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1.0 EMERGENCY CONTACTS

IN THE EVENT OF AN EMERGENCY CALL NORTHEASTERN UNIVERSITY’S PUBLIC SAFETY DIVISION AT 617.373.3333

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. Table 1 below provides additional contacts at the university and department level.

TABLE 1: UNIVERSITY AND DEPARTMENTAL CONTACTS

<table>
<thead>
<tr>
<th>NAME</th>
<th>TITLE</th>
<th>EMAIL/PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jack Price</td>
<td>Director, EH&amp;S</td>
<td><a href="mailto:j.price@northeastern.edu">j.price@northeastern.edu</a> 617.373.2769</td>
</tr>
<tr>
<td>Steve Brehio</td>
<td>Assoc. Director, EH&amp;S</td>
<td><a href="mailto:s.brehio@northeastern.edu">s.brehio@northeastern.edu</a> 617.373.2769</td>
</tr>
<tr>
<td>Christopher S. Bingel</td>
<td>Radiation Safety Officer, EH&amp;S</td>
<td><a href="mailto:c.bingel@northeastern.edu">c.bingel@northeastern.edu</a> 617.373.2769</td>
</tr>
<tr>
<td>Elham Ghabbour</td>
<td>Laboratory Safety Program Manager, EH&amp;S</td>
<td><a href="mailto:e.ghabbour@northeastern.edu">e.ghabbour@northeastern.edu</a> 617.373.2769</td>
</tr>
<tr>
<td>Elisabeth Clark</td>
<td>Biosafety Program Manager, EH&amp;S</td>
<td><a href="mailto:e.clark@northeastern.edu">e.clark@northeastern.edu</a> 617.373.2769</td>
</tr>
<tr>
<td>Name</td>
<td>Position</td>
<td>Email</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------------------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>Qianheng Wang</td>
<td>Hazardous Material Program Manager, EH&amp;S</td>
<td><a href="mailto:qi.wang@northeastern.edu">qi.wang@northeastern.edu</a></td>
</tr>
<tr>
<td>Audrey Peace</td>
<td>Administrative Specialist, EH&amp;S</td>
<td><a href="mailto:a.peace@northeastern.edu">a.peace@northeastern.edu</a></td>
</tr>
<tr>
<td>Yasmin Chishti</td>
<td>Departmental Safety Officer, BioE</td>
<td><a href="mailto:y.chishti@northeastern.edu">y.chishti@northeastern.edu</a></td>
</tr>
<tr>
<td>Lee Makowski</td>
<td>Department Chair, BioE</td>
<td><a href="mailto:l.makowski@northeastern.edu">l.makowski@northeastern.edu</a></td>
</tr>
<tr>
<td>Susan Wilcox</td>
<td>Business Manager, BioE</td>
<td><a href="mailto:s.wilcox@northeastern.edu">s.wilcox@northeastern.edu</a></td>
</tr>
</tbody>
</table>
# Lab Safety Officer (LSO)

<table>
<thead>
<tr>
<th>Professor (PI)</th>
<th>Lab Location</th>
<th>LSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anand Asthagiri</td>
<td>EGAN 255</td>
<td>Robert Natividad</td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="mailto:natividad.r@husky.neu.edu">natividad.r@husky.neu.edu</a></td>
</tr>
<tr>
<td>Jeffrey Ruberti</td>
<td>EGAN 232</td>
<td>Monica Susilo</td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="mailto:monica.susilo@gmail.com">monica.susilo@gmail.com</a></td>
</tr>
<tr>
<td>Nikolai Slavov</td>
<td>MUGAR 111</td>
<td>TBA</td>
</tr>
<tr>
<td>Qianqian Fang</td>
<td>MUGAR 310</td>
<td>TBA</td>
</tr>
<tr>
<td>Lee Makowski</td>
<td>EGAN 257</td>
<td>Yasmin Chishti</td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="mailto:y.chishti@northeastern.edu">y.chishti@northeastern.edu</a></td>
</tr>
</tbody>
</table>
2.0 OVERVIEW

The Laboratory Safety Plan (LSP) presented herein is intended to present authorized personnel (laboratory user) within the Department of Bioengineering (BioE) at Northeastern University information that will facilitate the safe use of BioE laboratory facilities. Procedures conducted within laboratories vary. Thus, no general statements on the risk associated with working in BioE laboratories are appropriate. Review of the procedures presented in this manual serve as a baseline for all BioE laboratory users.

Many parties work collaboratively to ensure the safe operation of BioE laboratories, including: Department Chair, Principal Investigators (PIs), Faculty Advisors, 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 BioE Laboratory Access, Authorization Form located in Appendix 1 before engaging in any laboratory activities
- Develop 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
- Ensure that your research area is cleaned and all Chemicals and laboratory equipment are properly returned at the end of your research activity
3.0 LABORATORY TRAINING AND ACCESS

Every laboratory user is required to receive the appropriate training before they access any laboratory in BioE. Furthermore, prior to assignments involving new lab experiences that may result in new exposure situations; the laboratory user must obtain the appropriate training as determined by the PI and/or the DSO. Each laboratory user is required to submit verification of his/her training to the DSO Yasmin Chishti (y.chishti@northeastern.edu), who will maintain documentation of such training.

Each laboratory user, in consultation with his/her faculty advisor, must complete the training specific to their use. Laboratory training is conducted through the Office of Environmental Health & Safety (EHS).

3.1 LABORATORY TRAINING – EH&S

- 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 training (exceptions may be made for visiting laboratory users).

The user must start by logging into their MyNEU account. Next, click on the Services and Links tab. On the webpage there is a section titled “Environmental Health and Safety Services” that is located midway down on the right hand side. Within this section, the user can click on the “Take Online Training, Register for Classroom Training and View Your Training History”. At this point the user can access all EHS training options. All new incoming lab users need to complete the appropriate training. Then, annually, every returning laboratory user must take the appropriate REFRESHER training.

### Environmental Health & Safety Required Safety Training

<table>
<thead>
<tr>
<th>Safety Course</th>
<th>Required For</th>
<th>Initial</th>
<th>Refresher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Orientation</td>
<td>All laboratory workers</td>
<td>Online</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Chemical Hygiene I</td>
<td>All laboratory workers</td>
<td>Online</td>
<td>Every 2 years - online</td>
</tr>
<tr>
<td>Chemical Hygiene II</td>
<td>All laboratory workers</td>
<td>Online</td>
<td>Every 2 years - online</td>
</tr>
<tr>
<td>Hazardous Waste</td>
<td>All lab workers who manage or generate hazardous waste</td>
<td>Classroom</td>
<td>Annually - online</td>
</tr>
<tr>
<td>Biosafety Classroom Training</td>
<td>Lab workers that work with biological materials such as infectious agents,</td>
<td>Classroom</td>
<td>Annual - online</td>
</tr>
<tr>
<td></td>
<td>human and non-human primate materials, recombinant and synthetic nucleic</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>acids, transgenic animals, infectious agents or other biohazardous materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bloodborne Pathogens and Exposure</td>
<td>Personnel that work in clinical environments with the potential for exposure</td>
<td>Classroom: scheduled as</td>
<td>Annually - online</td>
</tr>
<tr>
<td>Control Classroom Training</td>
<td>to bloodborne pathogens</td>
<td>needed</td>
<td></td>
</tr>
<tr>
<td>Autoclave</td>
<td>All lab workers who work pathogenic or potentially pathogenic materials</td>
<td>Online and hands on with</td>
<td>Not applicable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>autoclave manager</td>
<td></td>
</tr>
<tr>
<td>Regulated Medical Waste Shipping</td>
<td>Anyone who packages, labels or ships regulated medical waste; or signs the</td>
<td>Online</td>
<td>Every 3 years or when the</td>
</tr>
<tr>
<td></td>
<td>shipping manifest for regulated medical waste shipments</td>
<td></td>
<td>regulations change - online</td>
</tr>
<tr>
<td>Radiation Safety</td>
<td>Anyone working with radionuclides</td>
<td>Online</td>
<td>Every 2 years - online</td>
</tr>
<tr>
<td>Radiation Safety Awareness</td>
<td>Anyone who is working in or has access to a radioactive laboratory, but not</td>
<td>Online</td>
<td>Every 2 years - online</td>
</tr>
<tr>
<td></td>
<td>using radionuclides</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laser Safety</td>
<td>Anyone working with lasers</td>
<td>Classroom</td>
<td>scheduled as needed</td>
</tr>
<tr>
<td>X-ray Safety</td>
<td>Anyone working with X-ray machine</td>
<td>Classroom: scheduled as</td>
<td>scheduled as needed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>needed</td>
<td></td>
</tr>
</tbody>
</table>
The online training courses listed on BioE’s TRAINING PROFILE are:

<table>
<thead>
<tr>
<th>Name of Course to Be Completed</th>
<th>Course #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Orientation</td>
<td>Course # 1500-1</td>
</tr>
<tr>
<td>Chemical Hygiene Part I</td>
<td>Course # 2500</td>
</tr>
<tr>
<td>Chemical Hygiene Part II</td>
<td>Course # 2510</td>
</tr>
<tr>
<td>Autoclave training (must complete an online component and hands-on component with the autoclave manager)</td>
<td>Course # 3520</td>
</tr>
</tbody>
</table>

Please complete the following classroom trainings. You will also have to register online:

<table>
<thead>
<tr>
<th>Name of Course to Be Completed</th>
<th>Course #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biosafety classroom training</td>
<td>Course # 3000</td>
</tr>
<tr>
<td>Hazardous waste classroom training</td>
<td>Course # 4000</td>
</tr>
</tbody>
</table>

Reminder: You may need additional safety training if you are working with Laser and Radiation.

Radiation Safety
- Radiation Awareness Training (for those not working with radioactive materials while working in radiation use lab)
- Radiation Safety Training & Exam for Initial Workers (for people that will be working with radioactive materials)
- Refresher Radiation Training for SEALED sources (e.g. Co-57, Ru-106, PT-197)
- Refresher Radiation Training for UNSEALED sources (e.g. H-3, C-14, P-32, S-35, IN-111)

Laser Safety

Other Training
- Hazardous Material Transportation: DOT/IATA General Awareness Training
- Autoclave Training – must complete an online component and hands-on component with the autoclave manager
- Semiconductor and Nanomaterials Lab Safety and Hazardous Waste
Refresher

- Regulated Medical Waste Online Training

All of these are available as online training sessions. The certificate of completion should be emailed to the DSO.

It is very important to recognize that laboratory users may be required to take additional training that does not appear in EHS’s TRAINING PROFILE for BioE. This will be determined by the type of work that the lab user will conduct.

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3.2 LABORATORY ACCESS

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Once the laboratory user has read the LSP, fulfilled his/her training responsibilities and submits the signed BioE Lab/Office Access Form (Appendix 1) access is granted and his/her laboratory work may begin. After the safety training is completed, each laboratory user is required to submit verification of his/her training to the DSO Yasmin Chishti (y.chishti@northeastern.edu), who will maintain documentation of such training.

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3.3 VISITING/VOLUNTEER/ UNDERGRADUATE LABORATORY ACCESS

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

https://www.northeastern.edu/policies/pdfs/Policy_on_Lab_Supervision.pdf

All lab workers must have a status with the university. Full time staff, students, or sponsored account.

NO PERSONNEL WITH ACCESS TO BioE LABORATORIES SHOULD WORK ALONE. IF A SITUATION ARISES WHERE THE LABORATORY USER WILL BE ALONE, IT IS THE POLICY OF BioE THAT THE LABORATORY USER NOTIFIES THE PRINCIPAL INVESTIGATOR, FACULTY ADVISOR, AND/OR A COLLEAGUE OF THEIR WORK AND SCHEDULE.

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4.0 CHEMICAL PROCUREMENT & HANDLING PROCEDURES

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4.1 GENERAL INFORMATION

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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 (Figure 1).
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 described 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
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.

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, 617.373.3333), room number, responsible investigator with his/her office location and phone number, and an alternative contact with his/her office location and phone number.
4.2 THE GOAL OF MINIMIZATION

It is the goal of BioE 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. This means that there is no need to order large quantities of material when a small quantity is all that is needed, even if the price is better for the larger container.

4.3 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 Safety Data Sheets (SDS) that are provided by the vendor.

4.4 SAFETY DATA SHEET SDS AND GLOBALLY HARMONIZED SYSTEM

Globally Harmonized System (GHS)

OSHA revised its Hazard Communication Standard (HCS) to align with the United Nations’ Globally Harmonized System of Classification and Labeling of Chemicals (GHS) and published it in the Federal Register in March 2012 (77 FR 17574). Two significant changes contained in the revised standard require the use of new labeling elements and a standardized format for Safety Data Sheets (SDSs), formerly known as, Material Safety Data Sheets (MSDSs). The new label elements and SDS requirements will improve worker understanding of the hazards associated with the chemicals in their workplace. To help companies comply with the revised standard, OSHA is phasing in the specific requirements over several years (December 1, 2013 to June 1, 2016).

The Globally Harmonized System (GHS) online training

Hazard Communication Standard Pictogram

As of June 1, 2015, the Hazard Communication Standard (HCS) will require pictograms on labels to alert users of the chemical hazards to which they may be exposed. Each pictogram consists of a symbol on a white background framed within a red border and represents a distinct hazard(s). The pictogram on the label is determined by the chemical hazard classification.

HCS Pictogram and Hazards (PDF)

OSHA – Globally Harmonized System of Classification and Labeling of Chemicals
<table>
<thead>
<tr>
<th>Safety Data Sheets</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemicals</td>
<td></td>
</tr>
<tr>
<td>SIRI SDS</td>
<td>EHS recommended site</td>
</tr>
<tr>
<td>SIRI SDS</td>
<td>Mirror link</td>
</tr>
<tr>
<td>Avantor SDS</td>
<td>Formerly known as Mallinckrodt Baker</td>
</tr>
<tr>
<td>Sigma-Aldrich SDS</td>
<td></td>
</tr>
<tr>
<td>National Library of Medicine - WebWISER</td>
<td></td>
</tr>
<tr>
<td>International Chemical Safety Cards</td>
<td>Languages available: Chinese, Dutch, English, Estonian, Finnish, French, German, Hungarian, Italian, Japanese, Korean, Russian, Spanish, Swahili, Urdu</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Compressed Gases</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Matheson SDS</td>
<td></td>
</tr>
<tr>
<td>Praxair SDS</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drugs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug Information Resources - MEDLINEplus</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Infectious Agents</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pathogen SDS and Risk Assessment</td>
<td></td>
</tr>
</tbody>
</table>
4.5 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 5).

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 chemical 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.

4.6 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
° F (37.8 °C) and a vapor pressure that does not exceed 40 pounds per square inch (psi) at 100 °F. A combustible liquid has a flash point at or above 100 °F (37.8 °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.

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4.7 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.

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

- **Never** store chemicals in alphabetical order. 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 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.

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)
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 on Cole-Parmer’s website at http://partners.coleparmer.com/techinfo/chemcomp.asp

Separate hazardous chemicals in storage as show in Table 2 below:

**TABLE 2: SEPARATING HAZARDOUS CHEMICALS IN STORAGE**

<table>
<thead>
<tr>
<th>SOLIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxidizers</td>
</tr>
<tr>
<td>Flammable Solids</td>
</tr>
<tr>
<td>Water Reactives</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LIQUIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acids</td>
</tr>
<tr>
<td>Flammables</td>
</tr>
<tr>
<td>Caustics</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GASES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxic</td>
</tr>
<tr>
<td>Oxidizers</td>
</tr>
<tr>
<td>Flammable</td>
</tr>
</tbody>
</table>

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. BioE has flammable storage cabinets in many labs.

Other rules for chemical storage:

- Do not store chemicals on bench tops or in hoods.
• 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.

4.8 CHEMICAL SPILL PLAN

Every BioE 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, 617.373.2769 (8:30 a.m. to 4:30 p.m.)

Public Safety, 617.373.3333 (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 (adsorbent, 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.

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. 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;
- 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 617.373.3333;
- Close doors to affected area;
- Have a person with knowledge of the incident and laboratory available to answer questions from responding emergency personnel.

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### 4.9 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 BioE laboratory user should become familiar with the Hazardous Waste Management section on the EHS website, accessible at: [http://www.northeastern.edu/ehs/ehs-programs/hazardous-waste-management/](http://www.northeastern.edu/ehs/ehs-programs/hazardous-waste-management/)

Remember:

- Hazardous waste must be disposed of in a timely manner.
- Hazardous waste containers must be closed at all times during storage, 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 for hazardous waste disposal.
As professionals in the field, and stewards of the environment, it is imperative that proper hazardous waste disposal practices be followed.

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**4.10 HAZARDOUS WASTE COLLECTION**

EHS requires laboratories 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. Secondary containment is must without condition. 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.”

Once hazardous waste container is full, date it and the laboratory user is required to request pick-up online through EHS’s website. 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.
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 chemical or chemical mixtures. The label should be dated when the container is full and/or ready for pick-up. Hazardous waste disposal labels are available with DSO in Egan 257 or EHS (submit request online).

DO NOT ABBREVIATE ON HAZARDOUS WASTE LABELS.
5.0 PERSONAL PROTECTIVE EQUIPMENT

5.1 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 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 splash 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 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.

BioE has safety glasses, goggles, and face shields available in most labs. BioE will purchase any personal protective equipment requested for any BioE laboratory user; any such request should be made to the Department Safety Officer.

5.2 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 BIOENGINEERING, 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 Laboratory Director.

5.3 CLOTHING AND GLOVES

Lab personnel must dress with potential laboratory hazards in mind. Clothing should protect as much of the body as possible.

Shoes that cover the entire foot must be worn whenever in the laboratory. Sandals, flip-flops, or other abbreviated footwear are prohibited in BioE laboratories.

Laboratory aprons or lab coats can be worn to provide protection from accidents and spills. BioE will provide laboratory users with lab coats upon request. Any request should be made with the Principal Investigator. **No used lab coats should be taken home; contact Yasmin Chishti, DSO (y.chishti@northeastern.edu), in order for them to be cleaned or 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, etc.) Gloves should be washed prior to removal whenever possible to prevent skin contamination.
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 Safety Data Sheet for the particular chemical should be used in choosing the appropriate gloves.

5.4 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.

5.5 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.

BioE has eye wash stations at each sink or safety shower. To prevent blocking access and use, make sure that no items are stored near eye wash stations or safety showers. Eye wash stations should always remain covered by dust covers.

5.6 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 911 for fire. For all other emergencies, notify NUPD at 617.373.3333
- Activate the building alarm (fire pull station). 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.
There are fire extinguishers located in every BioE lab. All fire extinguishers are maintained and inspected by the university’s Public Safety Division. If a fire extinguisher is used, or discharges accidentally, notify the Laboratory Director immediately.

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 alarm is activated in any research building evacuate the building immediately. Make sure colleagues in your immediate area are aware of the emergency and evacuate as well.

5.7 FIRST AID KITS

Many BioE laboratories have a first aid kit. Laboratory personnel should be aware of these locations. It is the responsibility of BioE laboratory personnel to inform the Principal Investigator of any accidents requiring first aid, and the need to resupply any first aid kit.

6.0 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 inches, or one pane open).

Every BioE 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 Laboratory Director immediately.

GENERAL GUIDELINES FOR FUME HOODS

• With particularly hazardous chemical 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 as instructed on the hood sticker has been placed. This is necessary to protect the user’s face and prevent chemical exposures.
• 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.

7.0 COMPRESSED GASES

7.1 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.

7.2 HANDLING PROCEDURES

The following procedures should be followed whenever compressed gas is required in a laboratory.

• 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.
• Transport gas cylinders in carts one or two at a time only while they are secured and capped. 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 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.

• 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.
7.3 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.

8.0 BIOSAFETY PLAN AND PROCEDURES

Link for Biosafety manual: http://www.northeastern.edu/ehs/ehs-programs/biosafety/plans-and-manuals/

Biohazard waste disposal: http://www.northeastern.edu/ehs/ehs-programs/biosafety/biohazardous-waste/

**Spill, Decontamination and Emergency Procedures for Work with Recombinant or Synthetic Nucleic Acids, Human Material, Infectious Agents and/or Toxins**

**SPILL PROCEDURES**

**Inside the biosafety cabinet:**
1. Wear a lab coat, goggles and gloves during cleanup.
2. Allow the cabinet to run during cleanup.
3. Apply appropriate disinfectant to spill areas and allow a minimum of 20 minutes contact time.
4. Wipe up the spillage with a disposable disinfectant-soaked cloth.
5. Wipe the walls, work surface and any equipment in the cabinet with a disinfectant-soaked cloth.
6. Discard contaminated disposable materials in appropriate biohazardous waste container(s) and autoclave before discarding as infectious waste.
7. Place contaminated reusable items in biohazard bags or autoclavable pans with lids before autoclaving and cleanup. Expose non-autoclavable materials to disinfectant, 20 minute contact time, before removal from the BSC.
8. Remove protective clothing used during cleanup and place in a biohazard bag for autoclaving.
9. Wash your hands.
10. Run cabinet 10 minutes after cleanup before resuming work or turning off the cabinet.

**Inside the lab, outside biosafety cabinet:**
Clear area of all personnel. Wait for aerosol to settle before entering spill area. Remove any contaminated clothing and place in biohazard bag to be autoclaved. Wear a disposable gown or lab coat, goggles and gloves during cleanup. Initiate cleanup with appropriate disinfectant as follows:

1. Soak paper towels in disinfectant and place over spill.
2. Encircle the spill with additional disinfectant being careful to minimize aerosolization while
assuring adequate contact.
3. Decontaminate all items within the spill area.
4. Allow 20 minutes contact time to ensure germicidal action of disinfectant.
5. Wipe equipment with 1:10 bleach followed by water than 70% alcohol.
6. Place disposable contaminated spill materials in appropriate biohazardous waste container(s) for autoclaving.
7. Place contaminated reusable items in biohazard bags, autoclavable pans with lids before autoclaving and cleanup.
8. Remove protective clothing used during cleanup and place in a biohazard bag for autoclaving.
9. Wash your hands.

**Inside Centrifuge**
1. Clear area of all personnel.
2. Wait 30 minutes for aerosol to settle before entering the area and attempting to clean up spill.
3. Wear a lab coat, goggles and gloves during clean up.
4. Remove rotors and buckets to nearest biological safety cabinet for cleanup.
5. Thoroughly disinfect inside of centrifuge with a fresh 10% bleach solution and paper towels.
6. Remove contaminated debris after disinfection (including paper towels), place in appropriate biohazardous waste container(s) and autoclave before disposal as infectious waste.
7. Remove protective clothing used during cleanup and place in a biohazard bag for autoclaving.
8. Wash your hands.

**Outside lab, during transport**
Transport biohazardous material in an unbreakable well-sealed primary container placed inside of a second unbreakable lidded container labeled with a biohazard symbol (cooler, plastic pan or pail). Should a spill occur in a public area, do not attempt to clean it up without appropriate personal protective equipment. As an interim measure, wear gloves and place paper towels, preferably soaked in disinfectant, directly on spilled materials to prevent spread of contamination. To assure adequate contact, surround the spill with disinfectant, if available, taking care to minimize aerosols. Call Environmental Health and Safety at 617-373-2769 to assist in cleanup.

**Major Biological Spill**
In the event of a major biological spill (one that cannot be safely cleaned using the procedures above), clear lab of all personnel and quarantine area of spill. Ensure all windows and openings are closed before leaving the lab. Label all doors as ‘DO NOT ENTER’ to prevent personnel from entering space or releasing biohazardous material. Contact Environmental Health & Safety at 617-373-2769 or campus police at 617-373-3333 for assistance.

**DECONTAMINATION PROCEDURES**
Each lab that works with biohazardous materials will have a specific procedure to follow. Be sure to follow the correct procedure to your biohazard materials.

In many of the cases, all work areas and equipment will be decontaminated with a liquid chemical disinfectant (e.g. 10% bleach and/or 70% ethanol). The disinfectant will be applied liberally, and the contact time must be **ten minutes**. If bleach is used, the solution will be made fresh on a **daily** basis using 1 part bleach in 9 parts water. The solution will be labeled as to contents and date of
preparation. Equipment to be decontaminated includes, but is not limited to, bench tops, biosafety cabinets, all benchtop equipment and incubators.

**EMERGENCY PROCEDURES**

Exposures to biohazardous materials including those containing recombinant or synthetic nucleic acids

Wash area immediately
- **Wounds, skin and needle stick exposure:** Thoroughly scrub the area for 15 minutes with warm water and soap.
- **Eye and mucous membrane exposure:** Flush immediately at nearest eyewash station for 15 minutes.

Seek care immediately
- **While you are treating your exposure area,** have a co-worker contact campus police at 617-373-3333 for help. Campus police will triage you and get you to a medical care facility for further treatment if necessary.
- **Be prepared with information for the healthcare providers.** Bring information about the agent and/or animal or material involved in your injury or exposure. This information should include agent description, route of exposure, dose and concentration, and any unusual characteristics of the agent.

Notifications
- **Notify your supervisor, PI, and EH&S (Environmental Health and Safety) about the incident.**
- **Submit an injury report form:** [http://www.northeastern.edu/risk_services/insurance_claims/claims_injured/](http://www.northeastern.edu/risk_services/insurance_claims/claims_injured/)

**CONTACT INFORMATION**

Environmental Health and Safety
617-373-2769 170 Cullinane Hall

NU Police Department
617-373-2121 (non-emergency) 617-373-3333 (emergency) 716 Columbus Place

Risk Services
617-373-6963 316 Columbus Place

Updated: 11/3/2015
APPENDIX 1 – ACCESS REQUEST FORM

Northeastern University
College of Engineering

Today’s Date: _________________________  Department of Bioengineering

[ ] Faculty  [ ] Staff  [ ] Graduate  [ ] Undergraduate  [ ] Other______________________________

Applicant’s Name: __________________________________________

NU ID number: __________________________

NU Email address: ____________________________________________

Office Address and phone number: __________________________________________

Home Address: ____________________________________________________

Phone Numbers: Home: __________________________

Cell: ______________________________________________

Type of Support: RA _____ TA _____ Other (specify) __________________________________________

Program: MS ___ PhD ___ Full time ____  Part time __________

Anticipated Graduation Date________________

Supervisor’s Name______________________________________

Type of access requested and location:

<table>
<thead>
<tr>
<th>Lab Access (Y/N)</th>
<th>Office Key (Y/N)</th>
<th>Building</th>
<th>Room</th>
<th>PI / Advisor Signature</th>
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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 Business Manager, Susan Wilcox, at 212A Lake Hall.

I have read and agreed to the statements above.

Applicant’s Signature: ____________________________ Date: __________

Faculty Advisor Signature: ____________________________ Date: __________

1. For laboratory access, applicant **must** read and comply with the BioE Laboratory Safety Plan then document satisfactory completion of the EH&S safety training.
2. Go to myNEU, Services and Links tab, Environmental Health and Safety Services. Select “Online Training” and register for classroom safety training(s).
3. Select the Online Training that is applicable to your laboratory and the duties you will perform within this laboratory (typically Chemical Hygiene 1 and 2, Hazardous Waste Management, etc.). Please consult with your advisor or BioE Lab Manager/DSO if you have questions.
4. **Please note that some safety trainings have periodic refresher courses.**

   Date Training Completed______________________

   Applicant Signature__________________________

   For lab access:

   Department Safety Officer’s Signature: ____________________________

   Date: __________

   **Please return the completed form to the Department Safety Officer, Yasmin Chishti, at 257 Egan. Send the completed safety training certificates by email to y.chishti@northeastern.edu.**

   For office access:

   Key Manager’s (Susan Wilcox, 212A Lake Hall) Signature/Date:

   ____________________________________________________________

   Date Key/Code Issued__________________________

   Date Key Returned__________________________

**PLEASE PRINT THIS PAGE, SIGN WHERE APPROPRIATE, AND RETURN VIA CAMPUS MAIL TO YASMIN CHISHTI, EGAN 257**

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. 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: ______________

If you are under age 18, please have your parent or guardian complete the following:

I state that I am the Participant's ____parent/ ____guardian, and am fully competent to sign this agreement; and that I execute this release for full, adequate, and complete consideration fully intending for myself, for the participant, and for the participant's family, estate, heirs, administrators, personal representatives, or assigns to be bound by same.

Parent/Guardian Name (please print): ____________________________

Relationship: ______________

Parent/Guardian Signature: ____________________________ Date: __________
This checklist must be completed prior to graduation and/or receiving your degree. Once you have completed the form, your Faculty advisor must inspect your laboratory work space and sign-off on the form.

**Background Information:**
Student Name: ___________________________ NUID: ______________
Department: ______________________________________________________
Laboratory: __________________________________________________________________

**Items to be completed:**

<table>
<thead>
<tr>
<th>Items to be completed</th>
<th>Completed (initial)</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>All biohazardous waste has been disposed of in the proper manner. This includes aspiration flask contents, bagged waste, sharps, serological pipettes, micropipette tips, and cultures.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any chemical substances, including buffers, kits and media that will no longer be used by your lab group has been labeled with the hazardous waste label. You have submitted a request for waste pickup.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any chemicals, solutions, or containers of materials that will be remain in the lab for use by your lab group are appropriately labeled with the name of the material(s) in the container and the hazards of the material. Do not abbreviate the name or use a chemical formula.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All material that will no longer be used by your lab group, including waste and trash, has been removed from cold rooms, walk-in freezers, warm rooms, equipment rooms, or other shared spaces/rooms.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All cabinets, shelving, fume hood or other storage areas have been checked and materials that your lab group will no longer use has been removed and appropriately handled.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All sharps containers have been closed and disposed of appropriately. If these materials are biologically contaminated, please call the EH&amp;S Manager for disposal arrangements (x2769). If the sharps are chemically contaminated, complete a hazardous waste label and contact Steve Brehio (x2769) for removal. If the sharps are contaminated with radioactive materials, contact the RSO.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For compressed gas cylinders, the regulators have been removed and caps screwed in place. Airgas has been contacted for the removal of all compressed gas cylinders and liquid nitrogen tanks that are no longer needed by your lab group.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency contact information (names and phone numbers) on doors and equipment have been updated.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have appropriately disposed or stored all materials in my workspace. Responsibility for any materials that remain in the lab has been assigned to another researcher or my Faculty Advisor is aware of the materials and is taking responsibility.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All surfaces, including the inside and outside of the fume hood, benchtops, sinks,</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
and cabinets, have been decontaminated and cleaned. All bench paper from your work space has been removed. Each sink used has been flushed with cold water for 5 minutes.

Radioactive materials that are no longer needed by the research group have been disposed of in the proper manner. Contact the RSO with questions.

All working surfaces, including equipment and tools, have been checked for radioactivity. A record of the contamination survey has been submitted to the Radiation Safety Officer (RSO).

All radioactive waste has been properly prepared for disposal. The RSO has been contacted for a waste pickup.

Graduate Student/Post-Doc Signature ______________________________ Date ______________

I verify that the laboratory clearance steps items noted above have been completed by the student named above.

Faculty Advisor Name ______________________________ Date ______________

Faculty Advisor Signature ______________________________

DSO Signature ______________________________

Adapted from Clarkson University, 2012
The Northeastern University plan for laboratory safety management is designed to ensure the safe conduct of all activities in research and teaching laboratories. Principal areas include Chemical Hygiene and Safety, Biosafety, Radiation Safety and Diving Safety. Overall responsibility for laboratory safety is summarized in the President’s letter to the Audit Committee (copy attached).

Primary responsibility for laboratory safety resides in the academic division, starting with the Principal Investigator or Laboratory Director and includes the Department Safety Officer (DSO), the Department Chair, the College Dean, and the Provost. Responsibilities include oversight of laboratory safety management policy and practice as well as written guidance on progressive disciplinary action for failure to comply with laboratory safety policy.

The Office of Environmental Health and Safety (EHS) is charged with monitoring laboratory personnel, facilities, and operations in relation to applicable federal, state and local regulations. EHS activities include periodic compliance auditing through inspections and safety awareness training and education. Additional activities include collaboration on laboratory safety policy development and facilitation of effective compliance programs by the research investigators. EHS is responsible for communicating the results of its inspections to management and for closure of laboratories where appropriate.

In addition, a special role is played by four safety committees which are constituted by the Provost to provide technical expertise in reviewing research protocols, to provide guidance and assistance to EHS and the academic division in implementing policy, and as a peer group, to help correct violations.

The responsibilities of individuals and units are described in more detail below.

**Responsibilities of Investigators and Directors in Charge of Laboratories**

Individuals with overall responsibility for teaching and research laboratories must take appropriate steps to implement safety and environmental programs in their laboratories.

Responsibilities include ensuring that:

• All personnel (faculty, staff, students) using the laboratory receive required safety and environmental training.
• Chemicals and other hazardous substances are safely stored, used, and properly discarded.
• Personal protective equipment assessments are performed and documented.
• Safety equipment is used properly and maintained appropriately.
• Periodic self-assessments of the laboratory are performed.
• Laboratory personnel are held accountable for matters of environmental, health and safety. (A qualified laboratory employee may assist a supervisor carry out his or her responsibilities, but the supervisor remains responsible for laboratory conditions.)

Prior to final approval of a leave or sabbatical, a faculty member in charge of a research laboratory must designate one individual working in the laboratory to be responsible for overseeing the laboratory and complying with all health, safety, and environmental requirements.

A graduate student may not be designated to fulfill this responsibility. A colleague knowledgeable about the specific safety requirements and in physical proximity to the laboratory should be designated subject to the approval of the Department Chair.
**Departmental Safety Officers** (previously designated as Chemical Hygiene Officer) The DSO bears significant responsibility for promoting and maintaining a safe, healthy, and environmentally sound workplace in their respective units. Specific duties include:

- Following up on violations identified by EHS.
- Identifying personnel or property at risk of exposure to particular safety or environmental concerns.
- Conducting periodic self-assessments of laboratories that are under their charge.
- Informing students, faculty, and staff of safety and environmental program requirements per EHS and assuring that they are followed.
- Reviewing procedures for responding to emergencies and assessing hazards.
- Implementing recommendations of EHS.

**Responsibilities of Department Chairs**

Department Chairs are responsible for environmental health and safety programs in their departments. The Chairs with laboratory space or activities that fall under the purview of the four committees appoint the DSO to help implement laboratory safety policies and procedures. Responsibilities include:

- Maintaining up-to-date lists of personnel working in their departments.
- Directing action to correct violations by department faculty, staff, and students brought to the Chair’s attention.
- Coordinating departmental responses to new regulations and inspections.
- Conveying information about safety and environmental issues appropriately to department faculty, staff, students and DSOs.

**Responsibilities of Faculty, Staff and Students**

Every individual is responsible for conducting his or her activities at Northeastern University in accord with all applicable governmental, University, and departmental policies and regulations. Failure to abide by established environmental, health, and safety procedures, to participate in training, and to report hazards and violations are subject to the applicable disciplinary processes.

**Responsibilities of the Office of Environmental Health and Safety**

EHS is responsible to provide laboratory personnel with guidance and technical support in implementing safety and environmental programs. EHS plays a quality assurance role by giving PIs, DSOs, Chairs, and other administrators timely and accurate information on the status of implementation programs and program trends. EHS supports efforts to address laboratory program deficiencies and assists the safety committees by:

- Advising the Principal Investigators or Laboratory Directors, DSOs, Chairs, and other administrators on the development of appropriate safety and environmental programs that conform with established policies, regulations, and standards.
- Providing training, technical assistance, and related services.
- Developing self-assessment tools for use by laboratory personnel and providing guidance in the use of these tools.
- Maintaining appropriate documentation of environmental and safety policies and programs, including records of training, inspections, and hazardous waste disposal.
- Conducting periodic audits and inspections of research and teaching laboratories.
ADDITIONAL PLAN ELEMENTS

1. Safety Awareness
   EHS is responsible for classroom-based, safety awareness training sessions in addition to online safety education courses. These training programs should be scheduled and updated on a regular basis. Safety courses are offered online through the EHS web site. In addition, courses are being offered on Blackboard. Future efforts should be made to provide access to safety awareness information through the MyNEU portal.

   EHS is responsible for a training profile that outlines required safety training programs for the appropriate areas of research interest for each academic department. Each semester, EHS should notify all Department Chairs and DSOs regarding the availability of safety courses. The PI or Laboratory Director is responsible for ensuring that all personnel in the laboratory receive the appropriate safety training to perform the tasks assigned to them. Working through the Provost’s Office, EHS will engage the relevant DSO, Department Chair, or College Dean in communicating to all faculty, staff and students regarding mandatory safety requirements if they work with hazardous materials or in hazardous environments. EHS will be provided with department lists of faculty, staff and students who require training.

2. Laboratory Compliance Inspections
   Central to the effort to ensure safe practices in laboratories is the need to carry out regular inspections. PIs, Laboratory Directors, and DSOs should conduct periodic self-assessment inspections in their laboratories. EHS is responsible for campus-wide, periodic laboratory inspections.

   Efforts should be made to streamline reports of inspections and expedite notification, thereby facilitating mitigation efforts by the responsible supervisor. Once safety inspections have been conducted, findings should be sent to research investigators and other responsible individuals. Such reports should be provided to the Provost’s Office.

3. Designation of Safety Officers
   Department or College Safety Officers serve as a department or college resource on environmental, health, safety matters. They coordinate needed services and related safety activities with EHS. Periodic reviews of the performance of the DSOs should be carried out by EHS, the relevant Safety Committee, and the Provost’s Office. After consultation with EHS, the Provost’s Office approves a list of individuals who are appropriate for these positions in September for appointment by November 1 of each year.

4. Safety Committees
   The Provost’s Office has direct oversight of the four safety committees that oversee research and teaching laboratories that involve hazardous materials or conditions; they are as follows:
   • Laboratory Safety Committee
   • Diving Control Board (underwater diving safety at Nahant)
   • Institutional Biosafety Committee
   • Radiation Safety

   On an annual basis, the Provost’s Office reviews the performance of each safety committee. The
Provost’s Office will make *de novo* appointments from the colleges/departments where needed. In addition, the Provost’s Office has direct oversight of appointments made to the Institutional Animal Care and Use Committee and the Institutional Review Board (human subjects). Facility Services oversees safety work groups that perform safety reviews on occupational and environmental safety programs for physical plant activities. This group reports to the Senior Vice President for Administration & Finance.

5. Response to violations

As described below, notices of laboratory violations should be sent by EHS to the Principal Investigator or Laboratory Director of the laboratory in which the violation exists and to the Department Chair or Dean of the responsible individual’s unit. Copies should also be sent to the alternate contact whose name appears with the responsible individual on the emergency door sign of the laboratory; the Department Safety Officer; the Dean of the College of multi-unit Colleges; the Vice Provost for Research; and the Provost. A faculty member on sabbatical who would otherwise receive the violation notice shall also be notified.

The PI or Laboratory Director has primary responsibility for ensuring that violations are corrected promptly and appropriately. The Department Chair shall ensure that the PI or Laboratory Director has addressed the violation. EHS will monitor the response actions required by the violation notice. If a written response documenting an adequate abatement action is not received within five days, then a second notice will be sent to the PI or Laboratory Director with copies to the Department Chair, the Dean, the Vice Provost for Research, and the Provost. If a third notice is required, then another inspection may be scheduled. If the violation is still not corrected, then EHS will determine whether closure of the laboratory is appropriate or whether other sanctions are needed. At any time in the process, EHS or the Provost’s Office can refer the violation to the appropriate Safety Committee. The Safety Committee is authorized to interview the violator and request explanations for the violation. The list of available sanctions is as follows:

1. For individuals, access to the laboratory may be restricted for a period of time or until the violation is corrected.
2. The laboratory may be closed to all users until the violation is corrected.
3. For individuals, the supervisor (Department Chair, Dean, or Provost) can issue a reprimand.
4. Repeat violations may result in suspension without pay.
5. Other actions as specified in the Faculty Handbook.

The appropriate sanction will be recommended by the relevant Safety Committee.