



BRANDEIS UNIVERSITY

CHEMICAL HYGIENE PLAN

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BRANDEIS UNIVERSITY CHEMICAL HYGIENE PLAN

1.0 GENERAL ADMINISTRATION AND RESPONSIBILITIES

The Occupational Safety and Health Administration (OSHA) Lab Standard (29 CFR 1910.1450) is designed to enhance the safety of laboratory personnel through better information and work practices.

The Brandeis University Chemical Hygiene Plan addresses the general hazards of common chemicals and physical hazards that may be present in your laboratory, and describes work practices, procedures and controls which are in place to protect you from those hazards. The professional judgment of Brandeis Faculty and Staff is essential and necessary in the interpretation and application of these procedures, and laboratories may modify or enhance these procedures to meet their specific uses and operational needs. The Environmental Health & Safety Department in coordination with the Laboratory Safety Committee shall assist in establishing additional safety guidelines (Brandeis Safety Operating Guidelines) to assist lab personnel with safe work practices, these guidelines will be made available to all lab personnel.

RESPONSIBILITIES

Each Science Department is responsible for supporting and promoting safe and compliant work practices in the laboratory in accordance with this Plan. Department faculty and administration are responsible for facilitating the implementation of the Chemical Hygiene Plan within each department.

The *Manager of Environmental Health & Safety* shall be the Chemical Hygiene Officer responsible for ensuring that the Department Chairs understand and carry out their responsibilities in this Plan.

The Department Chair for the following departments has the responsibility as the Chemical Hygiene Officer (CHO) for his/her respective department:

- Biochemistry
- Biology
- Chemistry
- Physics
- Psychology

The CHO may delegate responsibilities to an assigned Safety Officer who is qualified to implement the Chemical Hygiene Plan and lab specific hazard procedures in their

lab(s). It is however the CHO's responsibility to ensure that the Plan is being implemented in his/her lab(s).

The Manager of Environmental Health & Safety shall:

- Maintain the Chemical Hygiene Plan with input from the CHO's and the Lab Safety Committee;
- Periodically audit the implementation of the CHP and lab specific procedures and provide feedback to the CHO and Safety Officer(s).

1.1 **GENERAL RULES:**

Awareness is the most fundamental rule of Chemical Safety. Everyone should remain constantly aware of:

- A. **Chemicals hazards, as determined from the SDS (*Safety Data Sheets*) and other appropriate references. SDSs are available outside the Safety Office in *Gerstenzang*. Many SDS are also available through the web for those with internet access:**
 - <http://www.promega.com/msds/>
 - <http://www.airgas.com/content/msds.aspx>
 - <https://new.fishersci.com/wps/portal/CMSTATIC?pagename=msds>
 - <http://www.vwrsp.com/search/index.cgi?tmpl=msds>
 - <http://www.msdssearch.com/>
- B. **Appropriate safeguards for using chemicals, including personal protective equipment, use of proper techniques (no mouth pipeting, using chemical carriers, fume hood use).**
- C. **How and where to properly store the chemical when not in use and ensuring containers are closed when not in use.**
- D. **Proper personal hygiene practices. Always wash hands adequately when leaving a lab.**
- E. **The proper methods of transporting chemicals within the facility. Use of chemical carriers or carts.**
- F. **The appropriate procedures for emergencies including evacuation routes, spill cleanup procedures and equipment, proper waste disposal and emergency notification (63333).**
- G. **The practice to Never work alone in a laboratory or chemical storage area when handling highly toxic or reactive materials.**

- H. **Ensure that you are wearing appropriate eye and skin protection at all times. No open toe or mesh footwear in labs.**
- I. **When working with flammable chemicals, being certain that there are no sources of ignition near enough to cause a fire or explosion in the event of a vapor release or liquid spill. Similarly, when working with open flames, be certain that there are no flammable chemicals close enough to cause fire or explosion. See also Brandeis Safety Operating Guideline *Flammable and Combustible Liquids Handling*.**

1.2 PERSONAL HYGIENE

Personal hygiene is an important factor in chemical hygiene. To reduce exposure, lab personnel must consider and control the four routes of entry to the body, inhalation, injection, ingestion and adsorption to limit the chemical's ability to do harm. Proper personal hygiene practices must be followed.

Proper Personal Hygiene practices include:

- A. **Wash promptly whenever a chemical has contacted the skin.**
- B. **Avoid inhalation of chemicals; DO NOT "SNIFF" to test chemicals.**
- C. **DO NOT use mouth suction to pipette anything; use suction bulbs or other mechanical means.**
- E. **DO NOT drink, eat, smoke, or apply cosmetics in chemical areas.**
- F. **DO NOT store or prepare food, beverages or tobacco products in chemical storage or use areas. Food, drink, and especially tobacco absorb chemical vapors and gases from the air.**

1.3 PROTECTIVE CLOTHING AND EQUIPMENT

Personal protective equipment is provided by Brandeis to employees, faculty and students when and where necessary. It is the responsibility of each user to be certain that the appropriate equipment is worn as necessary.

- A. **Eye protection worn working with chemicals should meet the requirements of the American National Standards Institute (ANSI) Z87.1. Wear goggles such as type G, H or I at all times. When working with more than 10 mL of a corrosive liquid also wear a face shield, type N, large enough to protect the chin, neck, and ears, as well as the face.**

- B. Always wear low-heeled shoes with fully covering "uppers"; **DO NOT** wear shoes with open toes or with uppers constructed of woven material.

1.4 **HOUSEKEEPING**

Common housekeeping practices contribute greatly towards chemical hygiene and safety. A clean work area is much safer than a cluttered or dirty one. Some appropriate housekeeping measures include:

- A. Keep all aisles, hallways, and stairs clear of all chemicals, equipment or other obstructions which could cause a trip or fall hazard or otherwise obstruct unimpeded entry and exit.
- B. Keep all work areas and especially workbenches clean of clutter and obstructions. **DO NOT** use lab hoods as storage areas.
- C. All working surfaces and floors should be cleared regularly.
- D. Access to emergency equipment, showers, eyewashes and exits should never be blocked by anything. Equipment will be inspected on a regular basis. Any defects should be reported to the PI, Facilities or Environmental Health and Safety Office.
- E. Waste must be kept in the proper containers and labeled properly. **DO NOT** pour waste down laboratory sinks. pH buffer aqueous solutions between 6.0-11.0 SU and containing no other prescribed material may go down lab sinks.
- F. Ensuring that all chemicals are properly closed and stored in a manner that will not pose a health, fire or spill threat (i.e. away from the edge of countertops, *away from sinks*, away from heat sources, closed unless in use).
- H. All chemical containers must be labeled with both the identity of the chemical and its hazard. Do not alter or otherwise deface container labels. *OSHA Global Harmonization Standards should be used.*
- I. All spills must be promptly cleaned up and the spilled chemical must be properly disposed of. Ensure spills do not enter sink drains. Contact EH&S at 64262 or Public Safety at 63333 immediately if a chemical spill gets into a sink or floor drain.
- J. Ensure that "Drain Disposal of Hazardous Chemicals is Illegal" stickers are posted at sinks at all times and replaced when necessary. Stickers are available from the EH&S office (6-4262).

- K. **DO NOT store chemical containers next to sinks, including hazardous waste containers.**

1.5 **PRIOR APPROVAL**

Employees must obtain prior approval to proceed with a laboratory task from the principal investigator when:

- A. **A new hazard physical or health hazard is introduced, “new” being defined as being a physical or health hazard in which employees have not been previously trained.**
- B. **There is a substantial change in the amount of chemicals in the order of 300% or greater.**
- C. **There is a failure of any of the equipment used in the process, especially, safeguards such as fume hoods or clamp apparatus.**
- D. **Members of the laboratory staff become ill, suspect that they or others have been exposed, or otherwise suspect a failure of any safeguards.**

1.6 **SPILLS AND ACCIDENTS**

Spills of toxic substances or accidents involving any hazardous chemicals that pose a human health or environmental risk should be reported immediately to the PI and or University Police (63333). University Police are available to contact Triumvirate Environmental Services for emergency response activities. The University EH&S Department is responsible for notifying the Massachusetts Water Resources Authority of any chemical discharge into the waste water system that is not approved by the discharge permit or other technical approval. EH&S can be contacted at 6-4262 or afinn@brandeis.edu.

1.7 **PROCEDURES FOR HIGHLY TOXIC CHEMICALS**

Additional safety precautions should be taken when dealing with highly toxic chemicals and agents such as carcinogens , mutagens, teratogens, biotoxins and other material with high acute toxicities Examples of material that should be scrutinized for additional controls would include IARC Group 1 material, IARC Group 2A and 2B material, “known to be carcinogen” material in the Annual Report on Carcinogens (National Toxicological Program), acutely toxic material with a median lethal does (LD₅₀) of less than 50mg/kg., and reproductive hazards (see MSDS for additional information).

Work with these materials should include additional safety precautions to include:

- Order the smallest amount available and required.

- Check, confirm and use personnel protective equipment with the best permeation resistance.
- Work in a proper functioning and uncluttered fume hood or glove box.
- Consult an MSDS prior to use for emergency information, exposure routes, signs/symptoms of exposure.
- Ensure that all containers are labeled.
- Limit traffic in lab areas utilizing highly toxic material. Ensure material is secure when not in use.
- Ensure proper decontamination supplies are available and surfaces/equipment properly decontaminated after use.
- Ensure waste containers are properly labeled and waste material handled properly.

1.8 PROCEDURES FOR FLAMMABLE CHEMICALS

In general the flammability of a chemical is determined by its flash point, the lowest temperature at which an ignition source can cause the chemical to ignite momentarily under certain controlled conditions. See also the Brandeis Safety Operating Guideline *Flammable and Combustible Liquids Handling* for additional details.

- A. Chemicals with a flash point below 200F (93.3c) will be considered fire-hazard chemicals.**
- B. Fire hazard chemicals should be stored in a flammable solvent storage area or in storage cabinets designed for flammable materials.**
- C. Fire hazards chemicals should be used only in vented hoods and away from sources of ignition.**

1.9 PROCEDURES FOR REACTIVE CHEMICALS

Reactivity information can be found in the "Handbook of Reactive Chemical Hazards" by L. Bretherick published by Butterworths (a copy is available in the Safety Office). Reactivity information is should also be available on a manufacturer MSDSs and labels.

As a general rule Brandeis shall ensure that any lab personnel who is handing or potentially exposed to a pyrophoric material (air & or water reactive) or other highly reactive material shall be made aware of and competent in the handling procedures for those materials. Labs are responsible for ensuring proper procedures are established and followed.

Handle reactive chemicals with all proper safety precautions, including segregation in storage and prohibition on mixing even small quantities with other chemicals without prior approval and appropriate personal protection and precautions.

1.10 PROCEDURE FOR CORROSIVE CHEMICALS AND CONTACT-HAZARD CHEMICALS.

Corrosivity, allergenic, and sensitizer information is sometimes given in manufacturer MSDSs and on labels.

A CORROSIVE CHEMICAL IS ONE THAT:

Fits the EPA definition of corrosive in 40 CFR 261.22 (has a pH greater than 12 or less the 2.5) or is known or found to be corrosive to living tissues.

Handle corrosive chemicals with all proper safety precaution, including wearing both safety goggles and face shield, gloves tested for absence of pin holes and known to be resistant to permeation or penetration, and a laboratory apron or laboratory coat.

1.11 PROCEDURES FOR HANDLING OXIDIZERS

Oxidizing agents, for example hydrogen peroxide, nitrates, perchlorates, hypochlorites, ozone, Flourine etc., can initiate combustion and therefore should not be stored in the same area with fuel, such as flammable, organic chemicals, or reducing agents. They should be stored on fire resistant shelving and segregated. See also the Brandeis Safety Guideline *Oxidizing Chemicals*.

1.12 PROCEDURES FOR HANDLING COMPRESSED GASSES

Compressed gas cylinders present unique hazards because they have the potential to pose both mechanical and chemical hazards. Hazards arise from the potential reactivity and toxicity of the gas, high rate of diffusion during release, as well as physical hazards caused by the size and weight of cylinders. Asphyxiation can be caused by high concentrations of even "harmless" gases such as nitrogen, as well as the potential for frostbite during gas release. Finally, the large amount of potential energy resulting from the compression of the gas makes a compressed gas cylinder a potential rocket.

Cylinders should always be clearly marked. They should be secured at all times when in use, storage or transport. Cylinders with valve cover should be transported only when the valve is closed and the valve cover secure on the cylinder. Only the appropriate type of regulator should be used on a particular cylinder and only personnel who are competent in using cylinders should be attaching or dismantling regulators. Cylinders should always be stored in a well ventilated safe place that is protected from accidental tip over and away from sources of ignition and oxidizers if it is a flammable gas. Empty cylinders should be clearly marked as "Empty".

1.13 CONTROL MEASURES AND EQUIPMENT

Chemical safety is achieved by continual awareness of chemical hazards and by keeping the chemical under control by using precautions, including administrative and engineering safeguards such as inventory control, material substitution, general and work site exhaust (hoods) and glove boxes. Laboratory personnel should be familiar with the precautions to be taken, including the use and practice of these controls. Engineering safeguards and controls must be properly maintained, inspected on a regular basis, and never overloaded beyond their designed limits.

ADMINISTRATIVE CONTROLS

Administrative controls should be reviewed and incorporated wherever possible by lab personnel to include such actions as hazard reviews, establishment of safety protocols/procedures, in-lab safety reviews and communications, in-lab supervision, avoidance of working alone in labs with highly toxic or reactive materials. Controls should be established to help reduce the duration or frequency of exposure as well as the severity of exposure by working to reduce experiment size to minimize personal exposure (dose & time).

ENGINEERING CONTROLS

FUME HOODS

The laboratory fume hood is one of the most important safety devices in the laboratory.

Use: The ventilation system in the laboratory has been carefully balanced to ensure proper airflow and comfortable working conditions. To prevent cross drafts, laboratory doors should be kept closed, whenever possible. Contact the Lab Facility Maintenance Group with any ventilation issues.

Containers and equipment should be kept 6" back from the front sash of the hood to prevent air flow restriction and turbulence.

Maintenance: Laboratory fume hoods shall be evaluated by Environmental, Health and Safety or outside contractors at least annually. During these evaluations, average face velocity of the hood is measured, and the hood air flow characteristics and turbulence (if any) is visually evaluated with smoke tubes.

Hoods passing evaluation are labeled at an 18" sash height with a fume hood inspection sticker indicating the date of evaluation. If a hood face velocity is below 80 cfm, the failed hood(s) is reported to the Lab Facility Maintenance Group for service and are reevaluated when service has been completed.

1.14 CHEMICAL STORAGE: FLAMMABLE STORAGE CABINETS

Cabinets designed for the storage of flammable materials should be properly used and maintained. Read and follow the manufacturer information and also follow these safety practices:

- A. **Store only compatible materials inside a cabinet.**
- B. **DO NOT store paper or cardboard or other combustible packaging material in a flammable liquid storage cabinet.**
- C. **Check storage capacities in the *Flammable and Combustible Liquids Handling* operating guideline.**

1.15 EYEWASHES AND SAFETY SHOWERS

Eyewash stations are required in any lab where there is the potential for eye injury from exposure to injurious corrosive chemicals.

Requirements: The eyewash station must be capable of providing a continuous, soft stream of tepid water for at least 15 minutes. Personal eyewash units composed of bottled solution are generally not acceptable. Drench hoses may support eyewash stations, but do not replace them. Sink mounted eyewash generally do not replace use-specific eye wash stations.

Location: Eyewash stations should be located within 10 seconds travel time from the location of the hazard and on the same level (no stairs/ramps). Eye wash locations should be marked with a highly visible sign.

Maintenance: Brandeis will establish a PM program to have eyewash stations be flushed at least quarterly for 3-5 minutes to assure function and avoid build-up of bacteria. The path to the eyewash station must be free from obstructions.

Use: After any eye contact with a chemical, activate the eyewash station and flush eyes for at least 15 minutes. If the chemical is alkaline, flush for at least 30 minutes. Avoid rinsing the chemical into the uninjured eye. If contact lenses are in place, flush for one minute, remove the lenses, and continue flushing. After flushing for the appropriate amount of time, seek medical attention at the Brandeis University Health Center or the nearest emergency room.

Safety showers should be provided where chemicals are handled.

Requirements: Safety showers should provide at least 20 gallons of water per minute. The valve should be simple to activate and should remain activated until intentionally shut off. The valve should be within reach and not more than 69 inches above the floor.

Location: Safety showers should be located within 10 seconds travel time from the location of the hazard and on the same level (no stairs/ramps). Eye wash locations should be marked with a highly visible sign. The location should be marked with a clearly visible sign and, if possible, a large yellow circle should be painted on the floor under the shower.

Maintenance: Brandeis will establish a PM program to have Safety showers flushed annually. The path to the safety shower must be kept free from obstructions.

Use: In case of skin contact with a hazardous chemical, immediately activate the shower and flush the affected area for at least 15 minutes. If the chemical is alkaline, flush for at least 30 minutes. For contact with dry solids, brush the contaminant gently off the skin before using the shower. While under the shower, remove clothing and jewelry from the affected area. After flushing, seek medical attention immediately at the Brandeis University Health Center or the nearest emergency room.

1.16 RESPIRATORS

OSHA requires all employers to primarily prevent atmospheric contamination. If that cannot keep the vapor concentration below regulated levels, then the employer will implement a written respirator program (see 29 CFR 1910.134). The written respirator program will discuss such issues as respirator selection criteria, inspection, and maintenance. All personnel using respirators must be medically cleared, trained and fit tested in their proper use and care prior to using a tight fitting respirator (not a dust mask).

1.17 SIGNS AND SYMPTOMS OF EXPOSURE

Do not use odor as a means of determining that inhalation exposure limits are or are not being exceeded. Whenever there is reason to suspect that a toxic chemical inhalation limit might be exceeded, whether or not a suspicious odor is noticed notify your supervisor, the PI or Professor. Upon request, the Safety Office may monitor the air to determine if the permissible exposure level has been exceeded.

The *SDS* should be reviewed for which lab personnel are not familiar with the routes and symptoms of exposure.

1.18 SPECIAL PROCEDURES FOR CARCINOGENS

OSHA has noted that many laboratory workers use known or suspected carcinogens. While industrial workers might use only one or a limited few chemical carcinogens, laboratory workers are likely to use many such chemicals. (See also Section 1.7).

To limit possible exposures, Brandeis lab personnel should establish special procedures and precautions for work with carcinogens. Check the container label or the MSDS for carcinogen determination. Special precautions including but not limited to those listed below may be put in place when handling carcinogens.

A. REGULATED AND CONTROLLED WORK AREAS

Special work areas are designed for work with carcinogens. The rooms, including storage areas for the chemical carcinogens, will have restricted access. Signs stating "Authorized Personnel Only" will be posted at entrances to these work areas, and if necessary the areas will be locked. Only personnel with special instruction on the hazards and safe handling of carcinogens will be permitted access to the areas. The rooms where carcinogens are used and stored should be kept at a slight negative pressure when compared to the rest of the rooms.

B. CLOSED SYSTEM PROTECTION

All work involving carcinogens must be done in specially equipped closed systems to reduce the risks of employee exposure to the vapors. The closed systems include fume hoods, glove boxes or similar devices.

C. HANDLING OF CONTAMINATED WASTE WATERS

Rinse water and other waste waters contaminated with carcinogens are to be collected for disposal.

D. PERSONAL HYGIENE

Laboratory workers using carcinogens shall take extra precautions in maintaining good personal hygiene. In addition to hygiene practices in Section 1.2 workers will wash before leaving the facility. No food, beverage or tobacco products will be permitted in the restricted area.

E. PROTECTION OF VACUUM SYSTEMS

To protect vacuum lines and pumps, HEPA filters or high efficiency scrubber systems should be used.

F. PROTECTIVE APPAREL

Persons working in restricted areas should not wear any personal items such as jewelry which might be lost if decontamination is not possible. When possible, disposable clothing should be used. Gloves and long sleeves should be used at all times to prevent skin contact with the carcinogen.

G. ADDITIONAL PRECAUTIONS

Work with carcinogens should be done with the smallest amounts possible, purchase of the chemical should be restricted to minimal amounts necessary to prevent uninterrupted work.

1.19 HAZARD SPECIFIC SAFETY PROCEDURES

Specific safety procedures shall be developed by labs when the general safety procedures established in this Chemical Hygiene Plan and/or a Brandeis Safety Operating Guideline do not adequately address the hazard(s). Procedures must be written to clearly identify additional precautions and controls to protect the health and safety of personnel. This should include the evaluation of the hazard(s), special controls (administrative/engineering), personal protective equipment, emergency procedures, any special decontamination and/or disposal procedures. These procedures shall be made available to and clearly communicated to lab personnel to ensure they are competent in following the applicable procedures.

1.20 SUSPECTED EXPOSURE TO TOXIC SUBSTANCES

There may be times when employees suspect that they have been exposed to some toxic substance in their laboratory. If the circumstances surrounding the complaint are determined to cause a reasonable suspicion of exposure to a chemical, then the University EH&S Manager may initiate actions to formally evaluate the complaint. The victim is entitled to a medical consultation and, if so determined in the consultation also to a medical examination at no cost and with no loss of working time attributed to the victim.

The following are examples of some events or circumstances which might reasonably consider as evidence that an exposure to toxic substances is likely:

- A. Victim had direct skin or eye contact with a chemical substance.**
- B. Odor was noticed especially if person was working with any chemical which has a lower TLV than odor threshold.**
- C. Manifestation of health hazard symptoms such as headache, rash, nausea, coughing, tearing, irritation or redness of eyes, irritation of nose or throat, dizziness, loss of motor dexterity or judgment which resemble drunkenness etc.**
- D. Some or all symptoms disappear when person is taken away from chemical area into fresh air.**

EXPOSURE EVALUATIONS

Once a complaint of possible hazardous chemical exposure has been received, the complaint should be documented in a short memo along with the decision of appropriate action. If it was decided that no further evaluation of the event is

necessary, the reason for that decision should be included in the document. If a decision is made that the complaint should be investigated, then a formal exposure evaluation will commence.

1.21 EMPLOYEE INFORMATION AND TRAINING

The CHO or the delegated Safety Officer is responsible to ensure that anyone who performs lab related duties in his/her respective lab is aware of and is competent in the General Rules in section 1.1 and the requirements listed here.

- A. Providing all laboratory personnel with information and training concerning the hazards of chemicals in the laboratory. This *should* include an annual evaluation of the hazards and documenting this evaluation on the Brandeis Lab Hazard Evaluation Form. Communication of these hazards shall be documented on the Brandeis Training Log. *Evaluation forms and Logs are available at www.brandeis.edu/ehs.***
- B. Making lab personnel aware of the location, availability and content of this document (CHP). Contact your PI or the EH&S Office for a copy of this Plan.**
- C. Exposure Limits including TLV (Threshold Limit Value) and PEL (Permissible Exposure Limits). Know how to find and use an MSDS for this information.**
- D. Signs and symptoms associated with exposures to the hazardous chemical used in the laboratory. Know how to find and use an MSDS for this information.**
- E. The location of available reference materials including *Safety Data Sheets (SDS)* located in *Gerstenzang* outside of the Safety Office.**
- F. The measures employees can use to protect themselves from chemical hazards, including specific procedures such as appropriate administrative and engineering controls, personal protective equipment to be used, and emergency procedures.**

Information does not need to be a formal training session in a classroom setting. Information can be disseminated "on-the-job". All incoming undergraduate students are required to complete the *Brandeis Traincaster* on line training. The CHO or Safety Officer are responsible for communicating lab specific hazards and controls. A record must be kept of these hazard reviews (*Web based* general training AND Lab specific hazards). *Graduate students, Post Docs and Faculty shall complete initial on line training (see EH&S web site for link). Review of Lab Hazard Evaluation forms shall be completed and documented annually. (www.brandeis.traincaster.com)*

1.22 The Laboratory Standard requires that records of all Exposure Evaluations, Medical Consultations and reports be maintained in accordance to 29 CFR 1910.20.

All records should be kept for at least as long as the employees affected are employed at the facility. OSHA requires some records to be kept for thirty 30 years beyond the employee time of employment. Employee Relations (Human Resources) will maintain necessary records.