

MEC 416 LAB SAFETY MANUAL

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1.0 SCOPE

This document describes the standard operating procedures and practices encountered and to be practiced in the MEC 416 lab. 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.

For general emergency response measures, consult the [COEN Emergency Response Guide](#), which is described in Section 3.2.

It is mandatory that all individuals who perform work in 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 LAB SAFETY CHECKLIST

Below is a checklist of important safety-related information for your lab. **Familiarize yourself with this information. See Appendix A for map showing safety equipment locations.**

Lab Information:

Name: Functional Ceramics

Rm: MEC 416

Building Address: 1020 S Manitou Ave., Boise, ID 83706

Lab Phone Number: N/A

Important Safety-Related Locations:

Secondary Contact Info: On Door N/A Near Phone

Lab Safety Notebook: On the table next to the ball mill

Nearest Fire Extinguisher: MEC 4th floor, opposite MEC 416

Nearest First Aid Kit: In lab

Nearest Eyewash/Safety Shower: In Lab

Nearest Chemical Spill Kit: under sink next to fume hood

Nearest AED- MEC 2nd floor opposite elevator

Nearest Fire Alarm Pull: MEC 4th floor near stair well

Nearest Phone: MEC 4th floor near elevator

Safe Assembly Area For Evacuation: Engineering building parking lot

Meet 1st Responders: on W. University Dr.

3.0 EMERGENCY RESPONSE

3.1 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:**
 - **Activate the building's fire alarm system before calling 9-1-1.**
 - **Evacuate the building immediately!** Refer to **Appendix A Laboratory Evacuation Path** at the end of this document for additional evacuation information.
- **To report any police, fire, or medical emergency, call 9-1-1 from any phone.**

When calling 9-1-1:

- Stay on the line with the dispatcher.
- Provide the address of the building involved and your exact location if calling from a cell phone.
- The address of the MEC is: 1020 S Manitou Ave.
- 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.

3.2 COEN Emergency Response Guide

The **COEN Emergency Response Guide** has been designed to provide training to the College's faculty, staff and students to address an emergency situation.

The guide is included in your laboratory's safety notebook. It can also be accessed from the Safety website on the College of Engineering website. Go to <http://coen.boisestate.edu/safety/forms-documents/>, then click on the **COEN Emergency Response Guide** link.

3.3 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.

Secondary contact information is provided on the Emergency Response signage posted on the entrance of the lab.

4.0 LAB OPERATIONS AND HAZARDS

4.1 Description of Lab Operations

The operations and activities of this lab includes the following:

- Fabrication of oxide ceramics for dielectric and energy applications
 - Chemical synthesis, ball milling and high temperature sintering
-

4.2 Hazards Summary

The hazards of the lab's operation(s) include the following:

- Toxic Chemicals
 - Flammable liquid
 - Thermal energy
 - Mechanical
-

4.3 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** immediately.
-

4.4 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.
 - 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.
-

4.5 Personal Protective Equipment (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-toed shoes** must be worn in the lab at all times.
 - **Safety glasses or goggles** must be worn under the following circumstances in this lab.
 - When certain chemicals are being handled (refer to SDS)
 - By Visitors generally unfamiliar with lab hazards and processes
 - **When there is any foreseeable risk of injury to your eyes.**
 - **Lab Safety Coats** must be worn when handling chemicals.
 - It is recommended that approved **dust masks** be worn when working with coarse, non-hazardous nuisance powders. Contact the COEN Safety Liaison or the Environmental Health Safety and Sustainability office to discuss options for respiratory protection.
 - Workers must wear **face shields** and **chemical resistant gloves** when working with strong acids, bases or any other chemicals of similar toxicity.
 - Workers must wear appropriate **gloves** whenever handling hazardous chemicals.
 - NOTE: *Lab Safety Supply* (www.labsafety.com) is a good source for purchasing of and information on PPE. See your laboratory supervisor for information on and proper fitting of PPE.
-

4.6 Engineering Controls for Hazards

- This laboratory is equipped with an exhaust hood. This **hood** must be used whenever handling hazardous materials that can become airborne at levels approaching or greater than OSHA limits. **This hood is NOT to be used with perchloric acid.**
- This laboratory is equipped with a **flammables cabinet and corrosive cabinet**. Chemicals must be stored in **appropriate cabinets**.
- 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.
- Acids should be placed in **secondary containers**.
- Incompatible chemicals must always be **physically segregated** by storing them in separate cabinets and/or secondary containers.
- A **safety shower and eye wash station** are located in the laboratory near the left side of the hood.

4.7 Administrative Controls for Hazards

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.

4.7.1 Lab Signage

The following information is posted on the laboratory entrance from the main hall. This information is general lab information as well as contact information that can be readily updated as required.

- Information relating to the general hazards, PPE, and rules of the lab.
- Secondary contact information as described in Section 3.3 **Secondary Contacts** including CPR and AED certified personnel in COEN.

4.7.2 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 [COEN Emergency Response Guide](#)
- General training modules on blackboard.
 1. Hazardous Chemical Waste
 2. Compressed Gases
 3. Electrical Safety
 4. Hazard Communication
 5. Emergency Action Plan
 6. BSU Chemical Hygiene Plan
 7. Flammable and Combustible Liquids
- Specific training relating to tasks performed.
This training may include document-based training (procedures) as well as operational hands-on training.
- 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 [Laboratory Safety Notebook\(s\)](#) as described in Section 4.7.5.

In order to undertake the on-line training, contact the [COEN Safety Liaison](#) to be set up in blackboard.

When you are done, print out the web page which shows your test record. At the bottom of that page write the words "**I have read and understood the contents of the MEC 416 Laboratory Safety Manual**", sign and date the page, then submit it to the laboratory supervisor. **There is no need to print out your certificate of completion.**

- MEC 416 Laboratory Safety Manual (this document)
- Specific training relating to tasks performed. This training may include document-based training as well as operational hands-on training.

The Laboratory PI is responsible for ensuring training materials and processes are maintained.

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4.7.3 Certification

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.
 2. A Support Worker is a person who works periodically to support the facility or IT needs of the laboratory.
 3. A Laboratory Guest Worker is a person who works temporarily in the laboratory for a period of ten days or less in a given calendar year.
 4. A Laboratory Worker is a person who routinely performs work in the laboratory for a period of more than ten days in a given calendar year.
 5. A Laboratory Supervisor is a specific person charged with overseeing activities within the lab.
- Completion of the following training is required for the worker types as shown below:

	Laboratory Safety Manual	EHSS General Training	Task Specific Training
Laboratory Visitor	No	No	No
Support Worker	Yes	No	No
Laboratory Guest Worker	Yes	No	As required
Laboratory Worker	Yes	Yes	As required
Laboratory Supervisor	Yes	Yes	All

- The Laboratory PI is responsible for ensuring certification records are maintained.

Re-certification of workers is required annually or when there has been sufficient content change of the training to warrant re-certification as deemed by the Laboratory PI.

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4.7.4 Business Hours

With the exception of official university holidays, the normal hours of operation for the lab are:

Monday – Friday
8:00am – 5:00pm

Any qualified user is entitled to use the lab during these times.

Out-of-Hours Use:

The Laboratory Supervisor and qualified Laboratory Workers (as defined in 4.7.3) may use the lab outside these times provided that at least one other person is also present within earshot.

No user should be present in the lab on his/her own outside of normal business hours.

No work involving chemical solvents, acids, bases, furnaces, or other “dangerous” aspects should be conducted outside of normal business hours.

Any users found in violation of this policy will face disciplinary action, including possible exclusion from the lab, at the discretion of the Laboratory PI.

4.7.5 Laboratory Safety Notebook(s)

The 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 training 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

For more information on how to organize a lab safety notebook, contact the **COEN Safety Liaison**, Section 7.1.

4.7.6 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.
-

4.7.7 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.

4.7.8 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.
 - The completed inventory is to be printed and stored in the [Laboratory Safety Notebook\(s\)](#) as described in Section 4.7.5.
-

4.8 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/>.

Incidents (and near misses) can also be reported on-line from the [incident report forms](#) found on Risk Management's "forms and documents" page.

5.0 CHEMICAL EMERGENCIES

- 5.1 Chemical Contact
- **If you are not sure how dangerous the chemical contact is, call 9-1-1.** See Section 3.1 **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 2.0 **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 a area away from the exposure.
 - After immediate treatment for the exposure has been completed, contact your supervisor; then call EH&S at 863-8024 (24-hr cell) and Security at 426-1453.
 - Have the MSDS information for the chemical(s) available for reference. This information can be found in the notebook described in Section 4.7.5 **Laboratory Safety Notebook(s)**. If first responders are summoned, meet them at the location described in the **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 4.8 **Lab Incidents, Accidents and Property Loss**
 - 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 9-1-1. You may also pull a fire alarm.

Otherwise, take the following steps:

- If the spill occurs in the fume hood, close the hood sash.
 - 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 EH&S at 863-8024 (24-hr cell) and Security at 426-1453.
 - 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 clean up, contact your supervisor and EH&S at 863-8024 for assistance.

If EH&S is not available, contact Boise State Security at 426-1453.

Otherwise, take the following steps:

- If the spill occurs in the fume hood, close the hood sash.
- 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 or powder absorbent. 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 EH&S at 863-8024 (24-hr cell) and Security at 426-1453.
- Complete a [Spill Investigation Report](#) from Section 5.5.

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 EHSS at 863-8024 (24-hr cell) so that they can contact the proper authorities.**

If EHSS cannot be reached, the responding faculty or staff member must report the spill to the [COEN Safety Liaison](#), Section 7.1, or

Lander St. Wastewater Treatment Plant: 608-7382 or 608-7380

Boise Department of Public Works Pretreatment Contacts

Brett Morrison, Senior Environmental Specialist 608-7146

Brian Feather, Environmental Technician 608-7147

Terry Alber, Pretreatment Prog. Coordinator 608-7523

Rick Christenson, Senior Environmental Specialist 608-7512

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 uncontained release of chemicals into a drain. Contact EHSS for assistance in completing this form; see Section 7.2, *EHSS*.

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, or would like a copy of the Hazardous Waste Management Manual, contact the [EHSS Chemical Waste Officer](#) in Section 7.2.
-

6.3 Waste Pickup

- To have waste picked up from your lab, first fill out a [Waste Pickup Form](#). Contact either the [COEN Safety Liaison](#), (Section 7.1) or [EHSS Hazardous Waste Officer](#) (Section 7.2) for a copy of this form.
 - E-mail the completed form to [EHSS Hazardous Waste Officer](#).
 - Pickup will typically be done within 5 days of notifying EHSS, depending on storage needs and space availability. If you have any questions regarding how to handle waste, contact either your lab PI or supervisor, [COEN Safety Liaison](#) or the EHS Hazardous Waste Officer.
-

6.4 **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 EHSS. Consult with the Chemical Waste Coordinator in EHSS before disposing of any chemical down a sink or drain. Contact information is found in previous section.
-

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

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 in the container;
- and 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 Kimwipes 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; and a torn bag.
-

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:

Chris Siepert, Lab Safety Specialist
Office: ENGR 332
email: christophersiepert@boisestate.edu
cell: 440-8591

7.2 EHSS

For chemical contact, chemicals spills or other lab emergencies, call the EHSS 24 hr cell: 863-8024.

The Boise State Environmental Health, Safety and Sustainability (EHSS) team can provide a wealth of information regarding university policy and safety information regarding laboratory work across campus.

- Jane Bartlett, EHSS Hazardous Waste Officer
janebartlett@boisestate.edu
ph. 426-3303

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

- <http://vpfa.boisestate.edu/EHS/>
-

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
 - 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.
 - Calendar of safety-related events
-

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Appendix A. Laboratory Evacuation Path

EVACUATING YOUR BUILDING OR WORK AREA:

1. When ordered to evacuate or when alarms are activated, always leave immediately.
2. Follow path shown by red arrows in the following map to stairwells and descend to first floor exits.
3. Exit quickly and calmly using nearest emergency escape routes and marked exits and proceed to safe assembly locations as identified in the building maps of this section.
4. **Do not use elevators.**
5. Be alert for those persons needing assistance. See **EVACUATION ASSISTANCE** below.
6. During an evacuation, faculty, staff and students will generally go to the safe assembly area.
7. If you or members of your lab have specific information relating to the incident, ensure you meet first responders at the location defined in Section 2.0 **Lab Safety Checklist** with appropriate lab documentation (MSDSs, chemical inventory, etc.).
8. Be alert for trapped, injured or other persons needing assistance.
 - a. Help those requiring evacuation assistance get to designated areas for evacuation assistance. Transporting of individuals requiring evacuation assistance up or down stairwells shall be avoided until emergency responders arrive unless an imminent life-threatening condition exists.
 - b. Notify emergency responders immediately upon their arrival of the exact location of any injured or trapped persons, and those waiting in designated areas for evacuation assistance.

Do not return to an evacuated building unless directed to do so by authorities.

EVACUATION ASSISTANCE

1. Be alert for mobility-impaired, trapped, injured or other persons needing assistance.
2. **On second or higher floors, assist persons requiring assistance to get to a designated Evacuation Assistance Area.** These areas are identified in map on following page.
3. 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.
4. Notify emergency personnel immediately upon their arrival of the exact location of any injured or trapped persons, those waiting in designated Evacuation Assistance Areas and any others who may be anywhere in the building.

EVACUATION & SAFETY EQUIPMENT MAP- MICRON ENGINEERING CENTER, 4TH FLOOR

