturer/Instructor or TF/TA prior to conducting any work with HHC;
- Adheres to laboratory-specific protocol;
- Stores the HHC in a secure location and returns the chemicals to the original storage location as soon as safely possible after use to prevent unauthorized access to HHC;
- Reviews the laboratory procedure with lab supervisors prior to experiments involving HHC.

6. References

Regulations

29 CFR 1910 Subpart H Hazardous Materials
29 CFR 1910 Subpart Z Toxic and Hazardous Substances
29 CFR 1910.1450 – OSHA Laboratory Safety Standard
29 CFR 1910.1200 – OSHA Hazard Communication Standard
40 CFR 261 Identification and Listing of Hazardous Waste
Boston Fire Prevention Code
527 CMR MA Board of Fire Prevention Regulations
780 CMR MA State Building Code

BU Policies

a. Boston University Chemical Hygiene Plan
b. Boston University Comprehensive Risk-Based Laboratory Inspection Program
c. Chemical Containment Level Program
d. BU Laboratory Safety Committee
e. HHC Standard Operating Procedures (SOPs) templates

Supplementary Documents

f. NFPA 45 – National Fire Protection Administration Standard on Fire Protection for Laboratories Using Chemicals
g. NFPA Fire Protection Guide for Hazardous Materials
h. Handbook of Compressed Gases – Compressed Gas Association
i. IARC Group 1, 2A and 2B Lists – International Agency for Research on Cancer lists for known, probable and possible carcinogens

Forms

j. High Hazard Chemical Standard Operating Procedure templates