Northeastern University

LABORATORY SAFETY PLAN

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Revised September 2019 by Annalisa Onnis-Hayden, Departmental Safety Officer

2019

Revision Date	Version	Summary of Changes	Reviser(s) Initials

	Number		
05/16/2016	v.1.0	- Layouts of CEE laboratories were included. - EHS training requirement was updated - Important information regarding work practices was highlighted in all chapters. - Information about collection and disposal of sharps (needles and syringes) was included based on NEU Biological Manual provided by EHS - List and content of appendix was updated	CVM
10/23/2017	v.2.0	- Layouts of CEE laboratories were included. - EHS training requirement was updated	CVM
09/01/2019	v.3.0	Emergency Contacts were updated	AOH

Contents

1.0 EMERGENCY CONTACTS

IN THE EVENT OF AN EMERGENCY CALL NORTHEASTERN UNIVERITY'S PUBLIC SAFETY DIVISION AT x3333

* Remember: if you call from an in-house phone you simply dial 3333. If you call from a cell phone dial
1.617.373.3333

* Know your location and be specific about the nature of the emergency.

* Emergency contact numbers, along with laboratory safety data, are posted on every laboratory door.

CONTACT LIST

NAME	TITLE	EMAIL/PHONE
Sonya Granahan	Director, Risk Services	s.granahan@neu.edu 617.373.6963
Jack Price	Director, EHS	j.price@neu.edu 617.373.2769
Steve Brehio	Associate Director, EHS	s.brehio@northeastern.edu 617.373.5243
Cristina Kasauskas	Laboratory Safety Specialist	c.hughes@northeastern.edu 617.373.5217
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Evan Saravo	Laboratory Safety Program Manager	e.saravo@northeastern.edu 617.373.4015
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2.0 OVERVIEW

The Laboratory Safety Plan (LSP) presented herein is intended to present authorized personnel (laboratory user) within the Department of Civil and Environmental Engineering (CEE) at Northeastern University information that will facilitate the safe use of CEE laboratory facilities. Procedures conducted within laboratories vary. Thus, no general statements on the risk associated with working in CEE laboratories are appropriate. Review of the procedures presented in this manual serve as a baseline for all CEE laboratory users. All CEE users must also review and comply with Northeastern University's Laboratory Chemical Hygiene Plan, found at: http://www.ehs.neu.edu/laboratory_safety/chemical_hygiene/chemical_hygiene_plan/. For personnel who work at the George J. Kostas Research Institute for Homeland Security located at Northeastern University's Burlington campus, please refer to the STReSS Lab's individual Safety Plan Manual. This manual can be found at the following website: http://www.civ.neu.edu/stresslab/safety%20plan.html.

Many parties work collaboratively to ensure the safe operation of CEE laboratories, including: Department Chair, Principal Investigators (PIs), Faculty Advisors, Staff, and the Department Safety Officer (DSO) and/or Department Laboratory Manager. Primary responsibility for laboratory safety rests with the laboratory user. The LSP provides the user with the guidelines necessary, and the resources available, to ensure the user has the means to operate in a safe and efficient manner.

The laboratory user has the following responsibilities:

- To read this LSP in full and complete the CEE Laboratory User Form and Access Request Form **(Appendix 1)** before engaging in any laboratory activities (the LSP is on the department's website – www.civ.neu.edu – under Research > Laboratory and Office Facilities).
- Develop and practice good personal laboratory safety habits;
- Wear all required personal protective equipment;
- Inform appropriate personnel of any lab deficiency that may pose a safety hazard;
- Plan and conduct each laboratory operation in accordance with proper laboratory safety procedures and this LSP; and
- Ensure that your research area is cleaned; and all chemicals and laboratory equipment are properly returned at the conclusion of your daily research activities.
- Every CEE graduate student must complete the Laboratory Closeout Form **(Appendix 6)** before his/her thesis will be signed.

3.0 LABORATORY TRAINING AND ACCESS

Every laboratory user is required to receive the appropriate training before they access any laboratory in CEE. Furthermore, prior to assignments involving new lab experiences that may result in new exposure situations; the laboratory user must complete the appropriate training as determined by the PI, DSO and/or the Laboratory Manager. Each laboratory user is required to submit verification of his/her training to the DSO. The DSO maintains documentation of such training.

Each laboratory user, in consultation with his/her faculty advisor and/or DSO, must complete the training specific to their use in addition to the standard required trainings identified in section 3.1. Laboratory training is conducted through the Office of Environmental Health & Safety (EHS).

3.1 REQUIRED EHS TRAINING

- Each laboratory user is required to visit and utilize EHS's website at www.northeastern.edu/ehs/
- Each laboratory user must have an active NUnet account to register for EHS's online training, which is now available using the new Research Management Platform – BioRAFT.
- Copies of pertinent EHS web pages appear in **Appendix 2**.

The first page of Appendix 2 is a copy of EHS's homepage. The user will notice a TRAINING link in the upper left section of the homepage (Quick links) and the upcoming training sessions in the bottom right section (Calendar). When you click on the ONLINE TRAINING link EHS's ONLINE TRAINING page opens (Figure 2). Every new incoming employee, student or visiting scholar needs to take the appropriate INITIAL online training. Then, annually, every returning laboratory user must take the appropriate online REFRESHER training.

The MANDATORY training courses are:

- Safety Orientation is **MANDATORY** for all lab users. It is a one-time online training program
- Fundamentals of Laboratory Safety is **MANDATORY** for all lab users. It is a one-time online training program + online refresher required every 2 years (it replace the Former Chemical Hygiene 1 & 2)

In addition, as a result of the last CEE Lab Management and Safety Committee that was held on March. 6th, 2017, lab users will be now required to take the following training (in addition to the mandatory ones) and any other training based on the type of research each group performs:

- Hazardous waste management training is **required** for all users handling/generating hazardous chemicals/waste. **It is a one-time in-classroom training + an online refresher every year.**
- EH&S Assist Chemical Inventory Training. **It is a one-time online training**
- Laboratory Chemical Fume Hood. **It is a one-time online training + an online refresher every year.**
- Hazard Communication Training. **It is a one-time online training + an online refresher every 2 years.**

It is very important to recognize that laboratory users may be required to take additional training according to his/her designed activities. For example any laboratory user that will utilize the department's autoclaves must take EHS's autoclave training. Also, some personnel in the environmental discipline may be required to take EHS's bloodborne pathogens and biological safety training. Personnel who may work with hand and power tools must complete hand & power tool safety training.

3.2 ANALYTICAL INSTRUMENTS TRAINING

In order to be able to use the analytical instruments available in the CEE environmental labs, each student/visitor needs to contact Dr. Annalisa Onnis-Hayden to schedule a one-on-one training session on the specific instrument.

For a list of available instruments that require training before use, please see Section 12 in this document.

Once the laboratory user has fulfilled his/her training responsibilities, the DSO will grant access to the laboratories via Cardkey and his/her laboratory work may begin. Noncompliance with any provisions of the NEU and CEE safety training manuals will result in laboratory access and privileges revocation.

3.3 LABORATORY ACCESS

Once the laboratory user has read the LSP and submits the signed CEE Lab Access Forms (Appendix 1), fulfills his/her training responsibilities, and submits his/her training certificate (email confirmation from EHS) to the DSO, access is granted and his/her laboratory work may begin.

No personnel with access to CEE laboratories should work alone.

If a situation arises where the laboratory user will be alone, it is the policy of CEE that the laboratory user notifies the DSO and/or faculty advisor of their work and schedule.

3.4 VISITING/VOLUNTEER/UNDERGRADUATE LABORATORY ACCESS

Periodically visiting researchers and undergraduate students become involved in research activities that require access to CEE laboratories. CEE encourages external collaboration and the participation of qualified undergraduate students. As with our employed personnel, any individual wishing to use the CEE laboratories must complete appropriate training prior to gaining access.

According to Northeastern University Policy on Restricted Access and Supervision Requirements for Laboratories and Support Rooms.
https://www.northeastern.edu/policies/pdfs/Policy_on_Lab_Supervision.pdf

Undergraduate students need to be supervised while working in the laboratory either directly (with moderate and higher risk potentials present) or indirectly (with no or lower risk levels present). Undergraduates should work with their PI and the DSO to help determine what level of supervision may be required.

3.5 LABORATORY COURSES FOR UNDERGRADUATE AND GRADUATE STUDENTS

Laboratory instructors and teaching assistants are required to attend a safety presentation at the beginning of every academic year or when they first join the Department. All teaching assistants working in a Laboratory course must also take the required safety courses available through the Environmental Health and Safety Department at Northeastern, as reported in section 3.1 of this document. A laboratory technician, teaching assistant, or instructor must supervise all work during the scheduled laboratory period or at any other time.

Every lab course begins with a review of safety procedures, which are enforced throughout the course. An example handout distributed to students as part of the laboratory safety program is shown below.

Basic Safety Guidelines for the Environmental Engineering Laboratory

Safety and health in the laboratory can be achieved only through the full participation and cooperation of all students. The following guidelines must be practiced in order to protect you and your classmates from injury. This list is not inclusive nor a substitute for prudent caution and common sense.

1. Determine the potential physical and chemical hazards, and the safety precautions that apply to your experiment before beginning.
2. No laboratory work should be carried out in the absence of your instructor.
3. Do not perform unauthorized experiments.
4. Never begin an experiment unless you are confident you can finish or arrive at a safe endpoint before the end of the laboratory period.
5. Be alert to unsafe conditions and actions and call them to the attention of the instructor immediately.
6. Never leave an experiment that is in progress unattended without permission.
7. Allow yourself sufficient time for clean-up at the end of the laboratory period.
8. Safety glasses or goggles must be worn at all times in the laboratory.
9. Contact lenses may be a hazard in the laboratory, even with safety glasses or goggles. Chemicals can be concentrated under such lenses and cause permanent eye damage.
10. Safety hats must be worn when working on pilot-scale equipment, when others are working above you, or when objects may fall from above.
11. Proper protective gloves should be worn whenever the potential for contact with corrosive or toxic materials of unknown toxicity exists.
12. Laboratory coats should be worn to prevent contact with chemical splashes and spills.
13. Shorts, capris, sandals, ballet flats, and open toed shoes are prohibited. Exposure of legs and feet to spilled chemicals is a main cause of chemical burns. Long pants and shoes that cover the entire foot are required.
14. The appropriate respiratory protection must be worn whenever you are exposed to toxic airborne contaminants (gases, vapors, dusts, mists, or fumes).
15. Horseplay and other acts of carelessness are prohibited.
16. Avoid distracting or startling any other worker.
17. Confine long hair and loose clothing when in the laboratory.
18. No eating, drinking, smoking, or chewing of gum is permitted in the work area. Contamination of food, drink, and smoking materials is a potential for exposure to toxic substances.
19. Mouth pipetting is prohibited. A pipette bulb or aspirator should be used to provide a vacuum.

20. Do not put your nose directly over a container to smell the contents; waft vapors toward the nose instead (if necessary).
21. Learn the location and proper use of safety equipment: showers, eyewash, fire extinguishers, chemical spill kits, etc.
22. In case of a fire, chemical spill, or other emergency, alert the instructor and all other students in the laboratory.
23. Before opening a new container, check to be sure another container of the same chemical is not already opened.
24. Never return a reagent to the storage bottle. You may create an incompatible mixture by mistake or contaminate the chemical. Keep reagent containers closed. With an open container, dust and vapors may escape and gaseous or suspended material may enter, changing the nature of the reagent.
25. Always pour acid into water. Never pour water into acid.
26. Spilled chemicals should be cleaned up immediately and disposed of properly. Ask your instructor for assistance in clean-up procedure.
27. Outdated chemicals must be discarded, especially ethers and peroxidizable materials.
28. Hazardous, toxic, or undiluted chemicals should not be poured down the drain.
29. Chemical wastes must be disposed of properly.
30. Do not pour your waste into a waste container that is unlabeled.
31. The compatibility of chemicals must be determined before combining them in the same waste container.

KEEP IN MIND:

- Safety glasses or goggles **MUST** be worn at all times in the laboratory.
- Proper protective gloves should be worn whenever the potential for contact with corrosive or toxic materials of unknown toxicity exists.
- Laboratory coats should be worn to prevent contact with chemical splashes and spills.
- **Shorts, capris, sandals, ballet flats, and open toed shoes are prohibited.** Exposure of legs and feet to spilled chemicals is a main cause of chemical burns. **Long pants and shoes that cover the entire foot are required.**
- The appropriate respiratory protection must be worn whenever you are exposed to toxic airborne contaminants (gases, vapors, dusts, mists, or fumes).
- No eating, drinking, smoking, or chewing of gum is permitted in the work area. Contamination of food, drink, and smoking materials is a potential for exposure to toxic substances.

If a situation arises where the laboratory user will be alone, it is the policy of CEE that the laboratory user notifies the DSO, faculty advisor, and a colleague of their work and schedule.

3.6 STUDENT GROUPS WORKING IN LABORATORIES

Student groups are now required to work in their work bays located in Richards Hall. However, if they

need to conduct activities in any of the CEE laboratories, initial approval needs to be granted by the student group advisor, and DSO or department chair. While working in the laboratory, the students must be supervised by a teaching assistant, student group advisor, staff, or DSO. No work can be conducted unsupervised unless the students have been granted explicit approval by the DSO prior to performing the activity. Additionally, the student group or teaching assistant should notify the DSO about the activities occurring in the laboratory periodically. At the beginning of each semester, the schedule for performing work in the lab must be developed by the student group officers, teaching assistant, student group advisor, and DSO cooperatively to avoid room scheduling conflicts with the departmental courses and other student group and outreach activities.

If the student groups perform work using machinery and/or hand and power tools, proper training is required prior to use. This is important to ensure that the user knows the proper way to operate the machinery and the safety precautions that should be taken to avoid injuries and damage to the equipment. The teaching assistant and students that use the machinery or hand and power tools must complete the Hand and Power Tool Safety training segment on the EHS online training website and submit proper documentation to the DSO. Additionally, the supervisory teaching assistant must also complete the required safety courses available through the EHS website, as reported in section 3.1 of this document.

4.0 GENERAL HOUSEKEEPING AND GOOD PRACTICES

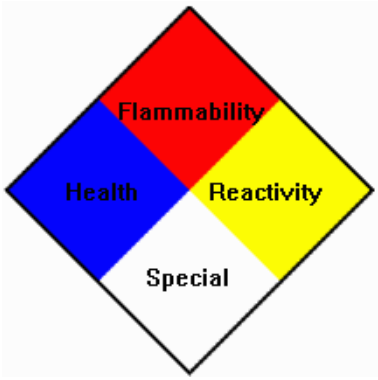
All personnel must make a conscious effort to keep the laboratories clean and tidy to ensure that research is conducted in a safe and uncontaminated environment. The following guidelines are good practice for working in the laboratory:

- Carefully read the label and Safety Data Sheet (SDS) before using a chemical.
- Make sure that all recommended personal protective equipment suggested on the SDS is available for use and in good working condition. If any protective equipment needs to be ordered, let the DSO know promptly.
- Be aware of the potential hazards existing in the laboratory and the appropriate safety precautions.
- Know the location and proper use of emergency equipment, the appropriate procedures for responding to emergencies, and the proper methods for storage, transport, and disposal of chemicals within the facility.
- Anyone considering running an experiment unattended should consider the possible hazards that could occur as a result of failures, malfunctions, operational methods, environments encountered, maintenance error and operator error.
- Inspect equipment or apparatus for damage before adding a hazardous chemical. Do not use damaged equipment.
- Inspect personal protective equipment and apparel for integrity or proper functioning before use.
- If any equipment is malfunctioning, notify appropriate lab personnel and put a sign on the equipment notifying others that it is out of service.
- At the end of each of your laboratory sessions, wipe down your bench space, return all chemicals, and clean/brush/dust off any equipment you have used.
- If using glassware, you must clean the glassware prior to leaving the lab for the day. When you return, put your clean glassware away in its proper storage location.
- Notify the DSO if there is any malfunctioning equipment, strange odors, leaks, or other potential issues.
- If your experiment creates a mess, please be courteous of others and clean up after yourself—this includes work performed in the ovens, hoods, autoclaves, and other common areas/equipment.
- If you notice a garbage can or glass disposal box is getting full, please place it outside the lab near the door so it can be emptied.
- Pick up after yourself. If you drop something on the ground, pick it up and dispose of it properly.
- Do not work in someone else's bench space or use their chemicals/tools/equipment without their permission. Stick to your designated space or use common areas.
- Remove contaminated clothing and gloves before leaving the laboratory. Wearing potentially contaminated gloves outside the designated laboratory space can result in exposures to items and surfaces in public and common areas.
- Keep all work areas, and especially work benches and hoods, clear of clutter and obstructions.
- Never block access to emergency equipment, utility controls, showers, eyewashes, and exits.
- Report all incidents and injuries to the NU Police Department, DSO, and advisor.

5.0 CHEMICAL PROCUREMENT AND HANDLING PROCEDURES

5.1 GENERAL INFORMATION

Northeastern University's laboratory doors are posted with emergency information to inform occupants and Boston Fire Department personnel of the presence of hazardous materials inside each laboratory. The National Fire Protection Association (NFPA) has developed a system for indicating the health, flammability, reactivity and special hazards for many common chemicals through use of the NFPA 704 Diamond (see below).



The hazard rating for the laboratory is determined by the chemicals, gases and other hazards used in each laboratory and establishing a rating for each hazard category based on the criteria below:

The NFPA 704 Hazard Identification System provides:

1. Planning guidance to the fire departments for safe tactical procedures in emergency operations;
2. On-the-spot information to safeguard the lives of firefighting personnel and others who may be exposed; and
3. A means of identifying hazardous materials and areas in which they are stored for students and employees.

It is important to realize that not all chemicals have been rated with the NFPA system. Additionally, the quantity of a chemical can influence the degree of hazard present. The diamond-shaped diagram gives a general idea of the inherent hazards of the chemical, as well as the order of these hazards under emergency conditions such as spills, leaks, and fires.

The diamond is divided into four color-coded quadrants. The top three quadrants of the diamond are labeled with the numbers (0-4) to indicate the degree of hazard for each category: health hazard (blue), fire hazard (red), and instability/reactivity hazard (yellow). The bottom quadrant (white) is used to indicate special hazards: water reactivity, radioactivity, biohazards, or other hazards. The higher the hazard rating on the NFPA diamond, the higher the hazard. An example of the EHS sign program is located below (408SN).

The NFPA system is one component of EHS's program. EHS updates laboratory door signs on an annual basis. The information updated on laboratory signs includes: emergency contact information (Public Safety, x **3333**), room number, responsible investigator with his/her office location and phone number, and an alternative contact with his/her office location and phone number.

5.2 THE GOAL OF MINIMIZATION

It is the goal of CEE to minimize the use of chemicals whenever practical. As research goals are contemplated, PIs and laboratory users, should evaluate their processes, taking chemical use into account.

Minimizing chemical use makes sense at all levels since it reduces procurement costs, reduces storage demand, reduces risk, and reduces disposal costs.

5.3 CHEMICAL PROCUREMENT

Before a new substance that is known or suspected to be hazardous is received, information on proper handling, storage, and disposal should be known to those who will handle it. The necessary information on proper handling of hazardous substances can be obtained from the SDS that are provided by the vendor.

Each laboratory user should consult with their PI, faculty advisor, or DSO before any chemical procurement is made, and should consider CEE's policy on waste minimization and the overall objectives of this LSP.

5.4 SAFETY DATA SHEETS (SDS)

The Hazard Communication Standard (HCS), 29 CFR 1910.1200, provisions have been incorporated into the Laboratory Standard, 29 CFR 1910.1450. The purpose of the HCS is to provide workers with information about potential risks due to chemical hazards in the workplace. The HCS created a "right to know" procedure for the worker who handles or is exposed to hazardous chemicals. Among the various topics covered by the HCS are the labeling of containers, availability of SDS, and the education and training of employees.

All students and employees should have access to the SDS at all times. SDS should be filed alphabetically in clearly labeled notebooks and updated as new sheets are received. The notebooks must be kept in an area easily accessible to all individuals in the laboratory. SDS are kept on file in each location where chemicals are stored. Each SDS is an excellent source of information, including, but not limited to, physical properties, fire and explosion hazards, chemical reactivity, recommended protective equipment, and spill and first aid procedures. Because of this, each student and employee should be familiar with the location and types of information available in SDS. If there are any questions about the material presented in the SDS, the laboratory worker should contact their advisor, PI, or DSO.

Prior to ordering a chemical, the SDS should be obtained to evaluate potential hazards associated with that chemical and to ensure the proper protective equipment is available for use upon receipt. Chemical substitution should occur if the chemical is determined to be extremely toxic and/or dangerous to handle. If an SDS is not received with or prior to the shipment, the material should be secured until the SDS is received. Additionally, each time a substance is received an updated SDS for the material must be obtained, reviewed, and placed in the SDS binder.

To locate a missing SDS visit the VWR link (this link is also on the computer in 408SN) at https://us.vwr.com/store/search/searchSDS.jsp.

5.5 CHEMICAL INVENTORY

Once an order is placed and the chemical(s) is (are) received, each laboratory user is required to enter the chemical(s) received into CEE's chemical inventory database. The database is located online through EH&S assist which can be accessed through the EHS website. After logging into EH&S assist, click on INVENTORY under CHEM and fill in the particulars of the order: date of purchase, vendor, item, quantity, storage location, SDS included (YES/NO). For more information about the chemical inventory please visit: http://www.ehs.neu.edu/laboratory_safety/chemical_inventory/.

Please note that you MUST contact the DSO to gain special access rights to be able to edit the inventory.

All laboratory users are allowed to view the inventory.

CEE's chemical inventory should be inspected annually. The DSO will coordinate this inspection with pertinent faculty and graduate students within the environmental discipline. During the inspection, those chemicals that meet one or more of the following conditions should be disposed of by the proper procedures:

- Those that exceed their appropriate shelf life;
- Deterioration of the chemical (visible by change in color; sedimentation or opacity);
- Questionable labels or no label;
- Leaking containers and/or corroded caps.

5.6 CHEMICAL TRANSFER AND TRANSPORTATION

When hazardous materials are transported or transferred between containers, the potential for an accident increases. The laboratory worker must exercise care when performing these procedures. Appropriate personal protective equipment and other safety equipment should be used during these operations (see Section 6).

When working with flammable and combustible materials, the laboratory worker should first ensure that no sources of ignition are present in the area. An exhaust hood should be used whenever flammables and combustibles are transferred from one container to another. In addition, when transferring flammable or combustible materials the containers should be bonded and grounded.

It is essential that there be sufficient expansion space within the container being filled. Overfilling a container can result in pressure great enough to cause leakage or rupture. The laboratory worker should be especially conscious of temperature changes that will affect the pressure. For example, a glass bottle with a screw cap lid can rupture if it is filled full to the top with a cold liquid and then stored in a warm or hot area.

Pipetting of liquids should be performed using a laboratory safety pipette bulb or pump. Automatic burettes or pipettes may also be used for the transfer and dispensing of some liquids.

The transport of chemicals should always be handled in such a way to ensure the safety of all laboratory personnel. Carts used for transport should be sturdy and have a substantial rim around the edge. Carts should also have wheels large enough to negotiate uneven surfaces, such as expansion joints or floor drain depressions, without tipping or stopping. CEE has a dedicated cart for the transport of chemicals between laboratories or transfer between floors or between buildings.

CEE requires all personnel to ensure chemicals are contained at all times during transport. For larger volumes the dedicated cart serves this purpose. When transporting single large glass containers (within a lab or between labs) the laboratory user should utilize the carrier located in 408SN (shown on the right). When transporting smaller volume glassware (between labs) the laboratory user should utilize one of the hand utility carriers (autoclavable). The hand carriers are located in 408SN, 468SN, 466SN, and 54SN.

5.7 CLASSIFICATION OF CHEMICALS

There are many ways to classify chemicals. Understanding these classes can further aid in determining the safe handling, storage, and disposal techniques to employ for specific chemicals. Some chemicals may actually fall into more than one class.

Flammables and Combustibles

Flammable substances are those that readily catch fire and burn. It is the vapors from a flammable liquid that burn, not the liquid itself. Flammable liquids are those that have a flash point below 100 degrees F (37.8 degrees C) and a vapor pressure that does not exceed 40 pounds per square inch (psi) at 100 degrees F. A combustible liquid has a flash point at or above 100 degrees F (37.8 degrees C). Many organic acids

are combustible materials. In addition to liquids, the Department of Transportation (DOT) also classifies flammable substances as solids and gases. Examples of flammable gases are acetylene, ethylene oxide, and hydrogen. Flammable solids are those that: a) are capable of producing fire as a result of friction or heat retained from production or, b) if ignited, produce a serious transportation hazard.

Explosives

Explosive gases and solids are also part of the flammable and combustible group. Mechanical shock, heat, and certain catalysts can act as initiators of explosive reactions. One example of an explosive mixture is a suspension of oxidizable particles, such as magnesium powder or zinc dust, in air. Explosives include nitrates, chlorates, perchlorates, and picrates.

Pyrophorics

Pyrophoric chemicals are those substances that react so rapidly with air and its moisture that the ensuing oxidation and/or hydrolysis lead to ignition. Ignition may be instantaneous, delayed, or occur only if the material is finely divided or spread in a diffuse layer. Some examples are:

- Finely divided metals, such as calcium, magnesium, and zirconium.
- Metal or non-metal hydrides, such as germanium and diborane.

Water-Reactive Substances

Water-reactive compounds react exothermically and violently with water, particularly if the water is present in limited quantities, since no significant cooling effect will occur. The following are examples of water-reactive substances:

- Alkali and alkaline earth metals, such as potassium and calcium;
- Anhydrous metal oxides and halides, such as calcium oxide and aluminum bromide.

Peroxidizable Substances

Peroxidizable substances slowly react under ambient conditions with atmospheric oxygen to initially form peroxides. The shelf life varies among the various compounds in this group.

Corrosives

Corrosives include strong acids, strong bases, dehydrating agents, and oxidizing agents. These chemicals erode the skin and respiratory epithelium, damage the eye and cause severe bronchial irritation.

Acids

All concentrated acids can damage the skin and eyes. Nitric, chromic, and hydrofluoric acids are particularly damaging because of the types of chemical burns they inflict. When handling these chemicals appropriate gloves, aprons, and face shields must be used.

Bases

Common bases include sodium hydroxide, potassium hydroxide and ammonia. Metal hydroxides are extremely damaging to the eyes. When handling these chemicals, appropriate gloves, aprons and face shields must be used.

Oxidizers

Oxidizers are any material that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of combustible materials. Examples of oxidizers include: hydrogen peroxide, permanganate, and chromic acid.

5.8 CHEMICAL LABELING

All containers in the laboratory must be labeled properly. The label on the original chemical's container is the most preferred, provided the information can be read clearly and the label has not been damaged. For chemicals and solutions not in their original containers, the following information must be displayed on the container:

- Full chemical name – NO ABBREVIATIONS
- User's name
- Date prepared
- Concentration or purity
- Any hazard information (if applicable)

If the container is too small to fit all of this information, place the containers in a secondary container (plastic bag, tray, bin, etc.) that provides enough space to display the relevant information. Bench top spaces, fridges, freezers, and other common areas will be checked periodically. If containers are improperly labeled and the owner is identified, the DSO will contact the owner to fix the label. If there is no identification, the container may be disposed of. To avoid loss of materials, make sure all chemicals and containers are properly labeled.

5.9 CHEMICAL STORAGE

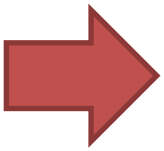
Proper storage of chemicals is important for the health and safety of the entire laboratory staff. Improper storage can result in hazardous situations that can endanger laboratory workers and physical property. Carefully read the label before storing a hazardous chemical. The SDS will provide any special storage information as well as information on incompatibilities.

The following is a list of important safety rules for the storage of chemicals:

- Segregate all chemicals according to hazard class then place alphabetically;
- Avoid storing chemicals in a fume hood;
- Return all chemicals to their appropriate storage areas after each use or at the end of the day;
- Flammable chemicals that need to be refrigerated must be stored in an approved explosion-resistant refrigerator that has been labeled as such;
- Never stack bottles on top of each other;
- Store chemicals only on sturdy shelving;
- Bottles of flammable liquids should not be stored near combustible materials;
- Chemicals must be stored in bottles with sealed and intact lids;
- Flasks and beakers with parafilm/rubber stoppers or other covers may not be used to store chemicals;

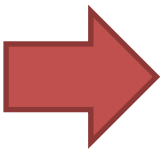
- No chemicals can be stored in drawers or other spaces that have not been specifically designated for chemical storage.

Keep the following in mind when storing and using chemicals. In general:



- Segregate REACTIVES from IGNITABLES
- Segregate ACIDS from CAUSTICS
- Segregate CORROSIVES from FLAMMABLES
- Segregate strong OXIDIZERS from EVERYTHING
- Most ORGANIC REACTIVES must be segregated from INORGANIC REACTIVES (metals)
- Chemicals must be stored in bottles with sealed and intact lids;
- Flasks and beakers with parafilm/rubber stoppers or other covers may not be used to store chemicals;
- No chemicals can be stored in drawers or other spaces that have not been specifically designated for chemical storage.

Some hazardous combinations:



- Acid + Oil or Grease = Fire
- Flammable Liquid + Hydrogen Peroxide = Fire/Explosion
- Acid + Caustic = Heat/Spattering
- Aluminum Powder + Ammonium Nitrate = Explosion
- Caustics + Epoxies = Extreme Heat
- Sodium Cyanide + Sulfuric Acid = Lethal Hydrogen Cyanide
- Chlorine Gas + Acetylene = Explosion
- Ammonia + Bleach (or other Chlorine source) = Toxic Chloramine (i.e., Mustard Gas)

If the laboratory user needs more information about chemical compatibility please refer to the compatibility chart in Appendix 3, and for more detail refer to Cole-Parmer's website at www.coleparmer.com/techinfo/chemcomp.asp

Separate hazardous chemicals in storage as follows:

- Solids:
  - oxidizers
  - flammable solids (red phosphorus, magnesium, lithium)
  - water reactives
  - others
- Liquids:
  - acids
  - oxidizers
  - flammable/combustible

- caustics
- perchloric acid

- Gases:
  - toxic
  - oxidizers and inert
  - flammable

Once separated into the above hazard classes, chemicals may be stored alphabetically. Use approved storage containers and safety cans for flammable liquids. Flammable chemicals are stored in flammable storage cabinets. CEE has flammable storage cabinets in 54 SN, 402 SN, 458 SN, 466 SN, and 468 SN. There is a corrosive storage cabinet located in 408 SN.

CEE has a dedicated chemical storage cabinet in 408SN. The cabinetry is numbered and the chemicals located in the cabinet are identified on the Chemical Inventory Database.

- Do not store chemicals on bench tops or in hoods or drawers.
- Liquids (particularly corrosives or solvents) should not be stored above eye level.
- Use secondary containers (one inside the other) for especially hazardous chemicals (carcinogens, etc.).
- Use spill trays under containers of strong reagents.
- Avoid exposure of chemicals while in storage to heat sources (especially open flames) and direct sunlight.

5.10 CHEMICAL SPILL PLAN

Every CEE laboratory user should try to anticipate the types of chemical spills that can occur, familiarize themselves with minor chemical spill clean-up procedures, and ensure the necessary equipment (spill kits and personal protective equipment) to respond to a minor spill is readily available. SDS contain special spill clean-up information and should also be consulted.

If the spill is too large for you to handle, is a threat to health, safety or the environment, or involves a highly toxic or reactive chemical, call for assistance immediately:

Environmental Health and Safety, x2769 (8:30 a.m. to 4:30 p.m.)

Public Safety, x3333 (24/7).

MINOR SPILLS - If you are cleaning up a small spill (<100ml) yourself, make sure that you are aware of the hazards associated with the materials spilled, have adequate ventilation (chemical fume hood on) and proper personal protective equipment (gloves, goggles, lab coat, and respirator if necessary). Consider all residual chemical and cleanup materials (absorbent, gloves, etc.) as hazardous waste. Place these materials in a sealed container (plastic bags) and store in a chemical fume hood. Contact the Office of Environmental Health and Safety for disposal instructions.

For minor chemical spills CEE has absorbent pads available in sealed plastic containers (below), these containers are located in 408SN, 466SN, 468SN and 54SN. Take an absorbent pad to displace the spilled chemical. Place the contaminated absorbent pad in a large plastic bag, label the bag properly, and place the bag in an operational fume hood.

CEE has additional wall-mounted spill kits located in 408SN, 402SN and 468SN.

If a spill occurs:

- Alert people in immediate area of spill;
- Increase ventilation in area of spill (turn on hoods);
- Always wear proper personal protective equipment;
- Avoid breathing vapors from spill;
- Use appropriate kit to neutralize and absorb inorganic acids and bases. Collect residue, place in container, and dispose as hazardous chemical waste;
- Clean spill area with soap and water.

LARGER SPILLS – When it is determined that a larger spill (>100ml) can be safely remediated by the laboratory user, the same method outlined above may be used. In the event of a larger chemical spill the likelihood increases that absorbent may be used. CEE has two 50-pound bags of absorbent available in 408SN and 468SN. The same disposal methods outlined above should be followed.

If a chemical spill threatens the health or safety of any laboratory personnel:

- Attend to injured or contaminated person(s) and remove them from exposure if it is safe to do so;
- Alert people in the laboratory to evacuate;
- If spilled material is flammable, turn off ignition and heat sources. Place another device (plastic bag) over spilled material to keep substance from volatilizing;
- Call **Emergency Response** number x3333;
- Close doors to affected area;
- Have a person with knowledge of the incident and laboratory available to answer questions from responding emergency personnel.

5.11 HAZARDOUS WASTE DISPOSAL

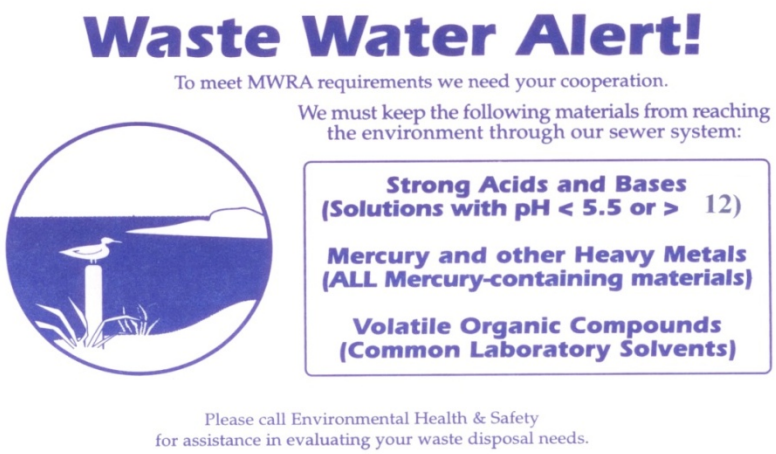
Laboratory hazardous chemical waste must be disposed of in accordance with local, state, federal and Northeastern University requirements. These waste management practices are designed to ensure maintenance of a safe and healthy environment for laboratory employees and the surrounding community

without adversely affecting the environment. This is accomplished through regular removal of hazardous waste and disposal of these wastes in compliance with all regulations and policies. Every CEE laboratory user should become familiar with the Hazardous Waste Management section on the EHS website, accessible at: http://www.ehs.neu.edu/hazardous_waste/.

Remember:

- Hazardous waste must be disposed of in a timely manner.
- When personnel are finished adding hazardous waste to a container, the label must be dated and a request to have the waste picked up must be made on the EHS website. (Visit: http://www.northeastern.edu/ehs/ehs/. On the right hand column, click on HAZARDOUS WASTE DISPOSAL REQUEST FORM.)
- Hazardous waste containers must be closed at all times, except when waste is being added or removed.
- All hazardous waste must be properly labeled at the time the waste is first placed in the container.
- Hazardous waste should be accumulated in a designated storage area consistent with applicable regulations.
- Hazardous waste regulations require separate training of personnel who generate or handle hazardous waste.
- Generators of hazardous waste are required to incorporate waste minimization into any process that generates hazardous waste.
- DO NOT use sinks or garbage cans for hazardous waste disposal.

All laboratory sinks in the Snell Engineering Center feed to a collection tank that is monitored by the Massachusetts Water Resources Authority (MWRA). The MWRA enforces provisions of the Clean Water Act, including the National Pollutant Discharge Elimination System where permits are granted and closely monitored to ensure contaminants do not enter the treatment system. The CEE laboratory user will notice that each laboratory sink has the following label:



As professionals in the field, and stewards of the environment, it is imperative that proper hazardous waste disposal practices be followed.

Additionally, due to the monitored collection tanks, all liquids that are dumped down the drain must be logged on the water log sheets located near each sink. This includes running tap water and washing hands or dishes. DO NOT DUMP ANY SOLIDS DOWN THE DRAINS.

5.12 HAZARDOUS WASTE COLLECTION

EHS requires departments to have designated "Satellite Accumulation Areas." According to EHS these designated areas must:

"… be at or near the point of generation. This area can be established on a bench top, fume hood, shelving unit or cabinet. If the material is flammable or combustible, this waste should be stored in a flammable storage cabinet to keep within fire code restrictions. It is recommended that hazardous waste, like other chemicals, should not be stored on the floor unless there is secondary containment, and they are away from exits and egresses. If a leak of hazardous waste could lead to a release into a floor drain or sink, then secondary containment will be required in all cases. Designated storage areas must be inspected by the generator of the waste on a weekly basis. One or more persons must be assigned to make these inspections and be identified on the "Satellite Accumulation Area" posting."

CEE has Satellite Accumulation Areas located in each laboratory (408SN, 468SN, 54SN, 008SN, 118 MU, and, 231EC) The Satellite Accumulation Area in 408SN is depicted below.

Once hazardous waste is deposited in the Satellite Accumulation Area the laboratory user is required to request pick-up online through EHS's website and register that action on the Hazardous Waste Disposal Record log located in each laboratory.

In the Hazardous Waste Management section of the EHS website the laboratory user can access an on-line Hazardous Waste Disposal Request Form.

Filled or unwanted wastes should be removed from the laboratory within three days so it is important the laboratory user make the pick-up request in a timely fashion.

Empty bottles can be requested using the same pick up request form through EHS website. Please verify that the container used for disposal is compatible with the hazardous waste it will store prior to use.

5.13 HAZARDOUS WASTE LABELING

All wastes that are hazardous must be clearly identified as "hazardous waste" on the label. In addition, the label should also show the physical hazards of the waste (e.g. corrosive), as well as an identification of the chemicals or chemical mixtures. The label should be dated when the container is full and/or ready for pick-up. Hazardous waste disposal labels are on file in each collection area and available from the DSO and should be used when declaring a material a hazardous waste. A copy of the hazardous waste label is detailed below.

DO NOT ABBREVIATE ON HAZARDOUS WASTE LABELS.

PLEASE ALSO ADD YOUR NAME TO THE LABEL.

HAZARDOUS WASTE

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

Northeastern University
Office of Environmental Health & Safety
170 Cullinane Hall
Boston, Massachusetts 02115
(617) 373-2769
www.ehs.neu.edu

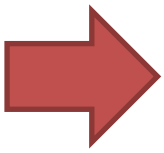
Investigator: _____ Phone #: _____
Dept: _____Room # / Bldg: _____
Date Container Filled: _____Container Size(s) _____
Principal Constituents (Give % and Full Chemical Name) _____
_____
_____
_____
Hazardous Waste Classification (Check *at least one*):
_____ Ignitable *(Includes flammable liquids, solids and gasses)*
_____ Corrosive *(pH of 2 or less, or 12 or greater, and/or can corrode steel)*
_____ Reactive *(Is unstable, can detonate or reacts violently with water)*
_____ Toxic *(Contains heavy metals, certain organics or pesticides)*
_____ Listed *(Appears on the F, U, P, or M List)*
_____ Other (Specify): _____

5.14 SYRINGES AND NEEDLES COLLECTION AND DISPOSAL

Syringes and hypodermic needles are dangerous instruments. The use of needles and syringes should be restricted to procedures for which there is no alternative. Blunt cannulas should be used as alternatives to

needles wherever possible (i.e., procedures such as oral or intranasal animal inoculations). Needles and syringes should never be used as a substitute for pipettes. When needles and syringes must be used, the following procedures are recommended:

a. Use disposable needle locking syringe units whenever possible.
b. When using syringes and needles with biohazardous or potentially infectious agents:
    1. Work in a biosafety cabinet whenever possible.
    2. Wear gloves.
    3. Fill the syringe carefully to minimize air bubbles.
    4. Expel air, liquid and bubbles from the syringe vertically into a cotton pledget moistened with disinfectant.
    5. Do not use a syringe to mix infectious fluid forcefully.
    6. Do not contaminate the needle hub when filling the syringe in order to avoid transfer of infectious material to fingers.
    7. Wrap the needle and stopper in a cotton pledget moistened with disinfectant when removing a needle from a rubber-stoppered bottle.
c. Bending, recapping, clipping or removal of needles from syringes is prohibited. If it is essential that a contaminated needle be recapped or removed from a syringe, the use of a mechanical device or the one handed scoop method must be used. The use of needle nipping devices is prohibited and the devices must be discarded as infectious waste.
d. Use a separate pan of disinfectant for reusable syringes and needles. Do not place them in pans containing pipettes or other glassware in order to eliminate sorting later.



USED DISPOSABLE NEEDLES AND SYRINGES MUST BE PLACED IN APPROPIATE SHARPS DISPOSAL CONTAINERS AND DISCARDED AS INFECTIONS WASTE.

6.0 PERSONAL PROTECTIVE EQUIPMENT AND SAFETY EQUIPMENT

6.1 EYE PROTECTION

Eye protection is required for all personnel and any visitors present in locations where chemicals are handled and a chemical splash hazard exists.

Safety glasses, goggles, and goggles with a face shield should be worn in the laboratory based upon the physical state, the operation, or the level of toxicity of the chemical used. Safety glasses effectively protect the eye from solid materials (dusts and flying objects) but are less effective at protecting the eyes from chemical splashes to the face. Goggles should be worn in situations where bulk quantities of chemicals are handled and chemical splashes to the face are possible. Goggles form a liquid-proof seal around the eyes, protecting them from a splash. When handling highly reactive substances or large quantities of hazardous chemicals, corrosives, poisons and hot chemicals, goggles with a face shield should be worn.

Contact lenses can increase the risk of eye injury if worn in the laboratory - particularly if they are of the gas permeable variety. Gases and vapors can be concentrated under such lenses and cause permanent eye damage. Chemical splashes to the eye can get behind all types of lenses. Once behind a lens the chemical is difficult to remove with a typical eye wash. For these reasons it is recommended that contact lenses not be worn in laboratories.

CEE has safety glasses, goggles, and face shields available in 408SN. Additional safety glasses are available in all labs. An eye glass sanitizer is also located in 408SN. CEE will purchase any personal protective equipment requested for any CEE laboratory user; any such request should be made to the DSO.

6.2 RESPIRATORY PROTECTION

Inhalation hazards can be controlled using ventilation or respiratory protection. Check the label and SDS for information on a substance's inhalation hazard and special ventilation requirements. When a potential inhalation hazard exists, a substance's label or SDS contains warnings such as:

- Use with adequate ventilation;
- Avoid inhalation of vapors;
- Use in a fume hood; and
- Provide local ventilation

Take appropriate precautions before using these substances. Controlling inhalation exposures via engineering controls (ventilation) is always preferred.

Use of Respirators. Respirators are designed to protect against specific types of substances in limited concentration ranges. Respirators must be selected based on the specific type of hazard (toxic chemical, oxygen deficiency, etc.), the contaminant's anticipated airborne concentration, and required protection factors.

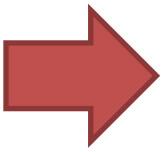
Types of respiratory protective equipment include:

- Particle-removing air purifying respirators
- Gas and vapor-removing air purifying respirators
- Atmosphere supplying respirators

Respirators are not to be used except in conjunction with a complete respiratory protection program as required by OSHA. If your work requires the use of a respirator contact EHS and the DSO.

6.3 CLOTHING AND GLOVES

Personnel are urged to dress with potential laboratory hazards in mind. Clothing should protect as much of the body as possible.



KEEP IN MIND:

- **Shoes that cover the entire foot must be worn whenever in the laboratory.** Sandals, flip-flops, ballet flats, or other abbreviated footwear are prohibited in CEE laboratories.
- Laboratory aprons or lab coats must be worn to provide protection from accidents and spills. CEE has lab coat racks located in all labs. Contaminated and/or soiled lab coats should be discarded and replaced.
- Loose fitting clothes, easily combustible clothes, long unrestrained hair, neckties, necklaces, and other such ornamental or pendant items are all fire and accident hazards, and are not appropriate in the laboratory.
- Decisions regarding the need to wear gloves and, secondly, the appropriate gloves are dependent on the hazard of the chemical, potential for contamination during the experiment and dexterity requirements. These decisions are made by the laboratory user's advisor.
- Proper glove selection is a function of the specific chemical resistance of the material as measured by permeation rate and breakthrough time. Disposable latex gloves have limited resistance to many commonly used laboratory chemicals. They should not be used in operations where contamination is anticipated and must be removed immediately and the hands washed should they become contaminated.
- **It is university policy that laboratory gloves be removed before exiting any department laboratory.**
- **Gloves should not be worn in common areas and should be removed before operating specific laboratory equipment (common controls, computers, phones, etc.)** Gloves should be washed prior to removal whenever possible to prevent skin contamination.
- Disposable gloves should only be used once. After they have been removed, throw them away and use a new pair of gloves if necessary.
- Non-disposable gloves should be replaced periodically, depending on frequency of use and their resistance to the substances handled.
- More resistant gloves include natural rubber, neoprene, nitrile, butyl, Viton, and polyvinyl chloride. Recommendation of the glove manufacturer and the Material Safety Data Sheet for the particular chemical should be used in choosing the appropriate gloves. The laboratory user can also consult the chart below.

GLOVE TYPE SELECTION GUIDE					
CHEMICAL FAMILY	BUTYL RUBBER	NEOPRENE	PVC (VINYL)	NITRILE	NATURAL LATEX
Acetates	G	NR	NR	NR	NR
Acids, inorganic	G	E	E	E	E
Acids, organic	E	E	E	E	E
Acetonitrile, Acrylonitrile	G	E	G	S	E
Alcohols	E	E	NR	E	E
Aldehydes	E	G	NR	S*	NR
Amines	S	NR	NR	F	NR
Bases, inorganic	E	E	E	E	E
Ethers	G	F	NR	E	NR
Halogens (liquids)	G	NR	F	E	NR
Inks	G	E	E	S	F
Ketones	E	G	NR	NR	G
Nitro compounds (Nitrobenzene, Nitromethane)	G	NR	NR	NR	NR
Oleic Acid	E	E	F	E	NR
Phenols	E	E	NR	NR	G
Quinones	NR	E	G	E	E
Solvents, Aliphatic	NR	NR	F	G	NR
Solvents, Aromatic	NR	NR	F	F	NR

- **Not recommended for Acetaldehyde, use Butyl Rubber*
- *S - Superior E - Excellent G - Good F - Fair NR - Not Recommended*

6.4 SAFETY SHOWERS

The purpose of a safety shower is to provide a high volume of water for rapidly rinsing a chemical off of a person's skin and clothing. Anytime a person has spilled a chemical on themselves and the chemical is of a nature that it must be removed rapidly the person should use the nearest safety shower. An example of this would be a large acid spill with acid over a large part of the body. Of course, small spills can be handled by running water over the affected area using any of the numerous sinks located in the laboratory. CEE has safety showers and eye wash stations in each lab as required.

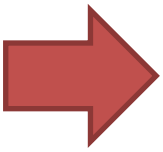
6.5 EYE WASH STATIONS

Eye wash stations provide a high flow of water, which can be used to flush a chemical from eyes. If there is any question about whether an eye-wash is necessary after a spill or splash, then the eye wash should be used without delay.

Eye wash fountains should provide a gentle flow of clean tempered aerated water for an extended period of at least 15 minutes with the eye(s) held open. Use of the hands should not be required to maintain the water flow. CEE has eye wash stations at each safety shower. In 008SN, 54SN, 458SN, and 068SN the laboratory sinks are equipped with an eyewash faucet. The stand-alone eye wash stations are not connected to drains. Thus, when turned on, water will flow on the floor. In the event of an emergency, continue using the eye wash as necessary. The floor can be cleaned up after personnel have been attended to.

6.6 FIRST AID KITS

Each CEE laboratory has a first aid kit. Laboratory personnel should be aware of these locations. It is the responsibility of CEE laboratory personnel to inform the DSO of any accidents requiring first aid, and the need to resupply any first aid kit.



Be sure you are aware of the location of safety showers, eye wash stations, first aid kits, spill response kits, fire extinguishers, and any other element of personal protection before starting working in the laboratory. In case of doubt, always ask your PI, DSO, or EHS department.

7.0 PERSONAL CONTAMINATION AND INJURY

7.1 GENERAL INFORMATION

- Know the locations of the nearest safety shower and eye wash fountain.
- Report all incidents and injuries to your supervisor and DSO.
- If an individual is contaminated or exposed to a hazardous material in your laboratory, do what is necessary to protect their life and health as well as your own. Determine what the individual was exposed to. The SDS will contain special first aid information.
- Do not move an injured person unless they are in further danger (from inhalation or skin exposure).
- A blanket should be used immediately to protect the victim from shock and exposure.
- Get medical attention promptly by dialing (617) 373-3333.

7.2 CHEMICAL SPILLS ON THE BODY

- Quickly remove all contaminated clothing and footwear.
- Immediately flood the affected body area with cold water for at least 15 minutes. Remove jewelry to facilitate removal of any residual material.
- Wash off chemical with water only. *Do not use neutralizing chemicals, unguents, creams, lotions or salves.*
- Get medical attention promptly by dialing (617) 373-3333.

It should be noted that some chemicals (phenol, aniline) are rapidly absorbed through the skin. If a large enough area of skin is contaminated, an adverse health effect (systemic toxicological reaction) may occur immediately to several hours after initial exposure depending on the chemical. If more than 9 square inches of skin area has been exposed to a hazardous chemical, seek medical attention after washing the material off the skin. If the incident involves hydrofluoric acid, seek immediate medical attention. Provide the physician with the chemical name.

7.3 CHEMICAL SPLASH IN THE EYE

- Remove gloves and wash hands with soap and water.
- Irrigate the eyeball and inner surface of eyelid with plenty of cool water for at least 15 minutes. Use eyewash or other water source. Forcibly hold eyelids open to ensure effective wash.
- Check for and remove contact lenses.
- Get medical attention promptly.

7.4 INGESTION OF HAZARDOUS CHEMICALS

- Identify the chemical ingested.
- Call for an ambulance by dialing (617) 373-3333.
- Call the Poison Information Center by dialing (800) 222-1222.
- Cover the injured person to prevent shock.
- Provide the ambulance crew and physician with the chemical name and any other relevant information. If possible, send the container, SDS or the label with the victim.

7.5 INHALATION OF SMOKE, VAPORS, AND FUMES

- Anyone overcome with smoke or chemical vapors or fumes should be removed to uncontaminated air and treated for shock.
- Do not enter the area if you expect that a life threatening condition still exists - oxygen depletion, explosive vapors or highly toxic gases (cyanide gas, hydrogen sulfide, nitrogen oxides, carbon monoxide)
- If CPR certified, follow standard CPR protocols.
- Get medical attention promptly.

7.6 BURNING CHEMICALS ON CLOTHING

- Extinguish burning clothing by using the drop-and-roll technique or by dousing with cold water, or use an emergency shower **if it is immediately available**.
- Remove contaminated clothing; however, avoid further damage to the burned area. If possible, send the clothing with the victim.
- Remove heat with cool water or ice packs until tissue around burn feels normal to the touch.
- Cover injured person to prevent shock.
- Get medical attention promptly.

7.7 ACTIONS TO BE AVOIDED DURING EMERGENCIES

There are some actions which must **not** be taken when handling emergencies. These include:

- Do not force any liquids into the mouth of an unconscious person.
- Do not handle emergencies alone, especially without notifying someone that the accident has occurred.
- Do not linger at the accident scene if you are not one of the emergency responders.

7.8 FIRE AND FIRE RELATED EMERGENCIES

If you discover a fire or fire-related emergency such as abnormal heating of material, a flammable gas leak, a flammable liquid spill, smoke, or odor of burning, immediately follow these procedures:

- Notify the Fire Department through the Division of Public Safety by dialing (617) 373-3333.
- Activate the building alarm (fire pull station). If not available or operational, verbally notify people in the building.
- Isolate the area by closing windows and doors and evacuate the building.
- Shut down equipment in the immediate area, if possible.
- Use a portable fire extinguisher to:
  - assist oneself to evacuate;
  - assist another to evacuate; and
  - control a small fire, if possible.

Provide the fire/police teams with the details of the problem upon their arrival. Special hazard information you might know is essential for the safety of the emergency responders.

If the fire alarms are ringing in your building:

- You must evacuate the building and stay out until notified to return.
- Move up-wind from the building and stay clear of streets, driveways, sidewalks and other access ways to the building.
- If you are a supervisor, try to account for your employees, keep them together and report any missing persons to the emergency personnel at the scene.

8.0 VENTILATION

8.1 LABORATORY FUME HOODS

Every laboratory ventilation hood used for the control of air contaminants is tested once per year to assure that adequate airflow is being maintained to provide continued protection against employee over-exposure to hazardous materials. The Office of Environmental Health and Safety is responsible for performing this testing. Laboratory hood airflow shall be considered adequate when the average face velocity equals a minimum of a 100 feet/minute and a maximum of 125 feet/minute with the hood sash at a working height (14 to 20 inches). *Note: New fume hoods in 402SN, 231EC, and 54SN have vertical sashes which are designed to be closed*.

Every CEE fume hood is equipped with a manual switch. If it is determined that the fume hood is not operating properly the laboratory user shall not use that fume hood and shall notify the DSO immediately.

GENERAL GUIDELINES FOR FUME HOODS

- With particularly hazardous chemicals or wastes, operations such as unpacking, diluting, packing, or reacting hazardous materials should be performed in the fume hood.
- Never use an inoperative fume hood.
- Chemicals should not be stored in hoods. Chemicals should be returned to their appropriate storage area. Only those items that are essential should be in the hood. Extraneous items may impair the effectiveness of the fume hood. Storing large pieces of equipment in the hood will affect the containment ability of the hood. EHS must be called before storing large equipment in the hood to evaluate the hood performance.
- The hood sash should be kept closed unless manipulations are being performed within the hood. When the hood is being used the sash should be open no more than 18 inches or where your hood sticker has been placed. This is necessary to protect the user's face in the event of an explosion and prevent chemical exposures when the products used are not being contained by the hood.
- Hoods may be turned off when not in use if adequate general laboratory ventilation can be maintained when they are not running. Hoods must be left on if any chemicals are in the hood or if the hood is required to maintain negative room pressure.
- Materials such as paper and dust should not be permitted to enter the exhaust ducts of the hood. They can adversely affect the operation of the hood by lodging in ducts and fans.
- Equipment, such as hot plates and heating mantles, should be placed at least 6 inches from the hood sash. Generally equipment should be placed as far to the back of the hood as practical.

9.0 DRYING OVENS

General hazards of operation

Primary hazards associated with using forced draft ovens are:

- Contact with hot interior oven surfaces and contents.
- Possible fire hazard with flammable or combustible substances placed in oven or if contents are improperly arranged in oven.
- Setting oven temperature incorrectly.
- Electrical problems.

CEE has drying ovens in 408SN and 68SN. The following policies apply to oven use:

DO NOT put the following in the ovens:

- Enclosed containers such as sealed jars, cans, or bottles;
- Flammable solvents of any kind;
- Explosive or easily ignited combustible materials;
- Open containers, boxes, bags, which will permit dust or powdered material to
- Escape and circulate in the oven; or
- Wet or moist samples in plastic bags.

DO NOT change oven temperature. If the temperature needs to be changed, consult with the DSO. For safety and to prevent accidental overheating of samples or glass and plastic ware, temperature changes will be posted on the oven.

DO NOT overfill ovens, as this may cause overheating and fire. Proper airflow in ovens is necessary for proper drying and to avoid overheating conditions

DO NOT use ovens for heated storage space. When your samples or glassware are dried, promptly remove your material.

10.0 COMPRESSED GASES

10.1 GENERAL INFORMATION

Compressed gases are unique in that they represent both a physical and a potential chemical hazard (depending on the particular gas). Gases contained in cylinders may be from any of the hazard classes (flammable, reactive, corrosive, or toxic). Because of their gaseous state, concentrations in the laboratory can increase instantaneously if leaks develop at the regulator or piping systems, creating the potential for a toxic chemical exposure or a fire/explosion hazard. Often there is little or no indication that leaks have or are occurring. Finally, the large amount of potential energy resulting from compression of the gas makes a compressed gas cylinder a potential rocket or fragmentation bomb if the tank or valve is physically broken.

10.2 HANDLING PROCEDURES

The contents of any compressed gas cylinder should be clearly identified. No cylinder should be accepted for use that does not legibly identify its contents by name. Color coding is not a reliable means of identification and labels on caps have no value as caps are interchangeable.

- Carefully read the label before using or storing a compressed gas. The SDS will provide any special hazard information.
- Do not handle gas cylinders unless you have been trained to do so. Contact the laboratory technician for assistance when necessary.
- Transport gas cylinders in carts one or two at a time only while they are secured and capped. CEE has a gas cylinder transport cart typically located in 468SN. When storing or moving a cylinder, the protective cap must be securely in place to protect the valve stem. Never move a cylinder with a regulator attached.
- All gas cylinders should be capped and secured when stored.
- Use suitable racks, straps, chains or stands to support cylinders. All cylinders, full or empty, must be restrained and kept away from heat sources.
- Use only Compressed Gas Association standard combinations of valves and fittings for compressed gas installations. Always use the correct pressure regulator. Do not use a regulator adaptor.
- Place gas cylinders in such a way that the cylinder valve is accessible at all times. The main cylinder valve should be closed as soon as the gas flow is no longer needed. Do not store gas cylinders with pressure on the regulator. Use the wrenches or other tools provided by the cylinder supplier to open a valve if available. In no case should pliers be used to open a cylinder valve.
- Use soapy water (SNOOP) to detect leaks. Leak test the regulator, piping system and other couplings after performing maintenance or modifications, which could affect the integrity of the system.
- Oil or grease on the high pressure side of an oxygen cylinder can cause an explosion. Do not lubricate an oxygen regulator or use a fuel/gas regulator on an oxygen cylinder.
- Never bleed a cylinder completely empty. Leave a slight pressure to keep contaminants out (172 kPa or 25 psi).
- All gas cylinders should be clearly marked with appropriate tags indicating whether they are full or empty. CEE has vinyl cylinder labels available in 468SN. Place the appropriate label (Full, Empty) on each cylinder.

- Cylinders of toxic, flammable or reactive gases should be purchased in the smallest quantity possible and stored/used in a fume hood or under local exhaust ventilation. If at all possible, avoid the purchase of lecture bottles. These cylinders are not returnable and it is extremely difficult and costly to dispose of them. Use the smallest returnable sized cylinder.

10.3 SPECIAL PRECAUTIONS FOR HYDROGEN

Hydrogen gas has several unique properties that make it potentially dangerous to work with. It has an extremely wide flammability range (LEL 4%, UEL 74.5%) making it easier to ignite than most other flammable gases. Unlike most other gases, hydrogen's temperature increases during expansion. If a cylinder valve is opened too quickly, the static charge generated by the escaping gas may cause it to ignite. Hydrogen burns with an invisible flame. Caution should therefore be exercised when approaching a suspected hydrogen flame. A piece of paper can be used to tell if the hydrogen is burning. Hydrogen embrittlement can weaken carbon steel, therefore cast iron pipes and fittings must not be used.

11.0 AUTOCLAVE OPERATION

CEE has two autoclaves, one located in 466SN (left) and 408SN (right).

Any laboratory user utilizing the autoclaves must take the appropriate training through EHS. Each autoclave has its own log book that the laboratory user must complete each time the autoclave is used. There is also a hard copy of the autoclave manual if needed.

11.1 GENERAL AUTOCLAVE PROCEDURES

An autoclave is a commonly used piece of equipment in laboratories. Autoclaves pose many hazards including physical hazards (e.g. heat, steam and pressure) and biological hazards. Each autoclave has unique characteristics. Review and understand the owner's manual before using any autoclave for the first time and as needed thereafter.

Autoclave maintenance is an important aspect of a properly functioning autoclave. Follow the manufacturer's recommendations for preventative maintenance and ensure all contractors are approved by the manufacturer. Maintenance should include periodic efficiency tests (e.g. *Bacillus stearothermophilus* spore testing) to ensure the autoclave is functioning properly.

Do not autoclave items containing corrosives (e.g. acids, bases, phenol), solvents or volatiles (e.g. ethanol, methanol, chloroform) or radioactive materials.

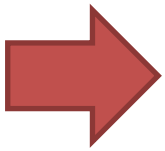
Utilize the following autoclave safety practices:

- Before using the autoclave, check inside the autoclave for any items left by the previous user that could pose a hazard (e.g., sharps).
- Clean the drain strainer before loading the autoclave.
- Load the autoclave properly as per the manufacturer's recommendations.
- To prevent bottles from shattering during pressurization, the caps of containers with liquids must be loosened before loading.

- Use a tray with a solid bottom and walls to contain the contents and catch spills.
- Add 1/4 to 1/2 inch of water to the tray so the bottles will heat evenly.
- Check plastic materials to ensure they are compatible with the autoclave.
- Individual glassware pieces should be within a heat resistant plastic tray on a shelf or rack and never placed directly on the autoclave bottom or floor.
- Make sure the door of the autoclave is fully closed (latched) and the correct cycle has been selected before starting the cycle.
- Wear heat-resistant gloves when opening the autoclave door after a cycle. If there is a sharps hazard (e.g. biological waste), wear heat AND cut resistant gloves.
- Before removing autoclaved items, wait 5 minutes for loads containing only dry glassware, and 10 minutes for autoclaved liquid loads.
- At a minimum, when removing items from an autoclave, a rubber apron, rubber sleeve protectors and heat-resistant gloves should be worn.
- For non-liquid loads, let the glassware cool for 15 minutes before touching it with ungloved hands.
- For liquid loads, let liquids stand for a full hour before touching with ungloved hands. Be sure others in the area know a heat hazard is present.

12.0 ANALYTICAL EQUIPMENT

CEE has several state-of-the-art analytical machines in 468SN, 466SN, and 231EC. No laboratory user is allowed to utilize any analytical machine until they have demonstrated proficiency with the department's Academic Specialist, Annalisa Onnis-Hayden and/or respective advisor.



Dr. Onnis-Hayden should be contacted when a laboratory user, in consultation with their academic advisor, determines they will need to operate any of this equipment.

Dr. Onnis-Hayden will ensure operational proficiency, coordinate sheduling, and oversee equipment performance and maintenance.

13.0 LABORATORY CLOSEOUT PROCEDURES

Proper disposal or transfer of all hazardous materials, and all laboratory equipment, used in CEE laboratories is the responsibility of the laboratory user. Proper disposal of hazardous materials is required whenever a laboratory user leaves the University or transfers to a different laboratory.

13.1 CHEMICALS

Ensure that all containers of chemicals are labeled with the name of the chemical. All containers must be securely closed. Beakers, flasks, evaporating dishes, etc. are not acceptable. Each container must be labeled properly. Chemical wastes must not be placed in the sanitary sewer or trash; they must be collected for transfer (to a new laboratory user or to proper storage) or disposal. Check refrigerators, freezers, fume hoods and bench tops as well as storage cabinets for chemical containers and address each item you are responsible for.

This process may take quite some time and should be started at least a month before departure from the laboratory. Resolution of chemicals you are responsible for must be addressed before the laboratory is vacated.

13.2 EQUIPMENT

If laboratory equipment is to be left for the next occupant, clean or decontaminate it before departing the laboratory. Unless equipment is going to be used in duplicate fashion by a successor (as confirmed by the advisor) it should be decommissioned and prepared for use by incoming personnel. If exhaust or filtration equipment has been used with extremely hazardous substances alert EHS and facilities personnel.

Decontaminate fume hood surfaces, counter tops and the interior of all freezers and refrigerators. Notify the DSO when the laboratory has been cleared.

13.3 GAS CYLINDERS

Remove gas connections, replace cylinder caps, and return cylinders to storage rack for return to vendor.

13.4 MICROORGANISMS AND CULTURES

Autoclave all cultures of microorganisms and dispose in regular trash. If material cannot be decontaminated contact EHS.

Decontaminate incubators, drying or curing ovens, refrigerators and freezers. If samples need to be retained, locate appropriate person to take responsibility for them (consult your advisor) and notify the DSO.

EACH LABORATORY USER MUST COMPLETE THE LABORATORY CLOSEOUT FORM LOCATED IN APPENDIX 6. ALL NECESSARY SIGNATURES MUST BE OBTAINED BEFORE YOUR THESIS OR DISSERTATION WILL BE SIGNED.

APPENDIX

APPENDIX 1: REQUIRED CEE LAB ACCESS FORMS

Northeastern University

Department of Civil and Environmental Engineering

Laboratory Access Form

As a laboratory user in the Department of Civil and Environmental Engineering at Northeastern University, I confirm that I have read – and will comply with – the Department's Laboratory Safety Plan.

I understand that if I am found in noncompliance with any provisions of the Laboratory Safety Plan that my laboratory privileges may be suspended or revoked.

This form must be signed, dated, and returned to the Laboratory Manager before any work is conducted in any department laboratory.

Print Name	Signature
NU ID#	Date

List any analytical instrument to be used

Department of Civil and Environmental Engineering
Access Request Form and Lab Release
Staff, Graduate Students, and Visitors

Northeastern University

Today's Date: _____

[ ] Staff **[ ] Graduate** **[ ] Other** _____

Applicant's Name: _____ **NU ID Number:** _____

NU E-Mail Address: _____

Office Address and Phone Number: _____

Home Address: _____

Phone Numbers: **Home:** _____ **Cell:** _____

Program: MS ____ **PhD** ____ **Full time** _____ **Part time** _____

Advisor's/Supervisor's Name _____

Type of access requested and location:

Access (Y/N)	Key (Y/N)	Building	Room	PI / Advisor Signature

Purpose of access:

_____

_____

Applicant: I agree to accept responsibility for all university keys or access by security code or ID swipe card. Keys/security codes/ID swipe cards will allow me to access offices/labs so that I can work on my university-related work in my designated laboratory, computer, or office space.

I will not allow non-Northeastern University students or personnel to access the facilities using my keys, security codes, or ID swipe card. I will not make duplicate copies of these keys nor loan them to anyone for any reason, nor will I share security codes or ID swipe cards. I agree that upon my departure from the University or completion of duties requiring my access to the facility, (i.e., graduation, separation from the University for any other reason, completion of TA course, etc.) I will return all university keys to the Academic Operations Manager in 424 Dana Research Center.

I have read and agree to the statements above.

Applicant's Signature: _____ Date: _____

Advisor's Signature: _____ Date: _____

Academic Operations Manager's Signature: _____ Date: _____

Department of Civil and Environmental Engineering
Access Request Form and Lab Release

Northeastern University

Note: Kyle Coleman's (ky.coleman@neu.edu) signature (020 SN) is required for the STReSS Laboratory at the George J. Kostas Research Institute for Homeland Security.

STReSS Lab Manager's Signature: _____ Date: _____

1. For laboratory access, applicant must document satisfactory completion of the safety training and have the department Academic Operations Manager's signature before access is granted. This applies to the following CEE locations: Snell Engineering: 008, 050, 050A, 054, 058, 068, 402, 406, 408, 458, 466, 468; Egan Center: 231; Mugar Hall: 118 MU; George J. Kostas Research Institute for Homeland Security: STReSS Laboratory, and any other departmental laboratories.

2. At a minimum, you must complete Safety Program Orientation, and Chemical Hygiene Parts 1 and 2, Hazardous Waste Management; EH&S Assist Chemical Inventory Training, Laboratory Chemical Fume Hood; and Hazard Communication.

The following must only be completed for laboratory access requests:

I understand that working in active research laboratories poses potential risks of harm. These risks may include damage to property, serious personal injury including chemical burns and even death. I agree to abide by all applicable policies, rules, and regulations. I agree to follow the direction of the lab personnel and staff. I agree that if granted, my approval to work in the labs may be withdrawn at any time at the sole discretion of Northeastern University.

Release of Claims

In consideration of Northeastern University granting _____ (name of person requesting authorization, hereinafter the "Participant") permission to work in a University lab, I/We, on behalf of myself/the Participant, the family heirs, personal representatives, guardians, successors, and assigns (all of whom are referred to as "Releasors"), hereby release Northeastern University, its Administrators, Faculty, Trustees, Officers, Directors, Employees, Volunteers, and Agents (all of whom are referred to as "Releasees") from, and agree not to sue Releasees, for any claims that I/we may have arising from, or in connection with, any physical, emotional or mental injury or property damage that Releasors may suffer as a result of my participation in the lab from any cause whatsoever, to the extent permitted by law.

I acknowledge that I am voluntarily executing this agreement of my own free will. After having the opportunity to consult with legal counsel of my own choosing, I acknowledge and understand that this agreement will release Northeastern University and its Releasees from any liability in connection with any injury or damages or losses suffered as a result of the Participant's participation in the lab activity.

I acknowledge that I have been made aware of any and all risks of participation in this Activity, and I hereby approve of the Participant's participation in the Activity.

Participant signature: _____ Date: _____

Revision Date	Version Number	Summary of Changes	Reviser(s) Initials
02/17/2016	v.1.0	Update of Academic Operation Manager contact information	CVM
04/12/2016	v.2.0	Eliminate undergrad option. This form is only for GRAD students, FACULTY and STAFF use.	CVM
10/23/2017	v.3.0	Update of list of CEE laboratories and mandatory safety training required.	CVM

APPENDIX 2: ENVIRONMENTAL HEALTH & SAFETY WEBSITE

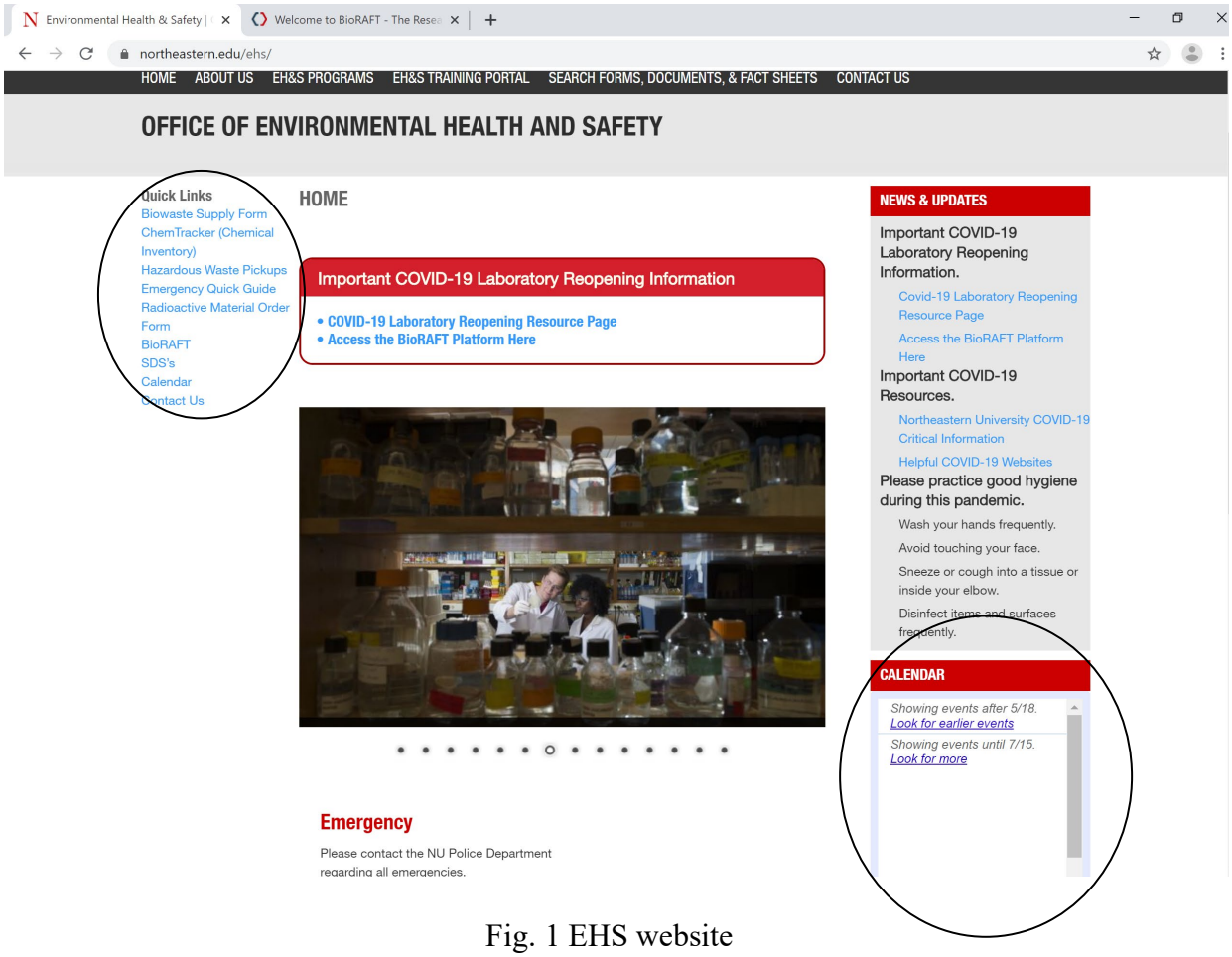


Fig. 1 EHS website

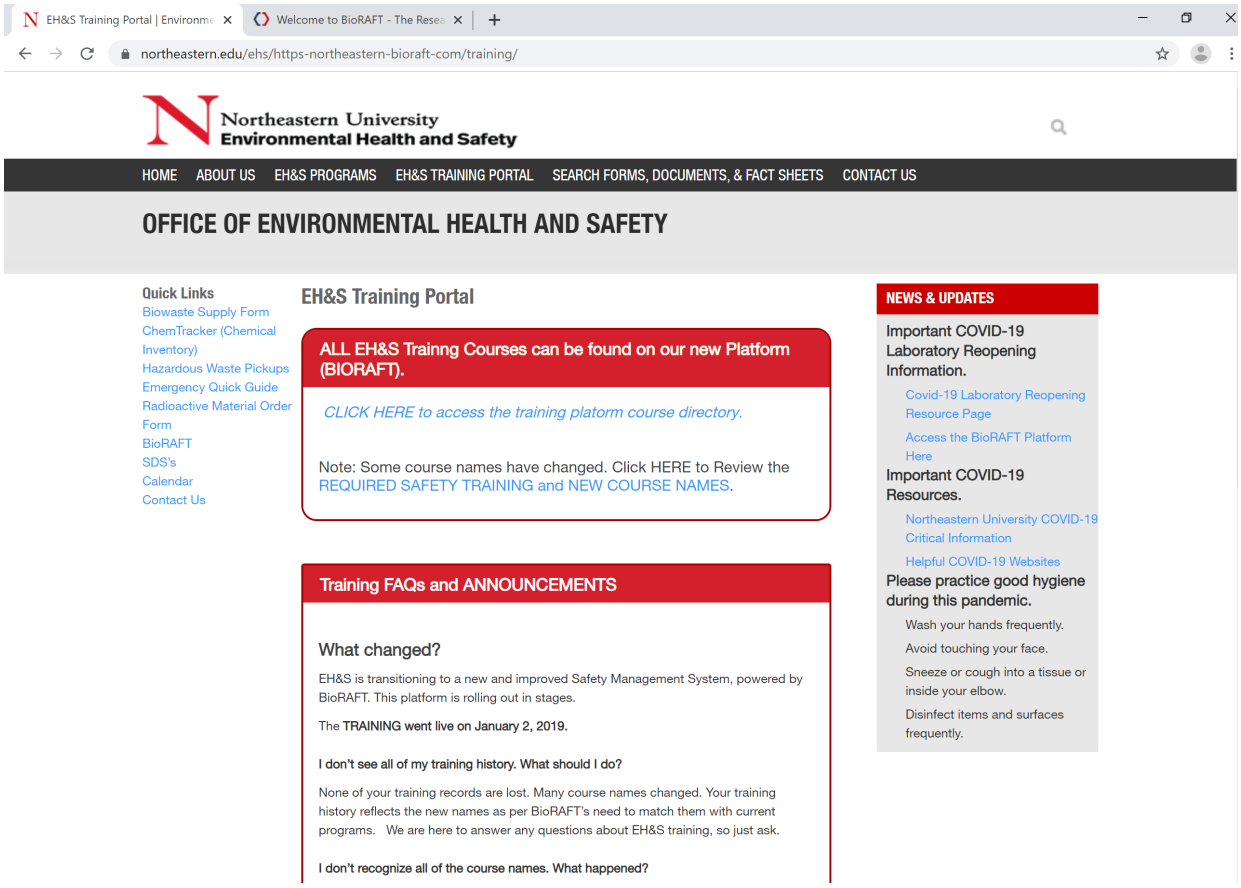


Fig. 2 EHS Online Training

APPENDIX 3: CHEMICAL INVENTORY

EH&S Assist Chemical Inventory Quick Guide

Accessing Bioraft

1. Log on to myNEU
2. In the self-service tab look for the Environmental Health and Safety Services section
3. Select EH&S Assistant
4. Log on using your myNEU username and password
5. Select Inventory in the CHEM tab
6. To view your inventory select *All Items*

How to Add a Chemical to your Inventory:

1. Click on the *Add Chemical* button
2. Scan the barcode into the *Inventory* # space. (You can type the barcode manually if you do not have the scanner)
3. Enter in the CAS # of the chemical into the *Search by* CAS # field and select your chemical from the drop-down list, [if either searching it by CAS # or the chemical description gives you no results. You must select "Not in Catalog" at the top of the screen and manually fill in the data for the chemical. Just be sure to type in the "CAS#" field not the "search by CAS#" field when using this method.].
4. Click on the *"i"* next to the Lab field and select the lab by room number
5. Select the physical state of the chemical, type in the size of the chemical into *Quantity per Unit,* and select the units under *Volume/Size*
6. Select the permanent location inside the lab where the chemical is located. If the location is not in the list you can type in the name of the location in the original field.
7. Click the *"i"* next to the *Vendor* field to select the vendor. If the vendor is not in the list you can type in the name of the location in the original field.
8. Select the *"i"* next to the *Contact* field. Select the Permit Holder as the contact
9. The fields in blue must be filled out
10. Click *Save/Return*

How to Search for a Specific Chemical in your Lab:

1. The Chemicals can be sorted by location, first letter, CAS #, and Inventory # from the *Inventory Main Menu*
2. Clicking on a header of a column such as *Inventory* # will sort the contents of the list by that category.

To Remove a Chemical:

1. Locate the chemical you would like to retire in your inventory
2. Select the *Remove* button next to the chemical
3. Select the reason for the removal in the drop down menu
4. Click on *Yes*

APPENDIX 4: CHEMICAL COMPATIBILITY CHART

CHEMICAL COMPATABILITY CHART

Certain hazardous chemicals should not be mixed or stored with other chemicals because a severe reaction can take place or an extremely toxic reaction product can result. The label and SDS will contain information on incompatibilities. The following table contains examples of incompatible chemicals:

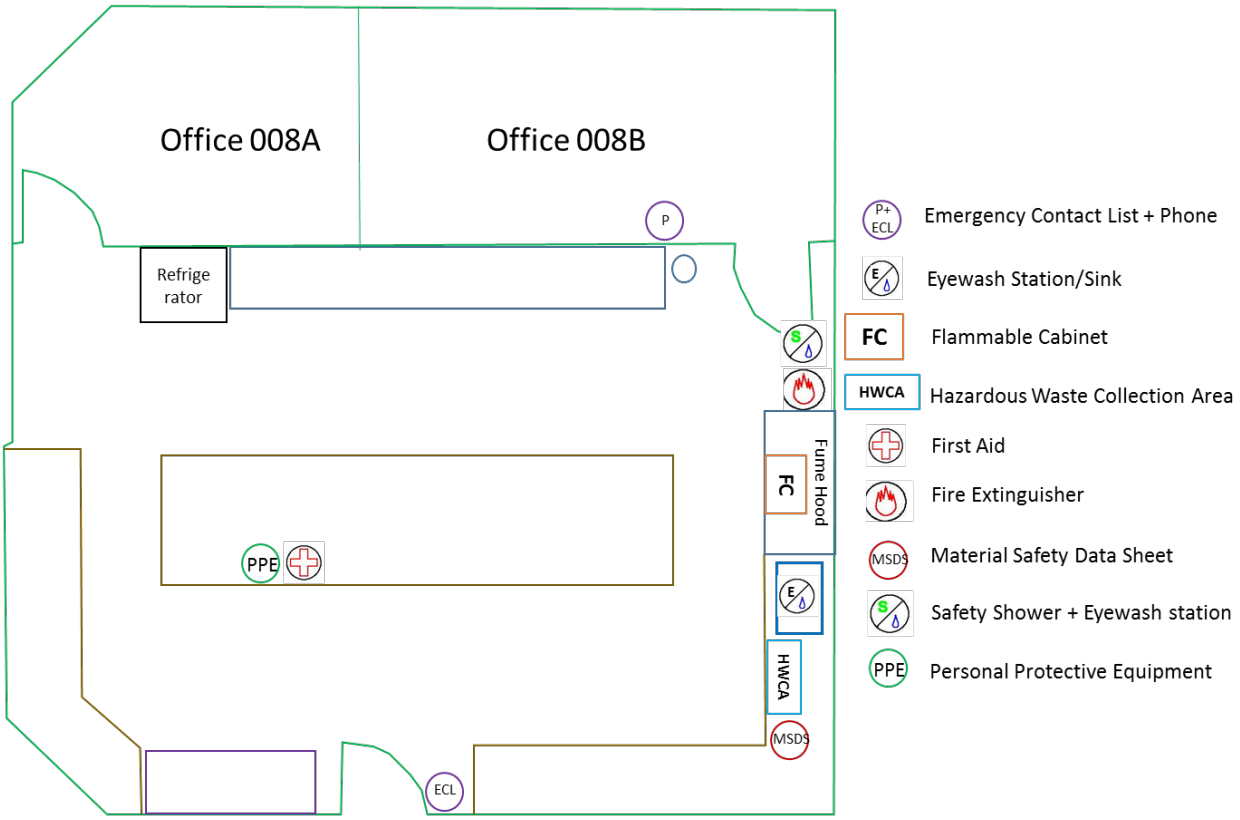
CHEMICAL	KEEP OUT OF CONTACT WITH
Acetic Acid	Chromic acid, nitric acid hydroxyl compounds, ethylene, glycol, perchloric acid, peroxides, permanganates
Acetone	Concentrated nitric and sulfuric acid mixtures
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Alkali Metals	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, the halogens
Ammonia, anhydrous	Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid
Ammonium Nitrate	Acids, metal powders, flammable liquids, chlorates, nitrites, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Any reducing agent
Azides	Acids
Bromine	Same as chlorine
Calcium Oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents.
Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, metal powders, sulfur, finely divided organic or combustible materials
Chromic Acid	Acetic acid, naphthalene, camphor, glycerin, turpentine, alcohol, flammable liquids in general
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals
Chlorine Dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene Hydroperoxide	Acids, organic or inorganic
Cyanides	Acids
Flammable Liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Hydrocarbons	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic Acid	Nitric acid, alkali
Hydrofluoric Acid	Ammonia, aqueous or anhydrous
Hydrogen Peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, flammable liquids, oxidizing gases
Hydrogen Sulfide	Fuming nitric acid, oxidizing gases, acetylene, ammonia (aqueous or anhydrous), hydrogen
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulfuric acid
Nitric Acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases
Nitrites	Acids
Nitroparaffins	Inorganic bases, amines
Oxalic Acid	Silver, mercury
Oxygen	Oils, grease, hydrogen; flammable liquids, solids, or gases
Perchloric Acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold

CHEMICAL	KEEP OUT OF CONTACT WITH
Phosphorus (white)	Air, oxygen, alkalies, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium Chlorate	Sulfuric and other acids
Potassium Permanganate	Glycerin, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrite	Ammonium nitrate and other ammonium salts
Sodium Peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric Acid	Potassium chlorate, potassium perchlorate, potassium permanganate (or compounds with similar light metals, such as sodium, lithium, etc.)
Tellurides	Reducing agents

(From Manufacturing Chemists' Association, Guide for Safety in the Chemical Laboratory, pp.215-217.)

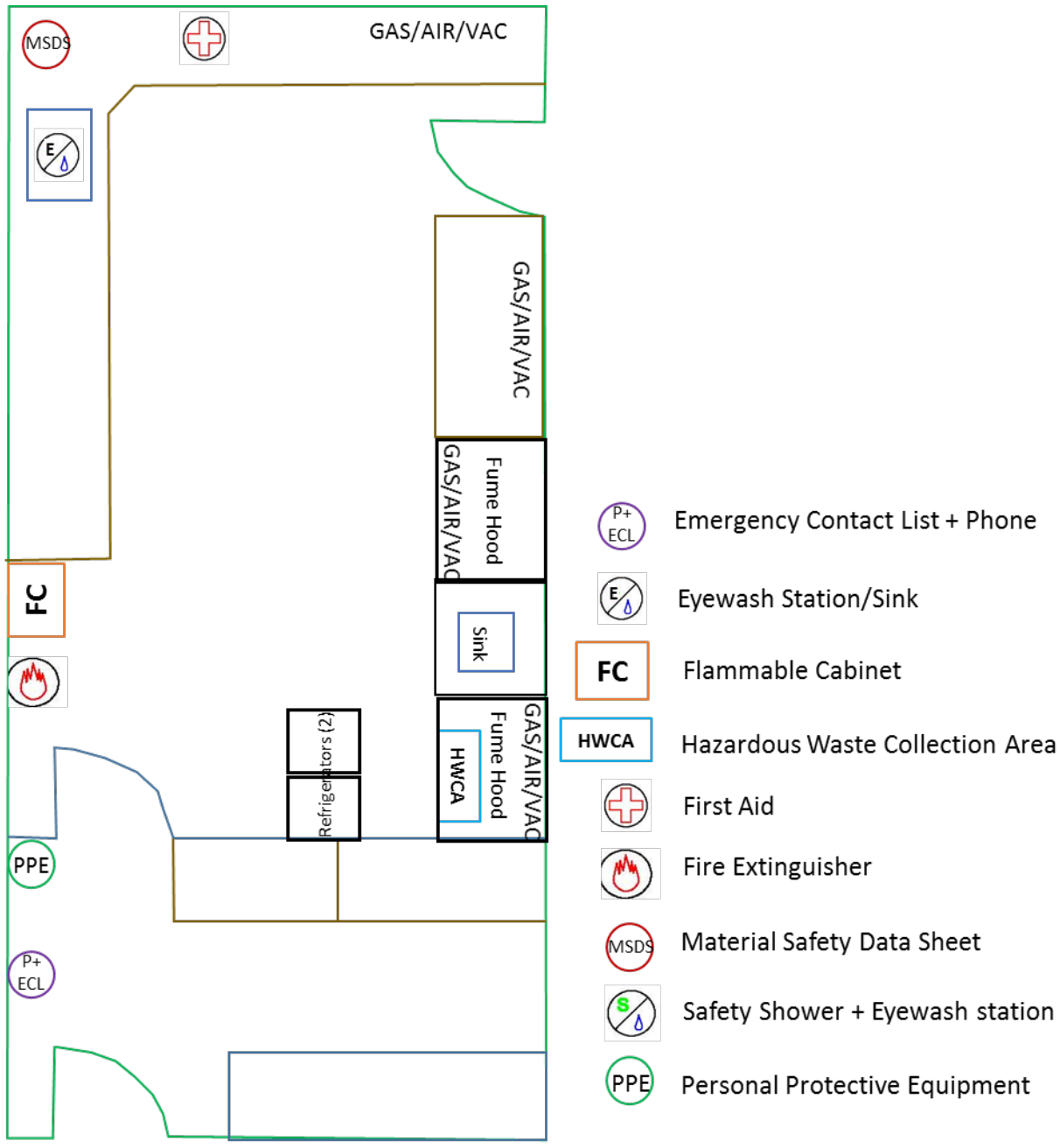
APPENDIX 5: CEE LABORATORY FACILITIES

008 SN – Sensor Technology Laboratory



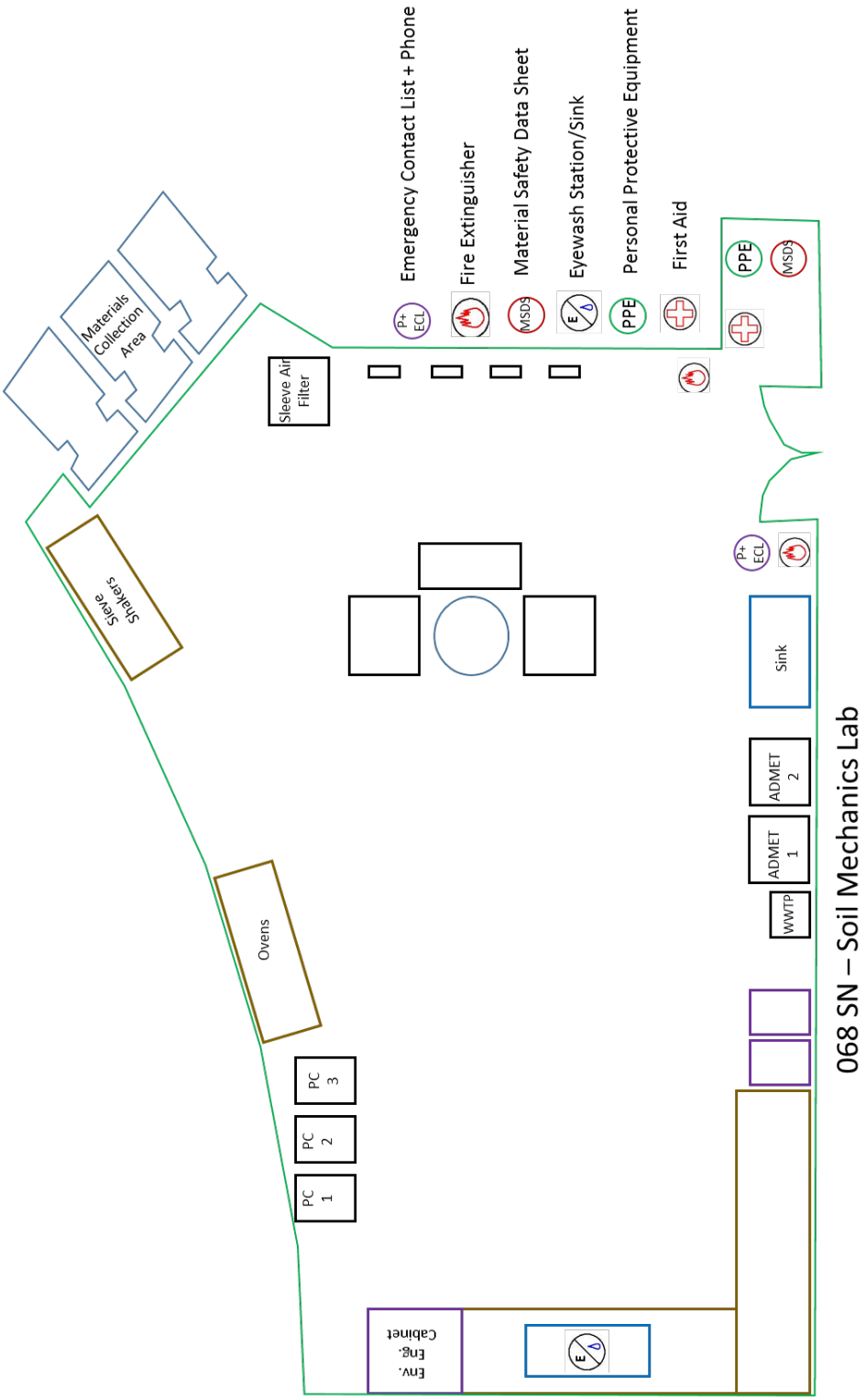
008 SN – Sensor Technology Lab

054 SN – Environmental Chemistry Laboratory

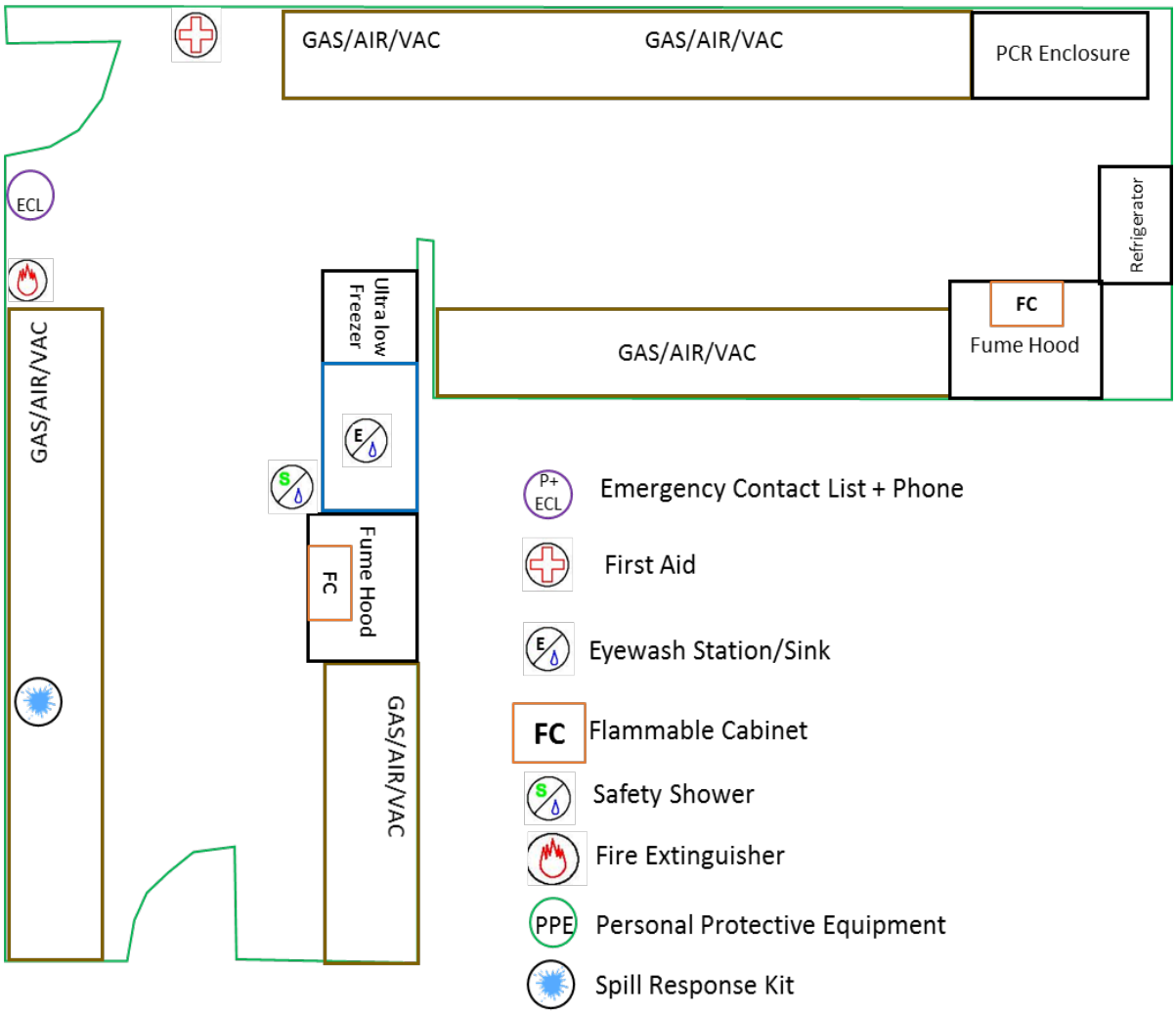


054 SN – Environmental Chemistry Lab

068 SN – Soil Mechanics / Materials Laboratory

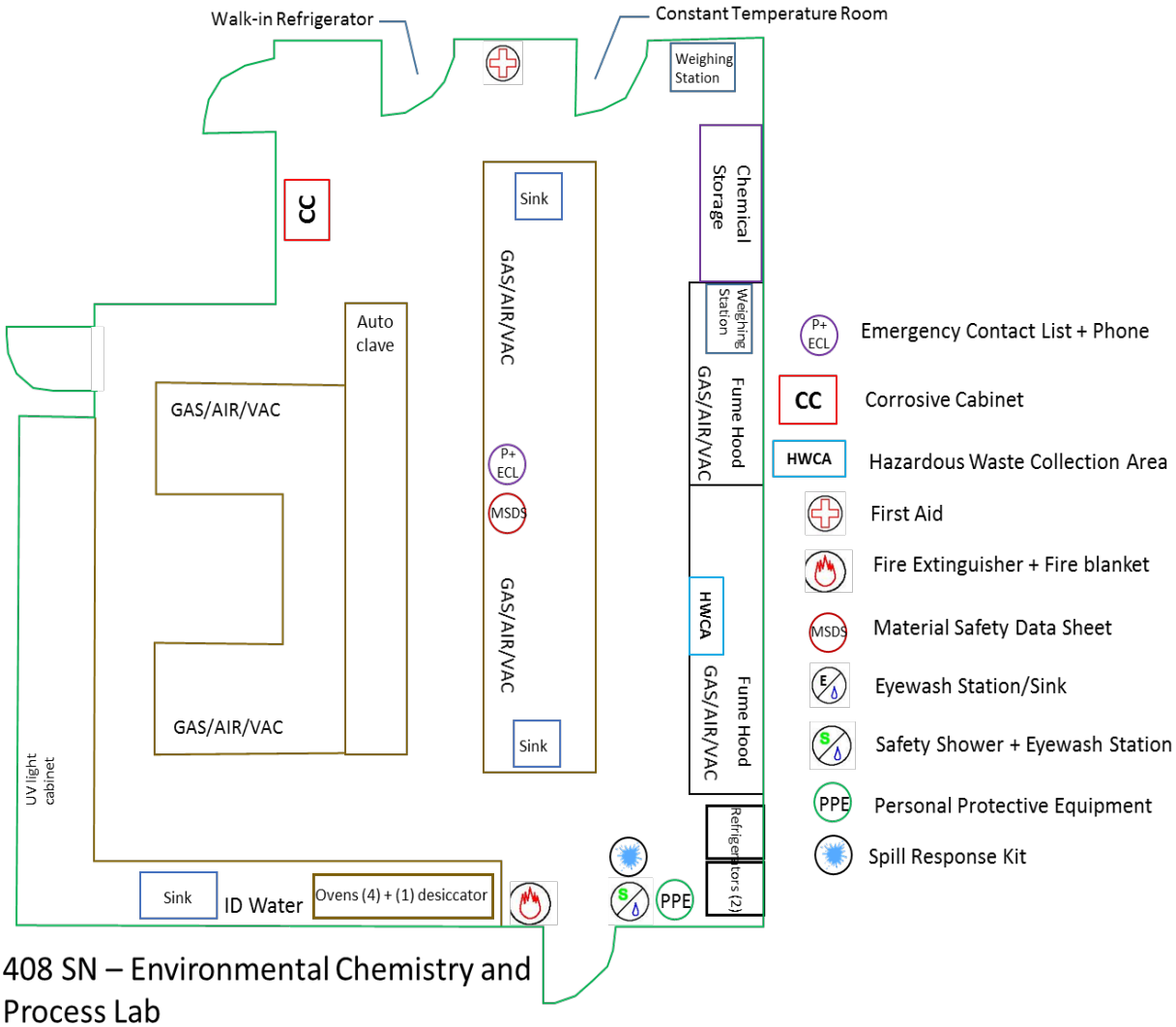


402 SN – Environmental Biotechnology/Genomics Laboratory

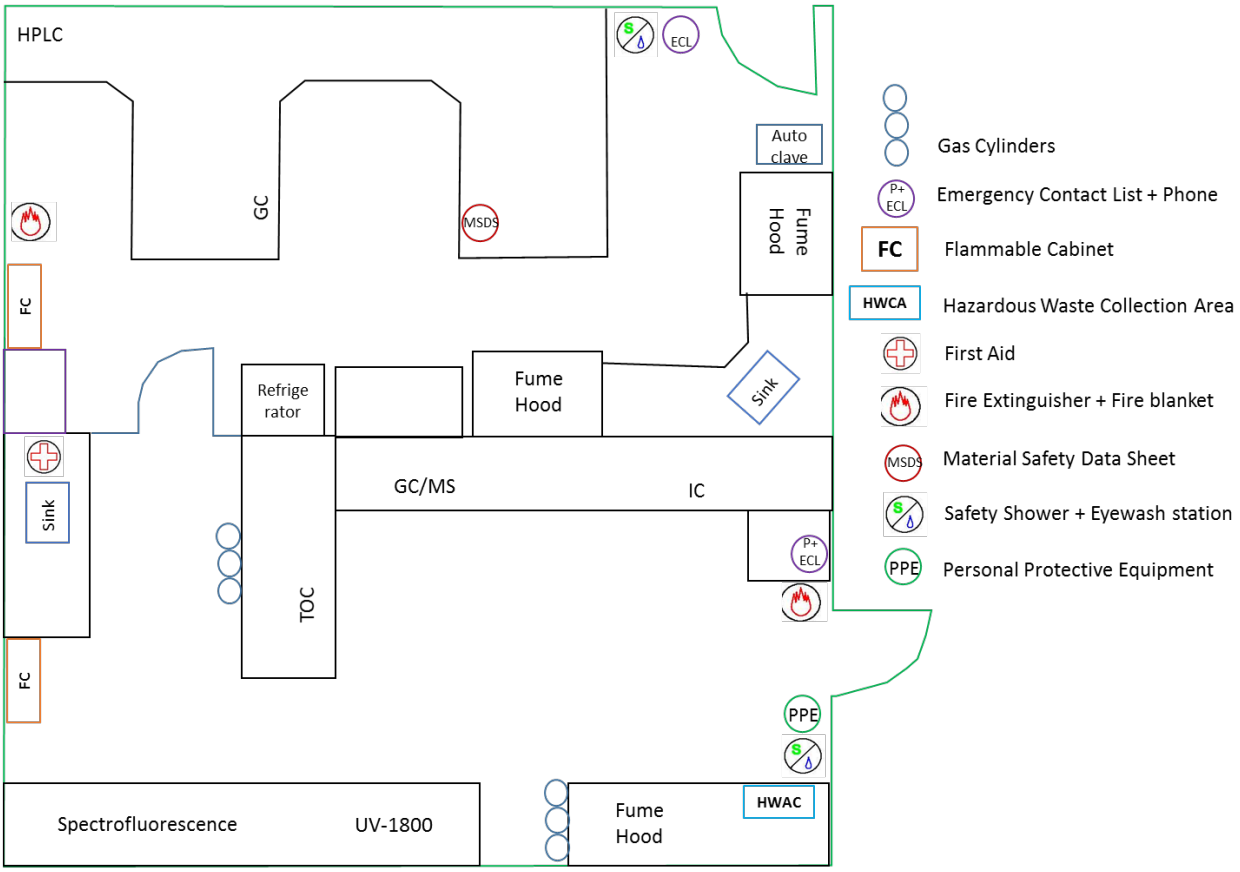


402 SN – Environmental Biotechnology/Genomics Lab

408 SN – Environmental Chemistry and Process Laboratory

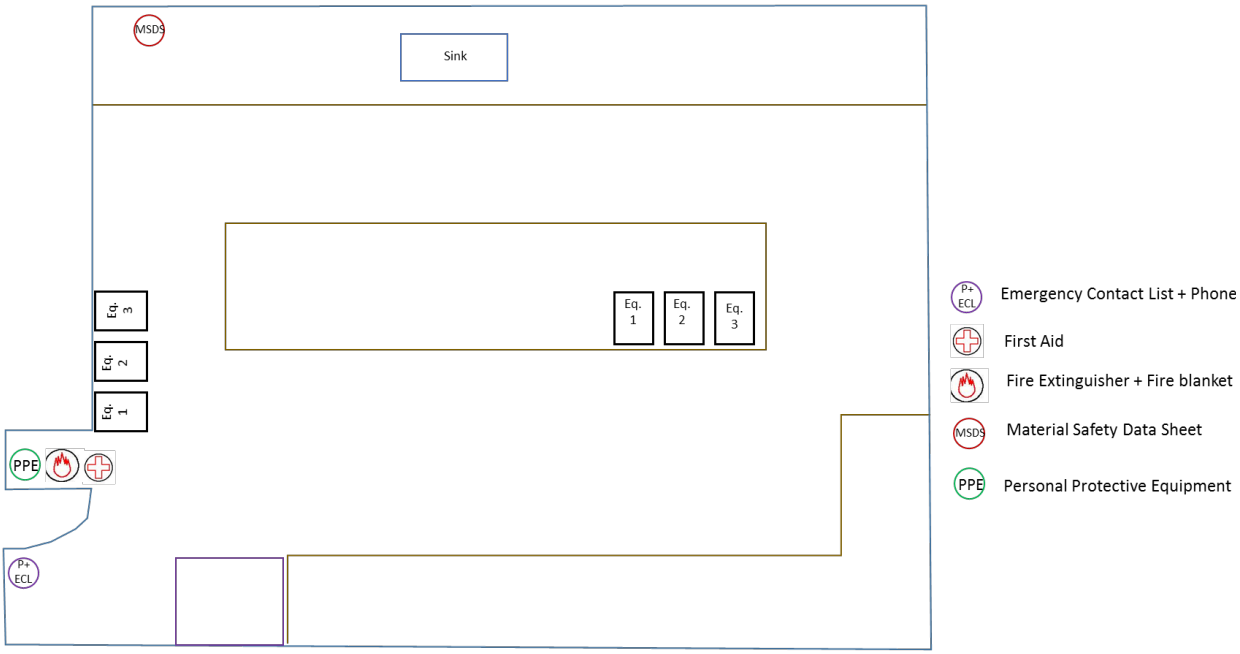


466/468 SN – Environmental Analysis Laboratory



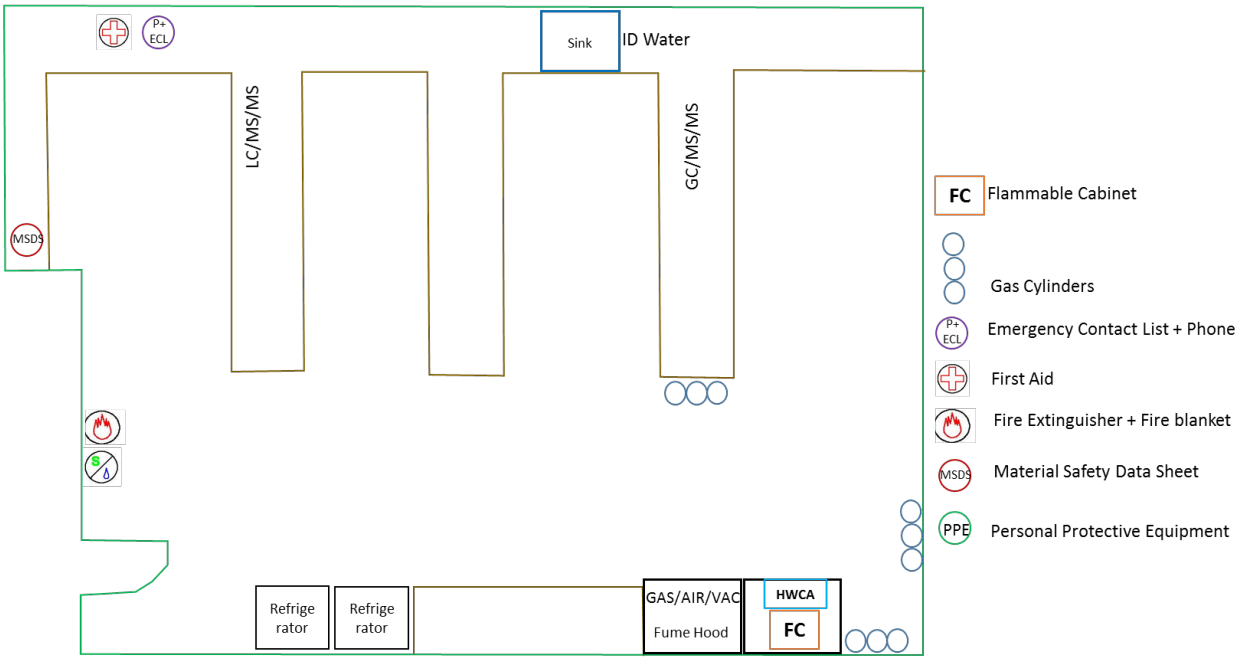
468/466 SN – Environmental Analysis Lab

458 SN – Geoenvironmental Laboratory



458 SN – Geoenvironmental Lab

231 EC – Environmental Organic Chemistry Laboratory



231 EC – Environmental Organic Chemistry Lab

APPENDIX 6: LABORATORY CLOSEOUT CHECKLIST

LABORATORY CLOSEOUT CHECKLIST

Northeastern University ❖ Department of Civil & Environmental Engineering

LABORATORY INFORMATION

Laboratory to be closed out: Building _____ Room(s) _____

Date laboratory will be vacated: _____

Principal Investigator (please print): _____

CHECKLIST

	✓	N/A	Initials
Chemicals			
Identify all chemicals for disposal	❑	❑	_____
Label all containers with full chemical name(s)	❑	❑	_____
Clean all laboratory surfaces including hoods	❑	❑	_____
Confirm that all hazardous waste and surplus chemicals have been removed	❑	❑	_____
If chemicals are in CEE inventory system, update records to include disposal information	❑	❑	_____
Gas Cylinders			
Return empty cylinders to storage area and notify Lab Manager	❑	❑	_____
Identify contents of cylinder(s) or previous contents, if empty	❑	❑	_____
Microorganisms and Cultures			
Place waste in biohazard bag	❑	❑	_____
Autoclave waste then overbag	❑	❑	_____
Clean all equipment used with above waste	❑	❑	_____
Equipment and Lab Furniture			
Clean or decontaminate any equipment or furniture to be left in lab	❑	❑	_____
Shared Storage Areas			
Check all shared areas for hazardous materials	❑	❑	_____

DEPARTMENT CLEARANCE

Principal Investigator's Agreement

I certify that my staff and I have adequately cleaned out and decontaminated the laboratories under my supervision.

_____ _____

Principal Investigator's Signature **Date**

Department Head/Designee

I am aware of the status of the lab(s) being vacated.

_____ _____

Department Head's/Designate's Signature **Date**

Northeastern University

Department of Civil and Environmental Engineering
Laboratory Closeout Checklist

- ☐ All items on **bench space** have been washed and cleaned
- ☐ **Bench space** has been wiped down and cleaned
- ☐ **Glassware and equipment** is cleaned and put away
- ☐ Samples in **fridge and freezer** are disposed of or labeled properly and handed to another lab group member for ownership
- ☐ Samples in both **environmental chambers** are disposed of or labeled properly and handed to another lab group member for ownership
- ☐ **Hazardous waste/bio-waste** is properly disposed of
- ☐ **Algae/shaker table experimentation** is complete and/or transferred to other personnel
- ☐ **Protocols/Procedures** have been transferred to other personnel
- ☐ **Chemicals** are put back and properly labeled
    - ☐ Chemicals that are disposed of are checked out of the inventory
- ☐ **Lab coat** and PPE are disposed of or wiped down and transferred
- ☐ **Empty cylinders** are ready for pick up and new cylinders have been transferred to other personnel

Print Name	Signature
Email	Transferred Personnel
PI Signature	Date
DSO Signature	Date