

COEN GENERAL RESEARCH LAB SAFETY MANUAL

Original Author:	Dick Sevier
Application:	MS Word
File Name:	COEN General Research Lab Safety Manual 1-May-2013.docx

REVISION HISTORY

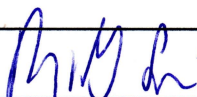

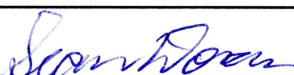
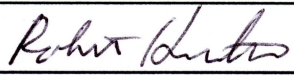
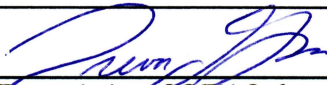
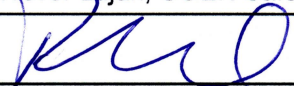
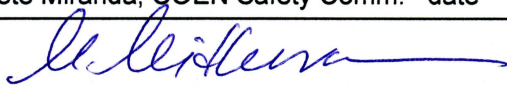
Rev.	Revision Description	Approved By:
1.0	As issued	
1.1	<p>Added section 3.2 Lab Access Restrictions, sections on 4.1 Elimination and 4.2 Substitution in 4.0 Hazard Control, section 7.4 BroncoAlert.</p> <p>Revised section 3.5 Lab Incidents, Accidents and Property Loss with information on ReportExec and revised 6.3 Waste Pickup to include upcoming new waste tracking processes.</p>	 5-13-13 Dick Sevier, COEN Safety Liaison date
		 5/15/2013 Suzy Arnette, EH&S Lab Safety Officer date
		 5-13-2013 Sean Donovan, COEN Safety Comm. date
		 5-13-2013 Robert Hamilton COEN Safety Comm. date
		 5-13-2013 Trevor Lujan, COEN Safety Comm. date
		 5/13/2013 Pete Miranda, COEN Safety Comm. date
		 Maria Mitkova, COEN Safety Comm. date

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1.0 SCOPE

This document describes the standard operating procedures and practices encountered and to be practiced in the College of Engineering research laboratories.

Due to the scope of the various activities of the lab regarding chemical usage, processes, and waste generation, this document is not intended to be comprehensive. Instead, it is intended to provide a general overview in defining safe work practices.

In addition to this general lab safety manual, additional training is required for each lab. See Section 4.5.2 for more information.

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, therefore, is the responsibility of both the PI and the individual.

2.0 EMERGENCY RESPONSE

2.1 Calling 9-1-1

- **If possible, first get out of immediate danger.**
- **To report any medical emergency or fire, call 9-1-1 from any phone.**
- **In the event of a fire, or if you feel the building's occupants are in danger:**
 - **Activate the building's fire alarm system before calling 9-1-1. Evacuate the building immediately!**
 - **If your building does not have fire alarm pulls, call University Security & Police at 426-6911 so that the alarm may be remotely activated.**

For other emergencies, contact University Security & Police 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 Security & Police at 426-6911.
-

2.2 Boise State Emergency Response Guide

The [Boise State Emergency Response Guide](#) is a document that describes appropriate responses in a variety of emergency situations. This guide is to be part of the lab safety notebook and can be found [here](#).

Also, emergency response topics can be accessed online through the links below.

- [General Instructions for all Emergency Situations](#)
 - [Active Shooter](#)
 - [Bomb Threats](#)
 - [Building Evacuation](#)
 - [Fire and Smoke](#)
 - [Flooding](#)
 - [Hazardous Materials](#)
 - [Medical Emergencies](#)
 - [Natural Gas Leaks and Pipeline Breaks](#)
 - [Power Shortages and Outages](#)
 - [Report a Crime](#)
 - [Report Sexual Assault](#)
 - [Report Unsafe Conditions/Incidents](#)
 - [Work-Related Injury or Illnesses](#)
-

3.0 LAB PRACTICES

3.1 Stop Work Practice

- 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](#), Section 7.1 immediately.
-

3.2 Lab Access Restrictions

Lab access is provided to members of the research team as determined by the PI. Others seeking access must make prior arrangements before entering the lab as described below:

- Visitors to the lab must first obtain prior approval by the lab PI (or designee of the PI) before entering. Visitors must also be accompanied by a member of the research team.
 - Support workers must discuss the nature of their work with the PI to determine if they may enter and whether they may work without oversight by research team members.
-

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3.3 Personal Behaviors

- 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 are permitted.
- 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.

3.4 Electrical Safety

Labs often rely on custom electrical circuits and devices to perform their work. However, there are limitations to what labs are able to do without the assistance of a licensed electrician.

When lab members intend to design, fabricate or modify electrical circuits that have voltages that exceed either 30 volts ac rms or 60 volts dc, they must first discuss the work with the [COEN Safety Liaison](#), Section 7.1.

The safety liaison will then contact a University electrician to see if their assistance is required.

3.5 Lab Incidents, Accidents and Property Loss

Note: If you have any emergency, first take appropriate measures as described elsewhere in this manual.

If you have an incident your lab, whether it was an actual accident or just a “near miss”, it should be logged using the ReportExec incident tracking system. This system requires the use of Internet Explorer as the browser, and can be found at:

<http://www.reportexecdirect4.com/boise/cesireportexec/olr/OLRMain.aspx?IsAuth=1&groupid=104>

If the incident resulted in injury or property damage, also 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 by going to:

<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.

4.0 HAZARD CONTROL METHODS

4.1 Heirarchy of Hazard Control Five commonly used methods to reduce the risk of hazards are shown in priority order:

1. Elimination
2. Substitution or reduction
3. Engineering controls
4. Administrative controls
5. Personal protective equipment (PPE)

While many are familiar with examples of PPE, it is important to understand the other methods and why then need to be employed first before PPE for hazard mitigation.

4.2 Elimination Hazard elimination is the best way to provide hazard mitigation by physically removing the hazard. An example would be to use a non-toxic material in place of a toxic one where possible.

4.3 Substitution In many cases, hazards can be reduced by substituting a less toxic material or a smaller amount of the material.

4.4 Engineering Controls Engineering controls are lab systems or features that protect all workers by removing the hazard from the lab, or sequestering the hazard. Examples of engineering controls include:

- fume hoods or other local exhaust systems to remove vapors and/or particles at source
- specialized storage systems such as flammables, acids, and corrosives cabinets, sharps containers, etc.)
- safety shields on tools
- “glove boxes” to contain hazardous materials

For more detailed information on the engineering controls required in your lab, consult the protocols and procedures for specific lab processes and/or discuss with your lab PI or supervisor.

4.5 Administrative Controls Administrative controls play an important part of reducing hazard risk when the above methods are not sufficient. Below are administrative controls that are in place for this laboratory.

4.5.1 Lab Signage The number of signs should be kept to a reasonable minimum and be clear and concise.

Information relating to the general hazards, PPE, and rules of the lab will be posted on the each laboratory entrance from the main hall.

If a phone is provided in the lab, the secondary contact information should also be provided adjacent to the phone.

4.5.2 Lab Training

Before performing any work in the laboratory, each worker must receive training as assigned by the PI. This training may include core training required for all workers as well as task-specific training based on the role of the worker in the lab.

The training may be delivered through various methods, including assignment of online modules, distribution of hardcopies or by hands-on training. More information on the assignment of training can be found in Section 4.3.4 [Training Requirements](#).

4.5.3 Training for Shared Lab Spaces

Shared lab environments require additional consideration in terms of assignment of appropriate lab training for the space. The workers must be trained to understand all of the hazards that exist within the space.

For shared spaces that are used by multiple PIs working independently or by co-PIs that have different research teams, a lab-specific safety manual should be developed by the PIs for the lab. Additional lab-specific training can be assigned by the PIs as needed.

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4.5.4 Training Requirements

Certification level is determined by the type of work performed or responsibilities held in the lab:

1. A Laboratory Visitor is 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, IT or other needs of the laboratory. Refer to Section 3.2 [Lab Access Restrictions](#) for information on lab access restrictions.
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 include 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.

	COEN General & Lab-Specific Safety Manuals	Task-Specific Protocols & SOPs	Other Online Training Modules	BSU Emerg. Resp. Guide	BSU Chem. Hygiene Plan
Lab Visitor	No	No	No	No	No
Support Worker	No	No	No	Yes	No
Lab Worker	Yes	As req'd, based on lab role	As req'd, based on lab role	Yes	Familiar *
PI, Laboratory Manager	Yes	All	All**	Yes	Familiar *

*must have a good understanding of the topics covered in the document and be able to readily reference it as needed.

**must complete all online training modules assigned by PI to workers in their lab.

4.5.5 Laboratory Safety Notebook(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:

1. This document
2. The lab-specific safety manual(s) for your lab(s)
3. Other training materials (protocols, SOPs, etc.)
4. Boise State Emergency Response Guide
5. Current contact information for COEN and BSU safety personnel
6. Information and forms relating to lab incidents/accidents
7. Records of safety training for each lab worker (Note: These may be located elsewhere but must be readily accessible).
8. 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](#), Section 7.1 or by clicking [here](#).

4.5.6 Chemical Ordering

- Lab personnel will order all chemicals in accordance with the College of Engineering chemical ordering policy.
 - This policy is designed to provide guidelines for how chemicals are ordered and delivered to laboratories.
 - For more information on the policy and the process to be followed, contact the [COEN Safety Liaison](#), Section 7.1.
-

4.5.7 Chemical Labeling

All chemicals, including those stored in temporary storage, must be properly labeled. Do not write over information printed on chemical labels. For temporary storage, include all the information from the chemical inventory list as well as the creation date of the temporary storage.

4.5.8 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.
 - Contact the [COEN Safety Liaison](#), Section 7.1 for more information.
 - Please read all worksheets to understand what chemicals require inventory and how to properly record the information.
 - The completed inventory is to be printed and stored in the Laboratory Safety Notebook(s).
-

4.6 Personal Protective Equipment

The information provided below is intended only to provide an overview of Personal Protective Equipment (PPE) requirements that may exist for your lab.

PPE should be considered the last avenue in providing work protection and be implemented only if elimination, substitution and, engineering and administrative controls cannot provide sufficient protection.

In general,

- **Closed-toe shoes and leg coverage** must be worn in the lab at all times.
- **Safety glasses** must be worn under the following circumstances in labs:
 - Performing sawing, grinding or cutting operations
 - When there is any foreseeable risk of injury to your eyes.
- **Lab safety coats and gloves** must be worn when handling chemicals and biomaterials.

For more detailed information on the PPE required in your lab, consult the protocols and procedures for specific lab 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.

NOTE: *Grainger Industrial Supply* (www.grainger.com) is a good source for purchasing of and information on PPE. See your PI or laboratory supervisor for information on and proper fitting of PPE.

5.0 CHEMICAL EMERGENCIES

5.1 Chemical Contact

- **If you are not sure how dangerous the chemical contact is, call 9-1-1.**
 - 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 [Lab Safety Checklist](#) in the safety manual for your lab. 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 your supervisor; then call University Security and Police at 426-6911.
 - Have the MSDS information for the chemical(s) available for reference. This information can be found in your lab safety notebook. If first responders are summoned, meet them at the location described in the Lab Safety Checklist in your lab safety supplement with the MSDS information for the chemical(s) that were contacted.
 - After the immediate needs associated with the contact have been dealt with, contact Boise State Risk Management to complete the proper forms relating to the exposure. See Section 3.4.
 - Complete a [Spill Investigation Report](#) from Section 5.5.
-

5.2 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 University Security and Police at 426-6911. You may also pull a fire alarm or request them to sound the alarm.

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 MSDS without putting yourself in harm's way.
- Evacuate the area, closing the doors behind you.
- Contact your supervisor; then call University Security and Police at 426-6911.
- Post warning outside the area and lock doors if possible to prevent re-entry.
- Complete a [Spill Investigation Report](#) from Section 5.5.

5.3 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 and University Security and Police 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 MSDS without putting yourself in harm's way.
 - Review applicable MSDS and determine controls, PPE, and need for assistance.
 - Put on necessary protective clothing (gloves, safety goggles or glasses, and lab coat).
 - Cover small spills with absorbent towels. Clean spill area working from outside toward the center.
 - Rinse spill area with water. Label and retain spill materials for EH&S.
 - Contact your supervisor; then call University Security and Police at 426-6911 so that they may contact EHS.
 - Complete a [Spill Investigation Report](#) from Section 5.5.
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5.4 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, Section 7.1) or

Lander Street Wastewater Treatment Plant:

Normal hours: 608-7382

After hours: 608-7380

Boise Department of Public Works Pretreatment Contacts

Mike Hunter, Senior Environmental Specialist 384-3993

Walt Baumgartner, Pretreatment Prog. Coordinator 384-3991

Terry Alber, Senior Environmental Specialist 384-3992

Also, complete a [Spill Investigation Report](#) from Section 5.5.

5.5 Spill Investigation Report

A Spill Investigation Report form must be completed in the event of a spill or an uncontained release of chemicals into a drain. The form can be found [here](#) or by going to:

<http://operations.boisestate.edu/ehs/files/2011/09/SpillInvestigationReport.pdf>

Contact [EHS](#) (Section 7.2) for assistance in completing this form if necessary.

6.0 WASTE MANAGEMENT

6.1 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.

6.2 Hazardous Wastes

- Waste classified as Hazardous Waste must be disposed of properly, in accordance with BSU's [Hazardous Waste Management Manual](#).
- If you have any questions regarding whether a waste material is hazardous or how to store or dispose of it, contact the EHS Hazardous Waste Officer in [Section 7.2](#).

6.3 Waste Pickup

All chemical waste generated in Boise State laboratories must be disposed of by the university's EHS department.

Currently, EHS uses an Excel spreadsheet for user's to complete and email to the Hazardous Waste Officer. Beginning in the summer of 2013, EHS will be moving to a software-based process by Chematix that will allow the user to characterize the waste and enter the pickup request into the system prior to EHS picking it up. While the system may have a learning curve, over time it is expected to streamline waste pickup requests, particularly for users that have processes that require frequent pickup of identical waste components.

EHS will be providing training on the Chematix system. During the transition to the new system, EHS will support both methods of chemical pickup requests.

If you have any questions regarding how to handle waste, contact either your lab PI, supervisor, [COEN Safety Liaison](#), Section 7.1 or Hazardous Waste Officer, [Section 7.2](#).

6.4 Illegal Disposal of Waste

Examples of illegal waste treatment include:

1. Leaving solvent-wetted materials or containers on the bench top or in fume hood to evaporate.
 2. Diluting a waste to render it non-hazardous.
 3. Venting a pressurized aerosol can solely to remove the contents.
 4. Disposing a waste down the sink or drain without prior approval from EH&S. Consult with the EHS Hazardous Waste Officer, [Section 7.2](#) before disposing of any chemical down a sink or drain.
-

6.5 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
-

6.6 Hazardous Waste Containers

If hazardous waste is not in its original container, make sure the replacement container is of a material that has long term compatibility with the waste.

Hazardous waste containers must be closed/sealed to the manufacturer's specifications. The only time a hazardous waste container can be open is when you are actively putting waste in the container.

Hazardous waste containers must be in good condition; replace deteriorated or damaged containers immediately.

Make sure you use only containers that seal properly and reliably. Those that don't are considered open (non-compliant) containers.

Examples of open containers include:

- "zip-lock" bags with a damaged seal or with material in the seal
 - a container with an improperly fitting or missing lid;
 - a container or bag that has a crack, hole or tear
-

7.0 ADDITIONAL RESOURCES

7.1 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:

Dick Sevier, Research Support Engineer

Office: ENGR 332

email: dicksevier@boisestate.edu

cell: 286-8175

7.2 EH&S

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
ph. 426-3906
- Katie Thomas, EHS Hazardous Waste Officer
katiethomas1@boisestate.edu
ph. 426-3303

Additional information regarding other members of the EHS team, university policy, training, etc. is provided on their website site at:

- <http://operations.boisestate.edu>
-

7.3 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
 - Safety training resources for research and teaching labs as well as for student projects
 - Commonly used forms, documents and templates
 - Chemical management guidance, including chemical ordering, chemical inventory and MSDS record-keeping
-

7.4 BroncoAlert

All students, faculty and staff are encouraged to opt in with their personal contact information to BroncoAlert, the emergency notification system at Boise State. The phone and text-based system allows the university to notify students, faculty and staff when an emergency is taking place on or near campus. The system will only be used in critical situations, including weather emergencies, with potential to affect health or safety.

More information on how to register for BroncoAlert can be found at <http://news.boisestate.edu/bronco-alert/>
