**W.M. Keck Foundation nanoENGINEERING**

**Lab Safety MANUAL**

|  |  |
| --- | --- |
| Original Author: | Natalya Hallstrom |
| Application: | MS Word |
| File Name: |  |

**REVISION HISTORY**

|  |  |  |
| --- | --- | --- |
| Rev. | Revision Description | Approved By: |
| 1.0 | As Issued | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Dr. Natalya Hallstrom, Lab Manager date |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Keck Lab Committee:    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Dr. Jeunghoon Lee date  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Dr. Eric Hayden date  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Dr. Olga Mass date |
|  |
| Jon Scaggs, COEN Safety Liaison date |

**TABLE OF CONTENTS**

1.0 Scope 4

2.0 Share Lab Spaces 4

3.0 Lab Safety Checklist 5

4.0 Emergency Responce 6

4.1 Calling 9-1-1 6

4.2 Boise State Emergency Response Guide 7

4.3 Secondary Contacts 7

5.0 Lab Operations and Hazards 8

5.1 Description of Lab Operations 8

5.2 Hazards Summary 8

5.3 Chemical Hazards 9

5.4 Biological Hazards 10

5.5 Complressed Gas 11

5.6 Electrical Hazards 12

5.7 Mechanical Hazards 13

5.8 Flammable Liquid Hazards 13

5.9 Vacuum Hazards 14

5.10 Thermal Energy Hazards 14

5.11 Radiation Hazards 15

5.12 Stop Work Practice 15

5.13 Personal Behaviors 16

5.14 Personal Protective Equipment 17

5.15 Engineering Controls for Hazards 18

5.16 Administrative Controls for Hazards 18

5.16.1 Lab Signage 18

5.16.2 Training 19

5.16.3 Certification 20

5.16.4 Laboratory Safety Notebook 21

5.16.5 Lab Incidents, Accidents and Property Loss 21

6.0 Chemical Emergencies 22

6.1 Chemical Contact 22

6.2 Large Chemical Spill 23

6.3 Small Chemical Spill 24

6.4 Uncontained Spill Release 24

6.5 Spill Investigation Report 24

7.0 Chemical and Waste Management 25

7.1 Chemical Labeling 25

7.2 Chemical Inventories 25

7.3 Chemical Operation Procedures 25

7.4 Definition of Waste 26

7.5 Hazardous Waste 26

7.6 Waste Puckup 27

7.7 Illegal Disposal of Waste 28

7.8 Segregation of Waste 28

7.9 Hazardous Waste Containers 29

8.0 Additional Resources 30

8.1 COEN Safety Liaison 30

8.2 EH&S 30

8.3 COEN Safety Website 31

Appendix A. Laboratory Evacuation 32

Appendix B. MCMR 222A/226A/226B Chemical Ordering Procedures 34

Appendix C. Additional Resorces 35

|  |  |
| --- | --- |
| Scope | This document is intended to provide safety information on the safety equipment, activities and hazards specific to the space(s) used by this lab.  This document is intended to be used in research labs in conjunction with the **COEN General Lab Safety Manual** and other lab safety training  <https://studylib.net/doc/6628757/coen-general-research-lab-safety-manual-12-2-2015.>  It is mandatory that all individuals who perform work in the lab be fully aware of this document’s existence, understand its contents, and satisfy the testing requirements associated with it. This burden of knowledge and training is the shared responsibility of the PI, lab supervisor and individual lab workers. |
| Shared Lab Spaces | Shared lab spaces require additional cooperation by lab owners to ensure a safe environment for all.  A lab-specific safety manual should be written for any space that is:   * shared by multiple PIs working independently   OR   * shared by co-PIs that do not share the same research team   This may require having multiple lab-specific safety manuals as needed based on the lab spaces used. |

|  |  |  |
| --- | --- | --- |
| Lab Safety Checklist | Below is a checklist of important safety-related information for your lab space(s). **Familiarize yourself with this information. See Appendix A Laboratory Evacuation more information.**    **Lab Location:** MCMR  Room 222 A, B, C, D; 26A & 226B  Building Address: 1435 W. University Dr.  Important Safety-Related Locations:  Secondary Contact Info: Lab entrances  Lab Safety Notebook: Near 226A exit  Nearest Fire Extinguisher: MCMR 222A (on south wall)  Nearest Fire Extinguisher: MCMR 226A (on south wall)  Nearest Fire Extinguisher: MCMR 226B (on south wall)  Nearest Fire Blanket: MCMR 226A (on south wall)  Nearest Eyewash/Safety Shower: MCMR 222A (on east wall)  Nearest Eyewash/Safety Shower: MCMR 226A (on east wall)  Nearest Eyewash/Safety Shower: MCMR 226B (on east wall)  Nearest Chemical Spill Kit: Near exit of MCMR 226A under south sink  Nearest AED: MCMR firs floor by the elevator on south wall. Call Camus Security at (208)-426-6911 for Location.  Nearest Phone: MCMR 226A (on west desk)  Safe Assembly Area For Evacuation: About 100 feet from building  Meet 1st Responders: On University Dr. in front of building. | |
| 1. **Emergency Response** | | |
| * 1. **Calling 9-1-1** | | * **If possible, get out of immediate danger.** * **In the event of a fire, or if you feel the building’s occupants are in danger:**   1. **Evacuate the building immediately!** Refer to ***Laboratory Evacuation***  at the end of this document for additional evacuation information.   2. Once you are out of danger, contact University Dispatch so that they may sound the fire alarm if building evacuation is needed. * **To report any medical emergency or fire, call 9-1-1 from any phone.** * For other emergencies, contact University Dispatch at 426-6911.   When calling 9-1-1:   * Stay on the line with the dispatcher. * Provide the address of the building involved and your exact location when calling from a cell phone. The building address is located on the Emergency Contact sign on the door of your lab. * Provide a thorough description of the incident to ensure that proper resources are dispatched. * Do not hang up until the dispatcher tells you to do so. * Follow up the 9-1-1 call with a call to University Dispatch at 426-6911. |
| Boise State Emergency Response Guide | | The [***Boise State Emergency Response Guide***](http://coenintranet.boisestate.edu/Safety/COENEmergencyResponse/tabid/75/Default.aspx) has been designed to provide overall guidance for various emergency incidents which could occur at Boise State University. The online guide can be accessed from the university website at:  <http://emergencymanagement.boisestate.edu/emergency_procedures>  This guide provides emergency content on the topics below.   * [General Instructions for all Emergency Situations](http://emergencymanagement.boisestate.edu/about/emergency_procedures/general-instructions/) * [Active Shooter](http://emergencymanagement.boisestate.edu/about/emergency-procedures-2/active-shooter/) * [Bomb Threats](http://emergencymanagement.boisestate.edu/about/emergency_procedures/bomb-threat/) * [Building Evacuation](http://emergencymanagement.boisestate.edu/about/emergency_procedures/building-evacuation/) * [Fire and Smoke](http://emergencymanagement.boisestate.edu/about/emergency-procedures-2/fire-and-smoke/) * [Flooding](http://emergencymanagement.boisestate.edu/about/emergency_procedures/flood/%20) * [Hazardous Materials](http://emergencymanagement.boisestate.edu/emergency_procedures/hazardous-materials/) [Medical Emergencies](http://emergencymanagement.boisestate.edu/about/emergency_procedures/medical-emergencies/) * [Natural Gas Leaks and Pipeline Breaks](http://emergencymanagement.boisestate.edu/emergency_procedures/natural-gas-leaks-and-pipeline-breaks/) * [Power Shortages and Outages](http://emergencymanagement.boisestate.edu/emergency_procedures/power-shortages-and-outage/) * [Report a Crime](http://emergencymanagement.boisestate.edu/report-a-crime/) * [Report Sexual Assault](http://emergencymanagement.boisestate.edu/emergency_procedures/%E2%80%8Ehttp:/emergencymanagement.boisestate.edu/about/emergency_procedures/report-sexual-assault/) * [Report Unsafe Conditions/Incidents](http://emergencymanagement.boisestate.edu/about/emergency_procedures/report-unsafe-conditionsincidents/) * [Work-Related Injury or Illnesses](http://emergencymanagement.boisestate.edu/work-related-injury-or-illness/) |
| Secondary Contacts | | After calling 9-1-1 in an emergency situation, or if you have a non-emergency situation, it is important that you inform secondary contacts of the laboratory situation as soon as possible.  Secondary contact information is provided on the Emergency Response signage and is posted on the entrance of the lab and by your lab phone. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Lab Operations and Hazards | | | | |
| 5.1 Description ofLab Operation | | The operations and activities of this lab include the following:  MCMR 222A/226A/226B:   * Biomaterials and nanomaterials synthesis and characterization   Note: Some of these operations may be carried out outside of the laboratory. | | |
| 5.2 Hazards **Summary** | | The hazards of the lab’s operation(s) include the following:  MCMR 222A/226A/226B:   * Chemical * Biological * Compressed Gas * Electrical * Mechanical * Flammable Liquid * Vacuum * Thermal Energy * Radiation   More information on these hazards can be found below. | | |
| 5.3 ChemicalHazards | | Chemical hazards must be described in the protocols that use them. Consult these protocols or your PI if you have questions.  Information on managing chemical spills and handling chemical waste can be found in the **COEN General Lab Safety Manual**.  The following chemical storage rules apply to all chemicals used in the W.M. Keck Foundation for nanoEngineering Lab:  • Chemicals must be stored in **appropriate cabinets or shelves** and be appropriately vented.  • It is recommended that all liquid chemicals be placed in chemical resistant **secondary containers** (e.g., pans). EPA requires you to have enough [secondary](https://www.newpig.com/expertadvice/calculating-secondary-containment-needs/) containment to contain 100 percent of your largest container or 10 percent of the total volume, whichever is greatest [[40 CFR 264.175](https://www.govinfo.gov/content/pkg/CFR-2018-title40-vol28/pdf/CFR-2018-title40-vol28-sec264-175.pdf)[] https://www.govinfo.gov/content/pkg/CFR-2018-title40-vol28/pdf/CFR-2018-title40-vol28-sec264-175.pdf](file:///C:\Users\Natasha\Desktop\COEN%20Safety%20Adviser\Updated%20Keck%20LSM_4-3-2022\%5d%20%20https:\www.govinfo.gov\content\pkg\CFR-2018-title40-vol28\pdf\CFR-2018-title40-vol28-sec264-175.pdf)  Bulk quantities of chemicals (i.e., larger than one-gallon) **must be stored in a separate storage area**.  • It is mandatory that liquid chemicals be placed in **secondary containers** when 1) incompatible chemicals are placed on the same surface or 2) when chemicals are placed on a flat surface level with or above a drain.  • All flammable liquids must be stored in the Flammable Chemical Cabinet  Incompatible chemicals must always be **physically segregated** by storing them in separate cabinets and/or secondary containers. Refer to the ***Incompatible Chemical Storage Checklist*** for more information. This document can be found on the BSU EH&S website by clicking on the appropriate link under “Chemical Safety” at: <https://d25vtythmttl3o.cloudfront.net/uploads/sites/673/2019/11/Incompatible-Chemical-Storage.pdf>  For safety information and training contact Jon Scagg’s (email: [jonathanscaggs@boisestate.edu](file:///C:\Users\Natasha\Desktop\Safety%20Adviser\D.Estrada_Lab%20Safety%20Mannuals\jonathanscaggs@boisestate.edu), phone number: (208) 426-3943). | | |
| 5.4 BiologicalHazards | | Biological hazards must be described in the protocols that use them. Consult these protocols or your PI if you have questions.  To minimize the risk of exposure to biohazard materials:  • A biohazard warning sign must be posted in all areas and laboratories that contain biohazard agent  • All equipment (centrifuges, water baths, cryogenic freezers, etc.) that comes into contact with biohazard material must be labeled with the biohazard symbol.  • If working with biohazard materials, perform pipetting operations in a biological safety cabinet.  • When working with biohazard materials, gloves should overlap the lower sleeves and cuff of the lab coat. In some instances, it may be appropriate to wear double gloves.  • Sharps should be kept away from fingers as much as possible.  • Work surfaces and equipment must be decontaminated immediately after using biohazard materials.  Information on managing biohazard spills and handling biohazard waste can be found on the appropriate link under “Biological Safety” at: <http://boisestate.edu/operations/ehss/safety-programs/biological-safety/> | | |
| 5.5 CompressedGas | | Cylinders of non-toxic compressed gases are used in these laboratories. Only trained students, faculty, or staff may install or disconnect these cylinders. For safety information and training contact Jon Scaggs (email: jonathanscaggs@boisestate.edu, phone number: 208 426-3943).  • Gas cylinders must be chained and strapped down at all times.  • Handle cylinders of compressed gases as high-energy sources and therefore as potential explosives.  • Because of potential asphyxiation hazards, gas cylinders should be stored in appropriately ventilated closets or in an open storage area.  • Never store a cylinder next to a heat or flame source.  • When moving large cylinders, strap them to a properly designed, wheeled cart to ensure stability.  • Restrain cylinders of all sizes, empty or full, individually by straps, chains, or a suitable stand to prevent them from falling.  • Do not place gas cylinders so that there is contact with electrical circuitry.  • Inspect cylinder valves for damage or corrosion prior to use. If unsuitable for use, return to supplier.  • Use the appropriate regulator on each gas cylinder.  • The threads on the regulators are designed to avoid improper use.  • Do not use any adapter between the gas cylinder and the regulator.  • Always wear safety glasses and closed toe shoes when handling compressed gases. | | |
| 5.6 ElectricalHazards | | Electrical hazards may be encountered while working within ERB 2108/2110. In addition to normal electrical hazards such as 110V and 240V outlets, a variety of equipment is present in the lab which if care is not taken can result in electrical shock. These systems include UV Radiation sources. Simple precautions can be taken to reduce the risk:  • Before operating new equipment read and follow all equipment operating instruction for proper use.  • Do not take apart laboratory instruments or attempt electrical repairs unless you are a qualified technician assigned to perform electrical work by your supervisor. Fixed wiring may only be repaired or modified by Facilities personnel or an approved outside repair service vendor.  • Wet hands, salt solutions, and some anti-static devices may enhance electrical contact with body. Use extra caution and ground fault circuit when working around electricity.  • The accidental or unexpected starting of electrical equipment can cause severe injury or death.  • Improper use of extension cords is hazardous. Do not use extension cords or power strips ("power taps") as a substitute for permanent wiring. Never daisy chain extension cords or power strips to get power where it is needed. Inspect all electrical and extension cords for wear and tear.  Basic information on working with electrical devices can be found in the **COEN General Lab Safety Manual**  <https://studylib.net/doc/6628757/coen-general-research-lab-safety-manual-12-2-2015>.  For safety information and training contact Jon Scaggs (email: <mailto:jonathanscaggs@boisestate.edu>, phone number: 208 426-3943). | | |
| 5.7 MechanicalHazards | | Many laboratory instruments have moving parts. Some of these devices are automatic samplers, centrifuges, shakers, mixers, and rotary evaporators. Generally these machines have safeguards or interlocks to prevent machinery-related injuries, however, caution must always be exercised around moving parts. If working with such equipment, follow these safety guidelines:  • Avoid wearing loose clothing or necklaces that could be drawn into compressed gases  • Do not disable interlocks on doors, access panels, etc.  • Do not brake moving parts by hand; wait for motion to stop on its own.  • Be aware of assemblies that vibrate and could “walk” into other objects or fall off a counter.  • Safety glasses must always be worn around any power tool operation.  • Use caution with automatic or computer-controlled machines that could start unexpectedly. | | |
| 5.8 FlammableLiquid Hazards | | All flammable liquids must be stored in an appropriate Flammable Chemical Cabinet. Flammable liquids and their vapors should be kept away from any possible ignition sources (e.g., open flames, electrical or other sparks, heat sources, hot surfaces, etc.). For safety information and training contact Jon Scaggs (email: <mailto:jonathanscaggs@boisestate.edu>, phone number: 208 426-3943). | | |
| 5.9VacuumHazards | | Vacuum work can result in an implosion and the possible hazards of flying glass, splattering chemicals and fire. All vacuum operations must be set up and operated with careful consideration of the potential risks. Equipment at reduced pressure is especially prone to rapid pressure. Such conditions can force liquids through an apparatus, sometimes with undesirable consequences.  Prior to vacuum operation:  • Inspect glassware to make sure there are no defects such as chips or cracks that may compromise its integrity.  • Use only approved glassware for low-pressure work. Never use a flat bottom flask (unless it is a heavy-walled filter flask) or other thin-walled flask that is not appropriate to handle atmospheric pressure.  • Use a shield or fume hood sash between the user and any glass under vacuum or wrap the glass with tape to contain any glass in the event of an implosion. | | |
| 5.10 ThermalEnergyHazards | | Thermal hazard within laboratory can occur from a number of sources; however, there are some simple guidelines that can be followed to prevent heat related accidents. These guidelines include:  • Heating devices should be set up on a sturdy fixture and away from any ignitable materials (such as flammable solvents, paper products and other combustibles).  • Heating devices, and other electrical equipment, should not be installed near safety showers, eye washes, or other water spraying apparatus due to electrical shock concerns and potential splattering of hot water or breakage of hot glass.  • Heating devices should have a backup power cutoff or temperature limiting controller to prevent overheating.  • Make sure set temperatures do not cause violent reactions and that a means to cool potentially exothermic (heat generating) reactions is readily available. Note that larger volumes are exponentially more difficult to control should an exothermic process run away.  • Never use mercury thermometers in heating baths.  • Post “Caution: High Temperature” sign to warn people of the heat hazard near hot assemblies and to prevent burns. | | |
| 5.11 RadiationHazards | | Ultraviolet light:The UV trans illuminator, image station and biological safety cabinets are all sources of UV light. To minimize the risk of exposure to ultraviolet light:  • Eye protection should be worn at all times when there a potential for UV exposure. Eyeglasses should be ANSI-Z87 rated and provide protection from the side via a side lens or “wrap around “lens.  • A full face shield should be worn when working with UV light boxes for more than a few seconds.  • Never use a trans illuminator without the protective shield in place. Shield must be kept clean and replaced when damaged.  • Never work in the biological safety cabinet while the germicidal lamp is on. If possible, close the sash while the lamp is on.  Ionizing radiationis emitted by radioactive materials. Ionizing radiation includes cosmic rays, alpha, beta and gamma rays, X-rays, and in general any changed particle moving at relativistic speeds. Hand-on training and certification must be completed prior to working with ionizing radiation.  To minimize the biological effect of radiation:  • A radioactive warning sign must be posted in all areas and laboratories that contain radioactive materials.  • All equipment that comes in contact with radioactive materials must be labeled with the universal radioactive symbol.  • Use appropriate shield and personal protective equipment to reduce radiation exposure.  • Increase the distance between yourself and a radiation source.  • Decrease the amount of time spent a radiation source. | | |
| 5.12 Stop WorkPractice | | | * **A worker should never perform a job if she/he believes it to be unsafe or if inadequate PPE is available or sufficient safety measures are in not place.** * If a worker feels a job cannot be performed safely, she/he should see her/his supervisor immediately for resolution. * If a worker feels pressured into performing a job they believe to be unsafe, they should contact their PI and/or the COEN Safety Liaison immediately. | |
| 5.13 PersonalBehaviors | | | The Integrated Nanomaterials Laboratory users include faculty, research staff, post-docs, graduate and undergraduate students, as well as other users from both within and outside the university. Users must comply with University Policies and all regulations and procedures detailed in this safety manual.  Additional required behaviors include:   * Workers must be familiar with the hazards of the materials with which they are working. * No food or drink is permitted in the lab. * No unauthorized experiments. * Personnel must have pre-approval by his/her direct supervisor in order to perform work alone. * Work should not be conducted if the researcher is feeling tired or otherwise impaired. * No rough-housing is permitted in the lab. * When performing an operation, consider if nearby workers require additional protection and take appropriate measures. * Employ good housekeeping rules by maintaining a clean, uncluttered work area.   Violating the regulations or procedures detailed in this document, or endangering the safety of yourself or others, will result in the immediate denial of access to the lab. | |
| 5.14 PersonalProtectiveEquipment (PPE) | | | The information provided below is intended only to provide an overview of PPE requirements. For more detailed PPE requirements of your lab, consult with the procedure documents for those specific processes and/or discuss with your lab PI or supervisor.  **If you feel you are engaged in a process that places you at risk, it is your responsibility to wear the appropriate PPE, if available, or halt work until the proper PPE can be procured.**   * **Close-toes hoes** must be worn in the lab at all times. * **Leg coverage** is required at all times. * **Safety glasses** must be worn under the following circumstances in this lab: * Performing sawing, grinding or cutting operations * ***When there is any foreseeable risk of injury to your eyes.*** * **Lab Safety Coats** must be worn when handling chemicals and biomaterials. * NOTE: *Grainger Industrial Supply (*[www.**grainger**.com](http://www.grainger.com/)) is a good source for purchasing of and information on PPE. See your laboratory supervisor for information on and proper fitting of PPE. | |
| 5.15 EngineeringControls forHazards | | | * **Chemical fume hoods** are protective equipment and must be used correctly to offer protection from chemical exposure. * **Biosafety cabinets** are protective equipment and must be used correctly in order to protect laboratory workers and the surrounding environment from pathogens. * Chemicals must be stored in **appropriate cabinets** and be appropriately vented. * It is recommended that all liquid chemicals be placed in **secondary containers** (e.g., pans) that are capable of holding at least 110% of the volume of liquid held in the primary container(s). * It is mandatory that liquid chemicals be placed in **secondary containers** when: 1) incompatible chemicals are placed on the same surface or 2) when chemicals are placed on a flat surface level with or above a drain. * All flammable liquids must be stored in the Flammable/Chemical Cabinet. * Incompatible chemicals must always be **physically segregated** by storing them in separate cabinets and/or secondary containers. Refer to the [***Incompatible Chemical Storage Checklist***](http://coenintranet.boisestate.edu/LinkClick.aspx?fileticket=07rW6D4uFq8%3d&tabid=76) for more information. The document can be found here:   <https://d25vtythmttl3o.cloudfront.net/uploads/sites/673/2019/11/Incompatible-Chemical-Storage.pdf>   * or by contacting EHS at (208) 426-3303. | |
| 5.16 AdministrativeControls forHazards | | | Administrative controls play an important part of reducing hazard risk when engineering controls alone are not sufficient. Below are administrative controls that are in place for this laboratory | |
| 5.16.1 Lab Signage | The number of signs should be kept to a reasonable minimum and be clear and concise.  The following information will be posted on the each laboratory entrance from the main hall.   * Information relating to the general hazards, PPE, and rules of the lab.   If a phone is provided in the lab, the secondary contact information should also be provided adjacent to the phone. | | |
| 5.16.2 Training | Before performing any work in the laboratory, each worker must receive training as assigned by the PI. This training will generally consist of a combination of:   * This laboratory safety manual and its appendices * The [Boise State University Emergency Response Guide](http://coen.boisestate.edu/safety/files/2011/10/CEERG-online-version.pdf) * General online training modules as determined by lab management. * Specific training relating to tasks performed.  This training may include document-based training (such as protocols and procedures), as well as operational hands-on training. * The Boise State Chemical Hygiene Plan. * Online training modules provided by the Boise State EH&S. Any other training specified by the PI.   Note: The Principal Investigator (PI) is responsible for ensuring all workers within the lab are properly trained. All training records are to be maintained in the ***5.16.4 Laboratory***  ***Safety*** Notebook(s) as described in Section 0. | | |
| 5.16.3 Certification | Certification level is determined by the type of work performed or responsibilities held in the lab:   1. A Laboratory Visitoris a person who does not work in the laboratory but is simply visiting. All visitors must be escorted by a laboratory worker. Any person in the lab who does not fall in one of the categories below can be considered a lab visitor. 2. A Support Worker is a person who supports the facility or IT needs of the laboratory. Due to the broad description of this type of worker, it is recommended that the PI or Lab Supervisor discuss the work to be done with the worker to determine what training is needed, whether the worker must be accompanied by lab personnel, etc. 3. A Laboratory Worker is a person who performs work in the laboratory, regardless of whether that work is frequent or infrequent. 4. The Laboratory Manager is the person designated by the PI(s) who oversees the day-to-day activities within the lab. 5. The Principal Investigator (PI) is the person responsible for overall laboratory activities including laboratory safety initiatives. These initiatives includes defining safety practices and training materials, assessing the training level needed for each worker, ensuring safety training records are maintained and support of periodic inspections.   Completion of the following training is required for the worker types as shown below.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | Lab  Safety Manual | BSU Emerg. Resp. Guide | Task-Specific Training, incl. CITI | Chem.  Hygiene Plan | | Lab Visitor | No | No | No | No | | Support Worker | No | No | No | No | | Laboratory Worker | Yes | Yes | As required | Familiar \* | | PI, Laboratory Supervisor | Yes | Yes | All | Familiar \* |   \*must have general understanding of the topics covered in the document and be able to readily reference it as needed. | | |
| 5.16.4 LaboratorySafetyNotebook(s) | The laboratory safety notebook(s) is intended to provide a variety of safety-related content that can be readily accessed by lab members and visitors to the lab.  In general, the notebook will contain:   * The lab safety manual procedures and other tanning materials * College of Engineering Emergency Response Guide * Current contact information for COEN and BSU safety personnel * Information and forms relating to lab incidents/accidents * Records of safety training for each lab worker (may be located elsewhere but must be readily accessible). * Chemical inventory and MSDSs for lab   More information on how to organize a lab safety notebook can be obtained by contacting the COEN Safety Liaison or by clicking [here](http://coen.boisestate.edu/safety/laboratory-safety/lab-safety-manual/). | | |
| **5.16.5 Lab Incidents,**  **Accidents and** Property Loss | In the event of an incident where a person in the lab is injured, or where property is damaged, contact the Boise State Office of Risk Management and Insurance to ensure the proper measures are taken to protect health and property. Their contact information can be found at: <http://rmi.boisestate.edu/>  Also, your lab notebook should have the proper forms and a flow chart to describe how to handle an incident for an employee. | | |

|  |  |  |  |
| --- | --- | --- | --- |
| 1. **Chemical Emergencies** | | | |
| * 1. **Chemical Contact** | | * **If you are not sure how dangerous the chemical contact is, call 9-1-1**. See Section 4.1 ***Calling 9-1-1*** for additional information. * The treatment of a chemical exposure takes precedent over spill cleanup, spill containment, or property damage including water damage from the use of an eyewash or safety shower. * In the event of chemical contact with skin or eye, flush the affected area for a minimum of 15 minutes. Use the nearest safety shower and eye wash station as identified in Section 3.0 ***Lab Safety Checklist***. If possible, obtain assistance to remove contaminated PPE and clothing after flushing has begun. * If contact is made through inhalation, immediately move to an area away from the exposure. * After immediate treatment for the exposure has been completed, contact EH&S (or University Security if EH&S is not immediately available) to determine if medical treatment is necessary. Also, contact your lab supervisor. This contact information is provided in Section 4.3. ***Secondary Contacts***. * Have the MSDS information for the chemical(s) available for reference. This information can be found in the notebook described in Section 0. ***5.16.4 Laboratory*** * ***Safety***  Notebook(s)  * , described in Section 3.0 Lab Safety Checklist with the MSDS information for the chemical(s) that were contacted. * Contact Boise State Risk Management to complete the proper forms relating to the exposure. See Section **Error! Reference source not found.**. **Error! Reference source not found.**. * Complete a  ***6.5 Spill***   **Investigation**   * **Report**from Section 0. | |
| * 1. **Large Chemical Spill** | | A large spill is a spill greater than 200mL or 200 g OR any amount of an extremely hazardous substance OR beyond the cleaning capabilities or comfort level of the laboratory or laboratory workers.  **If deemed necessary or you are unsure of spill severity, immediately call 9-1-1. You may also pull a fire alarm.**  Otherwise, take the following steps:   * Turn off any potential sources of spark, flame, or heat without putting yourself in harm’s way. * Inform others in the area of the spill. * Evacuate the area, closing the doors behind you. * Contact your supervisor; then call University Dispatch at 426-6911. * Post a warning sign outside the area and lock doors if possible to prevent re-entry. * Do not begin cleanup until a trained faculty or staff member is present. * Retrieve Safety Data Sheets (SDS) without putting yourself in harm’s way. * Complete a  ***6.5 Spill***   **Investigation**   * **Report**from Section 6.3 | |
| * 1. **Small Chemical Spill** | | A small spill is defined as a spill less than or equal to 200mL or 200 g AND not of an extremely hazardous substance AND within the cleaning capabilities and comfort level of the laboratory and laboratory workers.  **If you are not sure or uncomfortable with the cleanup, contact your supervisor; then call University Dispatch at 426-6911.**  Otherwise, take the following steps:   * Inform others in the area of the spill. * Turn off any gas burners without putting yourself in harm’s way. * Retrieve SDS without putting yourself in harm’s way. * Review applicable SDS and determine controls, PPE, and need for assistance. * Put on necessary protective clothing (gloves, safety goggles or glasses, and lab coat). * Avoid breathing vapors. * Cover small spills with absorbent materials (sponge, paper towel, fabric towels). Clean spill area working from outside toward the center. * Rinse spill area with water. * All of the contaminated materials including absorbent, clothes, soil, wool, etc. must be removed, packaged and labeled for hazardous waste disposal. * Contact your supervisor; then call University Dispatch at 426-6911.Complete a  ***6.5 Spill***   **Investigation**   * **Report**from Section 03. | |
| * 1. **Uncontained Spill Release** | | A spill or release of chemicals into any drain is an uncontained spill release. **Communicate all uncontained spills to a member of EH&S at 863-8024 (24-hr cell) so that they can contact the proper authorities**.  If EH&S cannot be reached, the responding faculty or staff member must report the spill to the [***COEN Safety Liaison***](http://coenintranet.boisestate.edu/LinkClick.aspx?link=176&tabid=168#College_of_Engineering_Safety_Liaison) or  Lander St. Wastewater Treatment Plant: 608-7382 or 608-7380 Also, complete a **Spill Investigation Report** from Section 6.3. | |
| **6.5**  **Spill**  **Investigation**  **Report** | | A Spill Investigation Report form must be completed in the event of a spill or uncontained release of chemicals into a drain. Contact EHS for assistance in completing this form [***EH&S***](#_EH&S). | |

|  |  |
| --- | --- |
| 1. **Chemical and Waste Management** | |
| * 1. **Chemical Labeling** | * All chemicals, including those stored in temporary storage, must be properly labeled with the chemical or product name , concentration, primary hazard, date, name of responsible personnel. Do not write over information printed on chemical labels. Do not use formulas or abbreviations (for example: Water instead of H2O). For temporary storage, include all the information from the chemical inventory list as well as the creation date of the temporary storage. |
| * 1. **Chemical Inventories** | * A chemical inventory of the laboratory is to be performed on a yearly or more frequent basis. * The best way to maintain a chemical inventory is to make real-time adjustments as chemicals are ordered or depleted. * The ***Chemical Inventory UNHCEMS*** can be here: <https://cems.unh.edu/boisestate/CEMS/Dashboard> * The completed inventory is to be printed and stored in the ***5.16.4 Laboratory*** * ***Safety***  Notebook(s)  * as described in Section 0. |
| * 1. **Chemical Operation Procedures** | * When handling chemicals in this lab, the proper PPE must be worn (safety goggles/glasses, chemically compatible gloves, and a lab coat, closed toed shoes, and pants). Some chemicals may require an apron and face shield. * Procedures involving volatile toxic substances and those involving solid or liquid toxic substances that may result in the generation of aerosols should be conducted in a fume hood. * Once the chemical operation has been performed, the chemical must be placed in the storage cabinet immediately. Do not leave chemicals out. |

|  |  |
| --- | --- |
| * 1. **Definition of Waste** | A variety of solid and liquid wastes can be generated in the laboratory. Any lab worker or student that works with chemicals is required to understand how to safely handle, store, and dispose of these materials.  Once you determine a material:   * cannot be reused, * cannot be used for its intended purpose, * has exceeded its shelf life, * has no known owner or generator, * is no longer wanted or needed, or * is an end product of a process or experiment that cannot be used as feedstock in an existing process,   IT IS A WASTE.   * Please remember that maintenance fluids must, in most cases, be disposed of as waste. |
| * 1. **Hazardous Wastes** | * Waste classified as Hazardous Waste must be disposed of properly, in accordance with BSU’s ***Hazardous Waste Management Manual***   <https://d25vtythmttl3o.cloudfront.net/uploads/sites/319/2019/08/HazardousWasteManagementManual.pdf>   * If you have any questions regarding whether a waste material is hazardous or how to store or dispose of it, or would like a copy of the Hazardous Waste Management Manual, contact the ***EH&S*** [***Chemical Waste Officer***](http://coenintranet.boisestate.edu/LinkClick.aspx?link=176&tabid=168#College_of_Engineering_Safety_Liaison) in Section 8.26. |

|  |  |
| --- | --- |
| * 1. **Waste Pickup** | * To have waste picked up from your lab, request waste removal on Chemical Inventory System UNCHEMS   <https://cems.unh.edu/boisestate/CEMS/Dashboard>   * or contact your lab manager. * Pickup will typically be done within 5 days of notifying EH&S, depending on storage needs and space availability. * If you have any questions regarding how to handle waste, contact one of the following:   + Your lab PI or supervisor   + Natalya Hallstrom, Lab manager, COEN Safety Adviser   [natalyahallstrom@boisestate.edu](file:///C:\Users\Natasha\Desktop\Safety%20Adviser\D.Estrada_Lab%20Safety%20Mannuals\natalyahallstrom@boisestate.edu)  ph. (208) 426-5648   * + Chris Siepert, EHS Hazardous Waste Officer   [christophersiepert@boisestate.edu](mailto:christophersiepert@boisestate.edu)  ph. (208) 426-3913   * + Jon Scaggs, Lab Safety Specialist   [jonathanscaggs@boisestate.edu](mailto:jonathanscaggs@boisestate.edu)  ph: (208) 426-3943 |

|  |  |
| --- | --- |
| * 1. **Illegal Disposal of Waste** | Examples of illegal waste treatment include:   1. Leaving solvent wetted wipes in a hood or on the bench top to air dry. 2. Leaving a container open to allow the waste to evaporate. 3. Pouring an unapproved waste into a drain. 4. Diluting a waste to render it non-hazardous. 5. Venting a pressurized aerosol can solely to remove the propellant. 6. Disposing down the sink or drain without prior approval from EH&S. Consult with the Chemical Waste Coordinator in EH&S before disposing of any chemical down a sink or drain. Contact information is found in previous section. |
| * 1. **Segregation of Waste** | You must segregate your waste streams.   * Keep liquids and solids in separate containers * Keep hazardous and non-hazardous waste in separate containers.   You must physically segregate, by secondary containment (separate spill trays, cabinets, etc.), your hazardous waste while in storage from the following:   * non-hazardous waste * drains * incompatible waste * product chemicals |

|  |  |
| --- | --- |
| * 1. **Hazardous Waste Containers** | Hazardous waste containers must be:   * sealed/closed to manufacturer’s specifications:   + the only time a hazardous waste container can be open is when you are actively putting waste into the container; * in good condition:   + replace deteriorated or damaged containers immediately.   NOTE: Make sure you use containers that seal properly. If they leak liquid from the lid when closed, they are considered open containers. Do not use zip-lock bags unless they have a physical means of sealing them to ensure they are sealed.  Examples of open containers that are noncompliant are:   * zip lock bags not completely sealed; * a Kimwipe cloth caught in the seal of a zip lock bag; * a lid completely off the container; * a lid loose on the container; * the wrong lid on a container; * the container leaks from the lid when sealed properly; * a cracked container; * a pinhole in a bag; or a torn bag. |

|  |  |
| --- | --- |
| 1. **Additional Resources** | |
| * 1. **COEN Safety Liaison** | The College of Engineering is staffed with a safety liaison that works closely with COEN labs and the Boise State Environmental Health and Safety team. The safety liaison can also help with chemical ordering, handling chemical waste and many other issues.   Contact information for the COEN Safety Liaison can be found below:  Jon Scaggs, Lab Safety Specialist Office: MCMR 140B  email: [jonathanscaggs@boisestate.edu](mailto:jonathanscaggs@boisestate.edu)  ph: (208) 426-3943 |
| * 1. **EH&S** | ***For chemical contact, chemicals spills or other lab emergencies, call University Dispatch at 426-6911.***  The Boise State Environmental Health and Safety (EH&S) team can provide a wealth of information regarding university policy and safety information regarding laboratory work across campus.  Two members of the EHS staff that support COEN labs heavily are:   * Suzy Arnette, Lab Safety Officer [suzyarnette@boisestate.edu](mailto:suzyarnette@boisestate.edu) ph. (208) 426-3906 * Chris Siepert, EHS Hazardous Waste Officer [christophersiepert@boisestate.edu](mailto:christophersiepert@boisestate.edu)   ph. (208) 426-3913  Additional information regarding other members of the EHS team, university policy, training, etc. is provided on their website site at:   * <https://www.boisestate.edu/coen-safety/contact-us/> |
| * 1. **COEN Safety Website** | * The COEN Safety website is hosted on the College of Engineering’s website at <http://coen.boisestate.edu/safety>. * Topics of the website include:   + Emergency response information   + Commonly used forms and documents   + Chemical management, including chemical ordering, chemical inventory and MSDS record-keeping   + Lab Safety (PPE, controls, etc.)   + Safety training, including types of training, templates, etc. |

###### Laboratory Evacuation

**When ordered to evacuate or when alarms are activated, ALWAYS LEAVE IMMEDIATELY.**

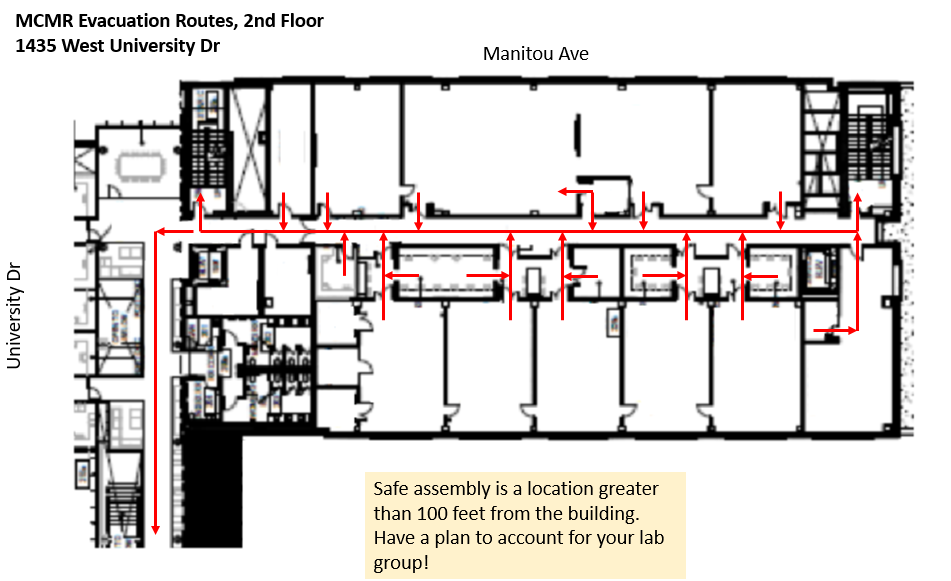
* Unless ordered otherwise by officials, designated Building Coordinators and/or alternates and assistants (identified with red armbands) shall direct and ensure, to the extent practical, that a safe personnel evacuation is conducted. Treat all alarms as warning of an actual emergency situation.
* All department heads, faculty, managers and supervisors must help direct employees, students, visitors and each other to obey evacuation instructions of emergency response personnel and/or the Building Coordinators.
* Building Coordinators and/or alternates and assistants shall notify emergency personnel immediately upon their arrival at the scene concerning the status of the evacuation, the exact location of any injured or trapped persons, those waiting in designated Areas for Evacuation Assistance, any others who may be anywhere in the building, and any other relevant information on the emergency situation.

**Exit quickly and calmly using nearest emergency escape routes and marked exits and proceed to Safe Assembly Locations.  DO NOT USE ELEVATORS!**

* Do not attempt to use elevators during an emergency.  Elevators are called to the first floor when the fire alarm system is activated.  Use only stairways in an evacuation.
* Use clear, safe escape routes and exits and proceed to the nearest outside Safe Assembly Location shown on this building’s posted evacuation map, or to a location ordered by emergency response personnel.  Do not return to an evacuated building until directed by University officials.
* If possible, take your coat and keys but do not take time to go to lockers or offices for personal possessions.
* Where applicable and, if possible and safe, turn off laboratory gases, exhaust fans, and close doors/windows as you exit.

**Assist persons requiring evacuation assistance to get to designated Areas for Evacuation Assistance.  Be alert for trapped, injured, or other persons requiring assistance.**

* Transporting of individuals requiring evacuation assistance up or down stairwells shall be avoided until emergency response personnel have arrived.  Unless imminent life-threatening conditions exist, relocation of these individuals shall be limited to the designated Areas for Evacuation Assistance.
* Notify emergency personnel immediately upon their arrival of the exact location of any injured or trapped persons, those waiting in designated Areas for Evacuation Assistance, and any others who may be anywhere in the building.



###### Chemical Ordering Procedures

1. Obtain quote from company, request an academic discount.

2. Locate the latest version of MSDS for the chemical(s) to be ordered. Ideally, the MSDS is from the manufacturer of the chemical of interest. Be sure to save a digital copy to the appropriate coen-cypress shared drive (e.g. the “L:-drive”) at L:\Lab Safety\MSDS for future reference. When saving the digital copy, add the date of the MSDS as a suffix so that you don’t overwrite earlier versions of that MSDS. Example: 1-Bromododecane \_Sigma\_MSDS.

3. Read the MSDS(s) noting any hazards and precautions.

4. Print out a copy of each MSDS, put date on the front page of each copy.

5. Write a Safety Protocol (SOP) where the following considerations are addressed:

a. Scope of work is defined

b. Hazards associated with the work are identified and analyzed (handling storage/compatibility/waste management).

c. Write detailed procedures.

6. Notify the laboratory manager of the pending purchase (provide a copy of the MSDS(s) and the safety protocol for review).

7. Once approved by the laboratory manager or PI:

a. send an email to Lab Safety Specialist Jon Scaggs (email: [jonathanscaggs@boisestate.edu](mailto:jonathanscaggs@boisestate.edu)

8. Once approved by the Lab Safety Specialist Jon Scaggs:

a. Add a copy of each MSDS to L:\Lab Safety\MSDS

b. Add a copy of the Safety Protocol (SOP) to L:\Lab Safety \Safety Protocols\Protocol Name

c. Add hardcopies of the MSDS(s) and Safety Protocol (SOP) to the MSDS and Safety Protocols Binders.

9. To place a purchase request use a Shared Services form. The form can be found:

<https://app.smartsheet.com/b/form/5203b1a69b9847df9018cd09e7641b52>

10. Periodically check on the progress of the order. In general, orders will be shipped to the MCMR mailroom addressed in your name.

**Additional Resources**

**Environmental Health, Safety and Sustainability Website**

* The [Environmental Health, Safety and Sustainability website](http://vpfa.boisestate.edu/EHS/) provides a wealth of information regarding university policy and safety information for laboratory work on campus. The EHSS website can be found at[: https://www.boisestate.edu/operations/ehss/](file:///C:\Users\Natasha\Desktop\Safety%20Adviser\D.Estrada_Lab%20Safety%20Mannuals\:%20https:\www.boisestate.edu\operations\ehss\)
* The EHSS website contains:
  + Contact information to assist you in finding the right person to address your needs
  + Links to safety training offerings (both online and in person)
  + Various EHSS forms and signage
  + Hazard-specific (e.g., biological, chemical, laser, radiation) pages

**COEN Safety Website**

* The [COEN Safety website](http://coen.boisestate.edu/safety/) provides contact information for the COEN safety liaison and BSU EHSS personnel as well as information regarding COEN safety policies and procedures. The COEN Safety website contains information regarding:
  + Emergency response plans (both BSU and COEN)
  + Commonly used forms and documents
  + Chemical management, including chemical ordering, storage, inventory, SDS record keeping, and waste disposal
  + Laboratory safety and hazard mitigation
  + Safety training, including types of training, templates, etc.
  + Calendar of safety-related events

**COEN General Lab Safety Manual**

* The COEN General Lab Safety Manual provides an overview of COEN safety policies and procedures. A copy can be found at the following link.

<https://studylib.net/doc/6628757/coen-general-research-lab-safety-manual-12-2-2015>

* Topics covered in the COEN General Lab Safety Manual include:
  + Emergency Response Guide
  + General Lab Practices
  + Hazard & Risk Mitigation
    - Engineering & Administrative Controls
    - Personal Protective Equipment (PPE)
  + Chemical Emergencies
  + Waste Management