LABORATORY SAFETY
Mechanical Engineering

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I. Introduction

The Mechanical Engineering (MEE) Laboratory Safety Plan describes policies, procedures, and work practices that are intended to provide the faculty, staff, students and visitors to the MEE laboratories a safe and efficient work environment. This Safety Plan is a collection of standard operating policies and procedures based on the U.S. Occupational Safety and Health Administration (OSHA), the University of Maine and MEE rules and guidelines. This safety plan is to be a companion to the University of Maine System Laboratory Safety Plan Model and Guide (UMSLSP), OSHA Code of Federal Regulations and Maine Department of Labor rules and regulations.

Laboratory Areas

This document is a general safety plan for Mechanical Engineering teaching and research laboratories within the Crosby Laboratory and Advanced Manufacturing Center (AMC) building. Laboratory locations, name and faculty/staff supervisor are as follows:

<table>
<thead>
<tr>
<th>Room</th>
<th>Name</th>
<th>Supervisor</th>
</tr>
</thead>
<tbody>
<tr>
<td>103 (CL)</td>
<td>Parts and Supply Rooms</td>
<td>Art Pete</td>
</tr>
<tr>
<td>108 (CL)</td>
<td>Composite Materials lab</td>
<td>Art Pete</td>
</tr>
<tr>
<td>104 (CL)</td>
<td>Controls and Mechatronics lab</td>
<td>Vel/Shahinpoor</td>
</tr>
<tr>
<td>100 (CL)</td>
<td>Capstone Design Room 100</td>
<td>Peterson/Pete</td>
</tr>
<tr>
<td>107 (CL)</td>
<td>Hosmer Design Studio</td>
<td>Peterson</td>
</tr>
<tr>
<td>105 (CL)</td>
<td>Machine Shop</td>
<td>Art Pete/Peterson</td>
</tr>
<tr>
<td>102 (CL)</td>
<td>Ultrasonics Research lab</td>
<td>Peterson</td>
</tr>
<tr>
<td>116 (CL)</td>
<td>Fume Hood Room 116</td>
<td>Pete/Shahinpoor</td>
</tr>
<tr>
<td>105C(CL)</td>
<td>Smart Materials/Artificial Muscle Lab</td>
<td>Pete/Shahinpoor</td>
</tr>
<tr>
<td>203(CL)</td>
<td>Biomedical Engng/Adv. Robotics Lab</td>
<td>Shahinpoor</td>
</tr>
<tr>
<td>201(CL)</td>
<td>Pickerings/Turbojet/Wind Tunnel lab</td>
<td>Boyle/Shahinpoor</td>
</tr>
<tr>
<td>200(CL)</td>
<td>Rehabilitation Robotics (ReNeu) lab</td>
<td>Deshpande/Shahinpoor</td>
</tr>
<tr>
<td>202(CL)</td>
<td>MEE341/MEE442/MEE443 Labs</td>
<td>Poland/Peterson/Boyle</td>
</tr>
<tr>
<td>206 (AMC)</td>
<td>Remote Structural Monitoring lab</td>
<td>Caccese/Shahinpoor</td>
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<td>206 (AMC)</td>
<td>Cell Mech/Tissue Mfg lab</td>
<td>Sarvestani</td>
</tr>
<tr>
<td>204 (AMC)</td>
<td>Vince’s lab/Head Injury lab</td>
<td>Caccese/Shahinpoor</td>
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Scope

All laboratories within the University of Maine System must have a specific laboratory safety plan. This manual applies to all faculty, staff, students, visitors, UM employees and contractors that enter the MEEE laboratories.
Responsibilities

Laboratory Manager
Art pete is the MEE Laboratory Manager. The Laboratory Manager’s office is located in Room 102 Crosby Hall, phone (207) 581-2141.

Chemical Hygiene Officer
Art pete is Primary Chemical Hygiene Officer located in Room 102 Crosby Hall, phone (207) 581-2141.

Plan Distribution/Location

Copies of the MEE Laboratory Safety Plan will be maintained in the Laboratory Manager’s office, Room 102 Crosby and other places as deemed necessary.

The University of Maine Safety and Environmental Management (SEM) resources are available on the University of Maine SEM website http://www2.umaine.edu/SEM.

References

OSHA’s Final Rule (29 CFR 1910.1450)

University of Maine Safety and Environmental Management website http://www2.umaine.edu/SEM

Safety Training

MEE personnel are required to successfully complete the following safety training:

University of Maine Basic Safety Training
All faculty, staff and students working in the MEE department laboratories are annually required to successfully complete the University of Maine Basic Safety Training Course; this is a web-based course that includes a qualifying quiz (http://www2.umaine.edu/SEM). Each employee, graduate student or undergraduate student working in MEE laboratories is responsible for submitting proof of successful completion of this course to the Laboratory Manager.

MEE General Laboratory Safety Training
Every MEE employee, graduate student, and volunteer working in the
laboratories is required to complete and document safety training relevant to his/her responsibilities, as determined by the Laboratory Manager. These include the following training areas:

MEE General Laboratory Safety
Training Emergency Action Plan
Training Chemical Hygiene Plan
Training

In addition, MEE employees who work or supervise other workers in the lab are required to complete and document the following online training offered by SEM:
  - Basic Safety Training Course
  - Hazard Communication (HAZCOM) training
  - Satellite Accumulation Area training

All supervisors are required to complete and document:
  - Supervisor Safety Training

Authorized Personnel Categories

Personnel authorized to enter the MEE laboratories fall into the following three categories:

**Personnel with unrestricted entry to the MEE laboratories.**
This is the highest level of authorization. Personnel in this category must complete University of Maine Basic Safety Training, MEE General Laboratory Safety Training, Hazard Communication Training (HAZCOM), and Satellite Accumulation Area training (SAA) as well as training for equipment use.

**Personnel with restricted entry to the MEE laboratories.**
Personnel in this category are authorized to use specific laboratories. They must complete University of Maine Basic Safety Training; they must demonstrate knowledge of the MEE Safety Plan for the specific laboratory they will be using; and they must be trained on the equipment they will be using. This category of authorization applies only to laboratories where chemicals are not used; therefore HAZCOM and SAA training are not required.

**MEE administrative personnel authorization.** Personnel in this category are authorized to enter laboratories to perform administrative tasks. These personnel must complete University of Maine Basic Safety Training and the MEE General Laboratory Safety Training.
II. MEE General Laboratory Safety

General

- Proper personal protective equipment (PPE) should be worn at all times when working in the MEE laboratories.

- No sandals or open-toe shoes are allowed in any laboratory.

- Clothing of laboratory workers should protect from the neck to below the knees; no shorts, short skirts, sleeveless garments, or bare midriffs. Overly loose or tight (restrictive) clothing, long unrestrained hair, scarves or excessive fringe are also unsafe.

- No food is allowed in any laboratory. This includes candy, soda, coffee, tobacco, etc.

- Individuals must have specific training and show proficiency on a piece of equipment prior to use.

- There should be at least two people present when working with equipment in the laboratories.

- Authorized personnel working on live electrical controls will wear all PPE required for the task being performed.

Hearing protection

Hearing protection is required when operating machinery and power hand tools. This is particularly important in the Pickering/Jet Engine/Wind Tunnels lab.

After Hours Work

If you need to work in the MEE laboratories outside of normal business hours (7 a.m. through 5 p.m., Monday through Friday), please inform the Laboratory Manager and/or the faculty supervisor.

MEE Visitors General Safety Rules

Visitors to the MEE laboratories fall into three categories:

1. Tour groups and individual visitors;
2. Clients who are observing a project;
3. Clients who are participating in a manufacturing and/or testing procedure.
The MEE employee accompanying clients/visitors is responsible for the safety of the client/visitor and must ensure that the client/visitor is following all safety requirements.

No matter what the visitor’s purpose, the following minimum safety requirements will be observed:

- A MEE employee will accompany visitors.
- No food or drink is allowed in any laboratory. This includes candy, soda, coffee, tobacco, etc.
- Proper PPE should be worn at all times in all laboratories.
- Hearing protection is required around loud operations.

III. Emergency Action Plan

Background

The major hazards within the MEE laboratories are:

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Location</th>
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<tbody>
<tr>
<td>Fire</td>
<td>All labs</td>
</tr>
<tr>
<td>Chemical Spill</td>
<td>All labs</td>
</tr>
<tr>
<td>Explosion</td>
<td>All labs</td>
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</tbody>
</table>

The evacuation alarm in the Cosby Hall is sounded with an evacuation bell.

Emergency Procedures

In the event that you:
- Discover a fire or chemical spill emergency;
- Smell smoke or the odor of burning or abnormally hot material; or
- The alarm is sounded.

You shall:
- Verbally warn others in the area.
- Activate the Fire Alarm system. (Pull stations near the exits.)
- If your workspace is not currently involved and you can do so safely: Shut windows and close the door tightly behind you as you leave.
- Evacuate the building, conducting a minimal sweep for visitors and students on the way out.
- If you discovered the fire or chemical spill emergency Call 911 (Cell phone call 581-4040) from a safe place and inform them of what has happened.
- Assemble at the rally point and account for all employees.
- Brief the fire department of concerns upon their arrival.
- Remain outside of the building until the authorities give clearance.
Exit Pathways

Offices upstairs and downstairs exit out the nearest exit and go to the rally point. From the lab use the closest exit and go to the rally point (see attached building maps, Appendix B and/or attend training).

Use of Emergency Equipment

Although it is policy to evacuate in case of a fire, circumstances may dictate that a fire extinguisher is needed. ONLY use a fire extinguisher if:

1. You have been trained in the **hands-on** use of an extinguisher within the last three years.
2. You are able to put out the fire without endangering yourself or others.
3. You have an open path of escape at all times

Personal Injury Emergency Procedures

In the event that:
1. You are injured.
2. Come upon an injured person.
3. Encounter what you suspect to be blood or other bodily fluids.

You shall:
1. Call **911** (Cell phone call 581-4040) and inform them what has happened.
2. If the victim is other than you, administer first aid only if you are currently certified and are using the proper personal protective equipment.
3. If the situation involves suspected blood or other bodily fluids and no victim, still call Public Safety at **911** (Cell phone call 581-4040) and inform the dispatcher. Keep people away from the suspected bodily fluid (**DO NOT attempt a clean up on your own**).
4. The injured person should file an **INCIDENT REPORT Workers’ Compensation: Employee Injuries & Illnesses** (UM system form).

Prevention/Follow-up

Periodic safety audits will be conducted by the employees and safety coordinator to reduce the risk of hazards within the workspaces. Once an emergency situation has been mitigated, an incident investigation will be completed, and corrective measures will be implemented to prevent future recurrence of the problem.

Implementation and Maintenance

This plan will be reviewed, trained, and exercised when the plan is first implemented, whenever a new employee is hired, when changes necessitate, or at least once a year. The training will consist of providing a copy of the Emergency Action Plan and evacuation map to the employee, explaining procedures, walking through an evacuation, and answering any questions the employee has.
Annual evacuation drills will also be conducted.

The person responsible for updating and training this Emergency Action Plan is the MEE Laboratory Manager.

Further Information on Emergency Actions

Call the University of Maine Department of Safety & Environmental Management at 1-4055.

IV. Chemical Hygiene Plans

Objective

The MEE Chemical Hygiene Plan is a written set of rules and guidelines for the safe handling of chemicals in the MEE laboratories. The plan includes all aspects of handling chemicals: ordering, receiving, storage, use, disposal, and spill cleanup. It is the goal of the MEE department to have necessary chemicals available without storing an excess amount. MEE is committed to the safe use, storage and disposal of chemicals.

Responsibility

Chemical Hygiene Officer

The MEE Laboratory Manager will assume the role of Chemical Hygiene Officer for the department.

The Chemical Hygiene Officer will work under the guidance of the University of Maine Safety and Environment Management’s Chemical Hygiene Officer and has the authority to:

- Write and update the MEE Chemical Hygiene Plan on an annual basis.
- Implement and enforce the Chemical Hygiene Plan.
- Provide training for the Chemical Hygiene Plan to all MEE employees and students who use or may come in contact with chemicals.
- Be the point of contact between MEE employees and students, and Safety and Environment Management’s Chemical Hygiene Officer.

Project Manager

- Is responsible for chemicals ordered, stored, used and disposed by the project.
- Includes chemical and hazardous waste plans in the project’s work instructions.
- Ensures chemicals and chemical wastes are handled properly, including inspection of the project’s satellite accumulation area.
• Provides training for specific chemicals used for the project.
• Provides training for specific PPE necessitated by the use of chemicals as project work dictates, or on an annual basis.

Employees and Students
• Read and follow the Chemical Hygiene Plan.
• Read and follow the Material Safety Data Sheet (MSDS) for any chemical he/she will be using.
• Reads and follows the project work instruction and SOP.

Information and Training

Training requirements
A. University of Maine Basic Safety
B. MEE General Laboratory Safety
C. Emergency Action Plan
D. Chemical Hygiene Plan
   • Training on specific chemicals.
   • Chemical spill cleanup.
   • Satellite Accumulation Area (SAA).
   • Chemical storage and disposal.
   • PPE

Training implementation
The Project Manager will provide training to all project personnel concerning:
• The use and handling of specific chemicals.
• The project work instruction’s for chemical use and hazards.

The Project Manager will provide the Chemical Hygiene Officer with training records for all project personnel trained in specific chemical use for a project.

MSDS
• Material Safety Data Sheets (MSDSs) are OSHA-mandated forms that contain information relevant to a hazardous chemical. This form must include both acute and chronic health hazard information, recommended personal protective equipment (PPE), and emergency response procedures.
• MSDS will be maintained in the MEE environmental laboratories where chemicals are kept.
• All chemicals will have an MSDS.
• The Project Manager is responsible for providing the Chemical Hygiene Officer with the MSDSs for any new chemicals ordered to and/or used in the laboratory.

Training Records
• Will be maintained by the Chemical Hygiene Officer for each employee and student including employee name, training date, and name of the person conducting the training.
• Employee records will be maintained in the Laboratory Manager’s office for one year after the employment has been terminated in MEE.

Chemicals

Identification
All substances have a rating system governed by the National Fire Protection Association (NFPA) or the Hazardous Materials Identification System (HMIS). The MEE laboratories will use these two systems of hazard identification for all chemicals used by the MEE. The NFPA/HMIS rates from 0 (no hazard) to 4 (extremely hazardous) in three categories: health hazard, flammability, and reactivity.

A. Non-hazardous chemicals - Any substance in the MEE labs that has NFPA/HMIS ratings of less than 2 (0, 1) will be treated as a non-hazardous chemical for storage. This means the chemical does not require special storage, however, it may require special disposal.

B. Hazardous chemicals - Any substance that has a NFPA/HMIS rating of 2 or more will be treated as a hazardous chemical for handling, use, storage and disposal.

C. Handling, use, storage, and disposal will be in accordance with
   o The MSDS
   o MEE Chemical Hygiene Plan
   o The project’s work instruction

Accumulation/handling of waste
A. Project chemical waste storage and disposal plan
   Any laboratory SOP that uses chemicals will include a plan that will describe how:
   • Waste will be generated
   • Waste will be stored
   • Waste will be disposed

B. Procedure for collecting waste:
   1. The accumulation of waste is to be kept to a minimum.
   2. Waste will be placed into the smallest container possible.
   3. The container will be compatible with the chemicals making up the waste.
   4. The container will be labeled as waste with a list of the chemicals making up the waste.
   5. The waste container will be stored in a compatible cabinet closest to its generation point.
   6. The storage cabinet will be compatible with the chemicals in the waste.

C. University of Maine Chemical Reuse Program
   • SEM collects unneeded inventory and redistributes chemicals to campus departments at no cost to the end user.
   • The chemical reuse program is designed to reduce the quantity of unwanted chemicals being discarded on campus as hazardous waste. This service is provided to the campus community free of charge as part of an educational effort in reduce, reuse, and recycle strategies.
Chemical Disposal

Chemicals will be turned in to SEM for disposal when they:
- Have been consumed (empty containers).
- Are waste generated from lab experiments.
- Have become excess to the project.
- Are no longer needed by the project.
- Have been transferred to secondary containers.
- Have expired.

Procedure to dispose of chemical waste products to SEM:
1. Inform the Chemical Hygiene Officer that the chemical is being disposed (for inventory purposes).
2. Fill out a Request for Chemical Pick-up and Disposal form (see Appendix A) and fax it to SEM.
3. Attach Chemical Pick Up and Disposal form to the chemical container.
4. Place the container in the appropriate SAA for pick-up.

Procedure to dispose of nonhazardous chemicals:
1. Inform the Chemical Hygiene Officer that the chemical is being disposed (for inventory purposes).
2. The Chemical Hygiene Officer will determine the disposal requirements for the chemical and inform the responsible person of the procedure.
3. The responsible person will dispose of the chemical as required.
4. If a nonhazardous chemical is required to be turned in to SEM for disposal, follow the procedure for hazardous chemical disposal.

Disposal of chemical waste and wastewater to SEM:
1. The waste container will be turned in to SEM when:
   - It is full.
   - The project is completed.
   - Waste will not be generated for a period of five or more days.
2. Fill out a Request for Chemical Pick Up and Disposal form (see Appendix A) and fax to SEM.
3. The chemical waste will remain in the SAA for pick up.
4. University of Maine and MEE strive to limit waste production and release through:
   - Waste minimization, recycling/reuse, use reduction, and substitution with alternative chemicals that are less toxic to the environment and public health.
   - Depositing chemical waste in proper containers and disposing of through the SEM. With the exception of the rinsing of chemical residue in laboratory sinks, chemical waste will not be put into drains including storm drains.

Chemical Ordering and Receiving Procedures

Chemicals may be ordered within the following parameters:
• The chemical must be needed for a MEE project or classroom activity.
• Quantity must be the minimum required for the project’s completion.
• The designated MEE laboratory is authorized to support the chemical’s use based on:
  o PPE requirements.
  o Storage requirements.
  o Disposal requirements.

**Chemical receiving:**

1. An Administrative Assistant in the MEE office will receive or sign for all incoming chemicals being delivered to MEE by commercial carriers.
   • Leaking or damaged packages will be refused.
   • Chemicals will not be released for use until processing is completed.
   • Incoming chemicals will remain in original shipping packaging until processing is completed.
2. The Administrative Assistant will notify the person who ordered the chemical and/or the Laboratory Manager when chemicals have been received.
3. The Laboratory Manager or person who ordered the chemical will open the package, inspect the package for leaks/damage, then give the packing slip to the department Accounts Manager.
4. The chemical quantity and location is updated in the MEE chemical inventory and it is given a MEE tracking tag.
5. The chemical is then stored in the proper place in the laboratory according to its compatibility with other chemicals.
6. The MSDS should be added to the MSDS binder for the appropriate chemical storage area.

**Secondary Container Labeling**

If a chemical is transferred to a secondary container the container must be labeled with:

• A NFPA sticker with the appropriate numbers assigned to each color code.
• The date.
• The initials of the person using the chemical from secondary container (working quantity).
• When the working quantity is no longer needed, the person using the chemical is responsible for contacting the Laboratory Manager to ensure proper disposal of the chemical.

**Industrial Hygiene**

**Personal Protective Equipment (PPE)**

• PPE, as required by the MSDS, will be worn at all times when handling chemicals.
• PPE requirements will be listed in the appropriate Laboratory Operating Procedure
• If the MSDS does not require PPE, (Health NFPA/HMIS of 0 or 1) at a
minimum appropriate chemical glove and safety glasses will be worn.
• No sandals or open-toe shoes are allowed in any laboratory.
• Clothing of laboratory workers should protect from the neck to below the knees; no shorts, short skirts, sleeveless garments, or shirts that expose midriffs will be allowed during the use of MEE laboratories. Overly loose or tight clothing, long unrestrained hair, scarves or excessive fringe are not allowed during the use of MEE laboratories.

Storage Procedures

General chemical storage requirements:
• Chemicals will be stored according to manufacturers’ and MSDS instructions.
• Storage must be away from exits, heat, and direct sunlight.
• Shelves must be substantial enough to support the weight of the chemical containers and be chemical resistant.
• Flammable or reactive chemicals will not be stored in a wooden cabinet.
• Chemicals will not be stored over shoulder height - 4 feet.
• Sufficient area will be provided so that incompatible chemicals can be segregated.
• Proper ventilation of chemical storage cabinets will be supplied and special ventilation may be required (consult MSDS).
• Secondary containment will be provided for liquids that are flammable, corrosive, highly toxic, or highly volatile. Plastic tubs are sufficient in many cases.
• Flammables will be stored in flammables cabinets at all times.
• Drums will be grounded and stored upright on secondary containment pallets.
• Bench tops will not be used as storage areas.
• Chemicals requiring refrigerated/freezer storage must be stored only with compatible materials.
• Secured storage may be necessary for highly toxic or regulated chemicals; see the MSDS and Laboratory Manager.
• With the exception of gas cylinders, chemicals cannot be stored on the floor.
• Gas cylinders must be stored away from heat sources, kept upright, and secured with a proper harness.

Containers:
• Must be constructed from a proper material that is compatible with the chemical that it will contain.
• Must be physically sound (i.e., there should be no rust or bulging).
• Must have tight fitting lids that prevent a spill if the container is tipped.
• All containers, including gas cylinders, must be labeled with contents and hazards.
• Gas cylinders must have cap installed when not being used.

Compatibility
• Chemicals must be stored in such a manner as to avoid interaction between incompatible chemicals. Segregation of incompatibles may be accomplished
by adding labeled plastic tubs to the storage area, which provide both segregation and secondary containment in case of a leak. This will not work in the case of chemicals that attack the plastic tubs or give off fumes that interact with other chemicals in the same cabinet.

- Incompatible chemicals will not be stored above each other in the case of leakage.
- Any time there is any question, or an extremely hazardous chemical is to be stored, consult the MSDS and get advice from the Laboratory Manager and/or SEM.

Spill Response, Evacuation, and Reporting

Chemical spill guidelines

Chemical spills are separated into two classes: emergency and non-emergency:

- **Emergency spills** will be immediately reported to University of Maine Public Safety, and no clean up should be attempted. They are spills that:
  - Result in an injury.
  - Impact more than just the room it occurred in.
  - Is in a public area (hallway, stairwell, or common room).
  - Does not have a proper spill kit available.
  - Is larger than those on-site are trained to handle.
  - Requires PPE that is not available.
  - The employee does not know the proper PPE.
  - The employee is not sure what was spilled.
  - Are too large for the spill kit.
  - The employee is just not sure what to do.
  - May be too large for cleanup.

- **Non-emergency spills** result in none of the above-mentioned consequences and may be cleaned up by MEE laboratory workers providing they can do so safely.

Emergency chemical spill procedures guide

A. If the hazardous material has contaminated a person, take immediate first aid action. Most likely, this will be the use of the emergency shower and/or eyewash (rinse for a full fifteen minutes).
  - While taking first aid action, shout for help.
  - Let others know of the danger.
  - Seek medical attention.

B. If you are on the scene, but not the victim, administer first aid only
  - If you have been trained.
  - If you are using the proper PPE.
If you have called 911 or arranged for someone else to call 911.

C. If you have not been contaminated:
   • Leave the room.
   • Secure the door.
   • Warn others to stay away.

D. Activate the evacuation/fire alarm and call 911 from a safe place. Give the dispatcher the following information:
   • Location of the spill (building, room number and portion of room affected).
   • Identify the material spilled.
   • Your name and phone number where you can be reached.
   • Meet the emergency responders and identify yourself as the person who reported the spill.
   • Remain available until the commander of the hazmat team tells you your help is no longer needed.
   • The incident commander of the fire department is in charge of the incident and is required to follow very strict procedures. These procedures can take from one-half hour to five hours or more. Having accurate and timely information from the people involved can shorten these procedures.
   • Do not re-enter the building until it is declared safe by the authorities.

Non-Emergency chemical spill guide

A. Determine that you can safely handle the situation with your available resources.
B. Alert others in the area to the problem.
C. Prevent others from coming into contact with the hazardous material, by barricading, locking doors, establishing warning signs, or having someone stand at the entrance to direct traffic.
D. Perform the cleanup in accordance with the MSDS.
E. Call Safety and Environmental Management (581-4055) to report the spill and report the following information:
   • Where and when the spill occurred
   • Who was involved (both name and phone number)
   • What chemical was spilled
   • The quantity spilled
   • How the cleanup was accomplished
   • Safely dispose of the material resulting from the spill by placing it in a compatible, sealed container and label it as “Spill Cleanup Material”. This label must also contain a list of the chemical contents of the spill including amounts and concentrations. Complete and send a request for chemical pickup form to SEM.
• Maintain general cleanliness and housekeeping.
• Aisles and walkways will be kept clear of storage.
• Stairwells and hallways must be kept clear of combustible materials or items that may be easily moved into an exit path.
• A minimum egress of 28 inches must be maintained at all times.
• Work surfaces will be reasonably clear and should allow work to be conducted in an efficient and safe manner.
• Work surfaces will be clear of chemical spills and contamination.

### Fume hoods

• SEM inspects fume hoods annually.
• Use a tissue attached to the bottom of the sash to determine if airflow continues as you are working in the hood.
• Only equipment that must be vented or operated in a ventilated area will be maintained in a fume hood.
• Fume hood sashes shall not be placed above the maximum operating height.
• Sashes should be used at the lowest position possible to allow for comfortable manipulation of materials inside the fume hood.
• Equipment in fume hoods should not be operated if the airflow is below the minimum acceptable levels.
• Fume hoods which are used for processing or manipulations may not be used to store chemicals or hazardous waste.

### Air Monitoring

Air Monitoring to assess employees’ exposure level will be required for any chemical use, when the MSDS indicates the chemical is toxic by inhalation. Refer to 29 CFR 1910.1000 Table Z-1:

SEM conducts air monitoring as necessary
• The PI or Laboratory Manager will coordinate monitoring before the chemical is used on the project and any time the process has a significant change that may affect the exposure level.
• When a respirator is required the PI or Laboratory Manager will ensure all project employees are qualified before allowing them to use a respirator and the chemical.

If a respirator is required:
• The University of Maine Employee Medical Monitoring Procedure will be followed.
• SEM will perform respirator training and test fitting.
• Only respirators that have been test fitted to the employee by SEM will be used.
• Respirators will be clean and stored in a container that will prevent the respirator from being damaged.
Chemical Inventory

- An annual chemical inventory will be conducted for all MEE laboratories.
- The inventory is kept with the Laboratory Manager.
- Any chemical that is outdated or no longer needed will be disposed.

Laboratory Specific Plans

Chemical Hygiene Plans
Detailed Chemical Hygiene Plans (CHP) exist for the Environmental Engineering laboratories (Boardman Hall rooms 15/17, 36, 29, 30, 40) and chemical storage area (room 28S). These plans are available from the Laboratory Manager and printed copies are kept in laboratory rooms 29 and 40.

The laboratory-specific CHPs contain more detailed instruction on safety, chemical management, standard operating procedures and guidelines for the types of work performed in each lab area including:

- A. Proper chemical handling
- B. Chemical storage
- C. Chemical disposal
- D. Proper PPE
- E. Waste management plan
- F. SAA management plan

MSDS
Crosby Hall manager Art Pete will have an MSDS binder(s) containing information on chemicals located and/or used in those specific labs.

Emergency evacuation
Evacuation route maps are included in Appendix B of this document and are also posted on the walls near the MEE labs.

Implementation and Maintenance
This plan will be reviewed and all MEE laboratory personnel and students will receive plan training when the plan is first implemented. Training will also be held for new employees when they are hired, when changes in the plan necessitate, or at least once a year. The training will consist of providing a copy of the Chemical Hygiene Plan(s) to the employee, explaining procedures, and answering any questions the employee has.
V: Lockout/Tag out

Objective

The purpose of this letter is to define lockout/tag out policies and procedures to be used in the MEE laboratories.

Scope

This policy applies to all University of Maine employees and students working in the MEE laboratories engaged in servicing or maintaining machinery or equipment where unexpected release of stored energy could result in injury or death. This policy covers all tools and equipment in the MEE laboratories including those brought on site by University of Maine employees or students.

Responsibility

The Laboratory Manager/Safety Coordinator is the principal supervisor in charge of implementing, modifying and enforcing this policy.

Policy

The MEE laboratories follow the University of Maine Lockout/Tag out Program Revision 12/20/05 (http://www2.umaine.edu/SEM/policiesguides.htm under Occupational Safety). This program must be referenced for all official policy issues.

Only MEE faculty, staff and students who have successfully completed SEM’s lockout/tag out training program are authorized to conduct lockout/tag out. Lockout/tag out equipment must be obtained from SEM or the electrical shop and used exclusively for lockout/tag out purposes.

University of Maine Lockout/Tag out Program Appendices A thru D describes the lockout procedure required for equipment. The appropriate procedure should be defined for each piece of equipment prior to implementing lockout/tag out. The four types of procedures are:

A. Equipment-specific lockout procedure
The equipment does not meet the requirement of Appendices B, C, and D and has two or more power sources.

B. Simple lockout procedure
Equipment has one power source that can be locked out. For example, a disconnect box or circuit breaker.

C. Plug connected with no other potential of stored energy.
D. Motor vehicle & powered industrial equipment.
Annual audits of the lockout procedure will be conducted in accordance with the University of Maine’s lockout/tag out program (Interim Revision 12/20/05). Records of the annual audits will be maintained in the Laboratory Manager’s office.

VI. Equipment Installation, Repair and Troubleshooting

Objective
The purpose of this policy letter is to clearly define the procedures regarding equipment installation and electrical work in MEE laboratories. In effect, it defines the boundary between MEE employees and students, and University of Maine Facilities Management (UMFM) in terms of what work is permitted by each.

Background
Because of the unique and complex facilities installation and maintenance requirements of the MEE laboratories, there is need to clarify what installation and maintenance may be assumed by MEE personnel and what installation and maintenance is the responsibility of UMFM or its delegated subcontractor. This policy letter serves to clarify the delineation of authority between the MEE laboratories and UMFM.

Scope
This policy covers equipment installation, repair, maintenance and troubleshooting including but not limited to: new equipment, equipment upgrades and movement of existing equipment. The term “equipment” refers not only to machinery, but also to electrical and plumbing fixtures such as controls, switches, wiring, disconnects, breaker panels, lighting, hydraulic hoses, heating, ventilation and air conditioning (HVAC) systems and pneumatic piping.

Responsibility
The MEE Laboratory Manager/Safety Coordinator is the principal supervisor in charge of implementing, modifying and enforcing this policy. All authorizations for performing work under this policy require the signature of the MEE Laboratory Manager prior to the performance of any work.

Policy

General Boundaries
Installation or modification of equipment that is permanently affixed to the MEE
building (such as breaker panels, air lines, HVAC ducts, for instance) is the responsibility of UMFM. No MEE staff is permitted to work on plumbing or HVAC, including water or air lines/ducts that are considered part of the building.

**Electrical equipment**

Authorized and properly trained MEE employees may work on equipment up to the fusible disconnect, assuming the disconnect can be properly locked out at the breaker panel. Beyond the fusible disconnect (e.g. from the fusible disconnect to the breaker panel) work must be conducted by UMFM. The door to the fusible disconnect box is to be kept locked. The on/off switch will still be functional, access to the fuses/wires will only be allowed after the power source for the disconnect box has been properly locked out. At that time the door can be unlocked and opened. The MEE Laboratory Manager and the UMFM Electrician & Power Distribution Supervisor control the key.

Breaker Panels: Each breaker panel has an inner (to access circuit breakers only) and outer (which reveals the inner panel, wires, bus bars, etc.) door. The inner door will remain unlocked to allow access to the circuit breakers. The outer doors are locked and no MEE employee may open this outer door at any time. The key is kept with UMFM. As an extension of this policy, MEE staff and students are not permitted to puncture the breaker panels themselves, for example, to cut a hole to connect conduit.

**NFPA 70 E**


Electrical work conducted on equipment at the MEE laboratories by MEE employees or students must meet the requirements of NFPA 70 E. Individuals involved in this work, along with the MEE Laboratory Manager must attend an NFPA 70 E course to conduct work on live control panels.

Working on live circuits: Before work can be performed on live electrical systems, documentation must be provided to the Laboratory Manager in writing demonstrating that the work cannot be completed under lockout conditions. MEE equipment operates at or below 460 volts. Some control panels have a mix of parts at different voltages from 460 volts to 12 volts. Authorized MEE workers are required to wear the proper personal protective equipment (PPE) when working on live electrical equipment. To determine the proper PPE the following steps will be completed.

- A 4-foot area around the control box will be cordoned off using yellow caution tape.
- The control box will be locked out.
- The voltage in the control box will be identified.
• The need for shielding will be determined and put in place.
• Hazard/Risk will be determined based on Table 130.7 (C) (9) (a) Hazard/Risk Category Classifications in NFPA 70E.
• PPE will be determined based on the Hazard/Risk using Table 130.7 (C) (10) PPE Matrix in NFPA 70E.
• After the employee has donned the proper PPE the lockout may be removed and the power turned on to the control box.
• Work on the live control box can be completed.
• As soon as that portion of the work that has to be performed live is completed the control box will be locked out and the remaining work will be completed under MEE lockout/tag out policy.

In all other situations, authorized work will be performed using written lockout/tag out procedures that will be followed prior to working on equipment. Only MEE employees that have been trained in lockout/tag out (see http://www2.umaine.edu/SEM/policiesguides.htm) by University of Maine Safety and Environmental Management are authorized to lockout/tag out equipment.

This policy will be included in new employee training and reviewed annually.

Appendix A. (Chemical Pick Ups)

Request for Chemical Pickup form (University of Maine SEM)

Also access via http://www2.umaine.edu/SEM/forms.htm

Appendix B. (Machine Shop Rules)

Students have to read this form and sign it and give it to Crosby Laboratory Building Manager Art Pete

1. Safety glasses must be worn AT ALL TIMES while in the shop. On before entering the shop.

2. Safety toe shoes are required while in the shop.

3. Absolutely no “horseplay” in the shop.

4. No food, beverages, smoking or chewing tobacco is allowed in the shop or classroom.

5. Do not operate machinery while taking medication that renders you less than alert.

6. Do not operate any machinery or equipment without prior authorization from the instructor.
7. Keep your work area clean and clear of debris.

8. Do not operate any machinery or equipment unless the Instructor or TA is present in the shop.

9. During “breaks”, all work stops in the shop.

10. Everyone shares in clean up duty. Do not leave before clean up. After you have returned your tools and cleaned you machine and your area, go to the instructor for further clean up assignments.

11. No work is to be done before class starts, or after the call of clean up has been made.

12. In case of fire, exit the build verbally warning other as you go. Congregate beside the S.E. entrance to Boardman Hall.

13. Know how to turn off a machine before you turn it on.

14. Report all injuries, no matter how slight, to the instructor.

15. Do not disturb or talk to persons operating power machinery.

16. Do not allow yourself to be distracted by others talking to you or your cell phone.

17. Do not operate any machine with it’s safety guards removed.

18. Always stop the machine before making measurements or adjustments.

I have carefully read and I fully understand the above mentioned safety instructions. My signature is proof that I intend to conduct myself in a safe and responsible manner while working in the shop, so as to not endanger myself or others.

____________________________________    _____________  
Student signature        Date

____________________________________
Print Name
Appendix C. (Horizontal & Vertical Band Saws Rules)

Students have to read this form and sign it and give it to Crosby Laboratory Building Manager Art Pete

SAFETY INSTRUCTIONS- HORIZONTAL & VERTICAL BANDSAWS

1. Instructor must authorize your initial use of this machine.
2. Wear safety glasses.
3. Hold the work securely with the vise (horizontal band saw).
4. Keep hands clear of the machine while it is running.
5. Do not allow coolant to spill on the floor (horizontal band saw)
6. Keep the work area clear of scrap stock and debris.
7. Adjust the guide arm so as to allow for proper width or height of cut.
8. Select the proper cutting speed for the material.
9. Use a brush to remove chips, never your hands.
10. Avoid backing up stock on vertical band saw.
12. Keep the table clear of tools, scrap, or other materials.
13. Do not crowd the saw.
14. Be sure all guards are in place.
15. Secure all loose clothing, hair, and jewelry.
16. The operation of the band saws requires your undivided attention.

I have carefully read and I understand the above mentioned safety instructions. My signature is proof that I intend to use the above mentioned machine in a safe and responsible manner.

________________________________________       _______________
Student signature      Date
Appendix D. (Grinders Rules)

Students have to read this form and sign it and give it to Crosby Laboratory Building Manager Art Pete

SAFETY INSTRUCTIONS- GRINDERS

1. The instructor must authorize your initial use of any grinding machine.
2. Visually check the wheel for cracks and chips before starting.
3. Do not stand in line with the wheel as the wheel is running up to speed.
4. Make sure all guards are in place.
5. The gap between the wheel and tool rest, and between the wheel and spark guard should never exceed 1/16 inch on pedestal grinders.
6. Make no adjustments on the tool rest or spark guard when the machine is running.
7. Roll up sleeves, tuck in loose clothing or sweat shirt strings, remove jewelry.
8. Select the correct wheel for the job and be sure it is mounted properly.
9. Make sure the wheel is mounted with the paper blotters on both sides.
10. Have no combustible material in the area of flying sparks.
11. Do not grind on the side of the wheel, unless the wheel is made for it. The wheels on the pedestal grinders are not made for it.
12. Give the operation of the grinders your undivided attention.
13. Do not wear gloves.

I have carefully read and I understand the above mentioned safety instructions. My signature is proof that I intend to use the above mentioned machine in a safe and responsible manner.

________________________________________       _______________
Student signature      Date
Appendix E. (Milling Machine Rules)

Students have to read this form and sign it and give it to Crosby Laboratory Building Manager Art Pete

SAFETY INSTRUCTIONS- MILLING MACHINES

1. Instructor must authorize your initial use of the mill.

2. Wear safety glasses and safety shoes.

3. Roll up sleeves, secure loose clothing and hair and remove jewelry.

4. Check the entire mill setup before starting the machine.

5. Operation of the milling machine requires your undivided attention.

6. Stop the mill before making any adjustments.

7. Stop the mill and move work piece away from the cuter before taking any measurements.

8. Keep hands away from revolving cutters and never reach over a revolving cutter or arbor.

9. Never touch chips from the work piece with your hands.

10. Never leave the machine while it is running.

11. Turn off electrical power before opening guards.

12. Keep your work area clean.

13. Know how to stop the mill before starting it.

14. Use pliers or chip hooks to remove long stringy chips.

15. Always remove the wrench after tightening the draw-in bar or arbor nut.

16. Never wear gloves while operating the mill.

17. Make sure vise, clamps, and work piece are secure before starting any cuts.

18. Always remove the chuck key immediately after tightening the tool when using a drill chuck.

19. Be careful not to accidentally hit the motor switch when reaching for the spindle brake.
20. Make sure the arbor support is tight when using a horizontal mill.

21. Do not use bent arbors.

22. Make sure the appropriate locks are unlocked before engaging power feed or rapid traverse.

23. Make sure hand wheels are not going to hit you or others before engaging power feed or rapid traverse.

24. Don’t position work too close to cutter using rapid traverse. Get close by hand instead.

25. Don’t walk under a loaded hoist or shop crane.

26. Make sure the cutter will clear all vises and clamps and not mill into the table.

27. Make sure the work piece, vise and clamps clear the arbor.

28. Always operate the mill yourself. Don’t have someone else start the machine for you while you are making other adjustments.

29. Lock all locks except for those on the moving axis during any cutting.

I have carefully read and I understand the above mentioned safety instructions. My signature is proof that I intend to use the above mentioned machine in a safe and responsible manner.

________________________________________       _______________
Student signature       Date

Appendix F. (Lathes Rules)

Students have to read this form and sign it and give it to Crosby Laboratory Building Manager Art Pete

SAFETY INSTRUCTIONS- LATHES

1. Instructor must authorize your initial use of the lathe.

2. Wear safety glasses and safety shoes.

3. Roll up sleeves, secure loose clothing and sweat shirt strings and hair.
4. Do not run large chucks or face plate setups at high speed.
5. Check the entire lathe setup before starting the machine.
6. Operation of the lathe requires your undivided attention.
7. Stop the lathe before making adjustments.
8. Stop the lathe before taking measurements.
9. Keep hands away from revolving work and moving parts.
10. Never leave the machine while it is running.
11. Never touch chips from the work piece with your hands.
12. Always remove the chuck wrench immediately after use.
13. Never reach over revolving work holding devices.
14. Turn off electrical power before opening guards.
15. Always file left handed on a lathe.
16. Use a chuck cradle or board when mounting or removing a chuck or other spindle nose tooling.
17. Use extreme care when turning small diameters, that may deflect or bend at high speeds.
18. Keep your work area clean.
19. Rotate work by hand before starting the machine.
20. Know how to stop the lathe before starting it.
21. Move the tool bit out the way before adjusting setups.
22. Use pliers or chip hooks to remove long stingy chips.

I have carefully read and I understand the above mentioned safety instructions. My signature is proof that I intend to use the above mentioned machine in a safe and responsible manner.

________________________________________       _______________
Student signature      Date
Appendix G. (HR Online Training Records)

Subject: Basic Safety Training Records review (Part 1)

The HR online training recordkeeping system has been up and running for well over a year now and we are able to print a list by department of the people who have taken the Basic Safety Training Online. The attached excel spreadsheet is a list of all the employee’s that are in the HR System and the date they took their training last. Some may not work for you any longer so please remove them from your list.

Please remind your employee's that have not completed this training to go online within the next 30 days and complete this training. Once they complete the training it will allow them to print off a certificate that they should give to their supervisor. Once you have received the training certificate you can update this excel spreadsheet to track your department’s compliance.

Here is a link to the training: [http://www2.umaine.edu/SEM/Training/BasicSafetyTraining/basicsafety1.htm]

Basic Safety Online Training

This training is required for all employees, part time or full time. The complete UMaine Training Requirement Policy is attached.

If this email should have been sent to someone different in your department please let us know. Although the responsibility for safety training and compliance lies with the chairperson or director, you have the option to designate one person to serve as the department or unit safety coordinator in your place.

We appreciate your dedication to safety and helping us insure the University of Maine is in compliance to all safety regulations and laws. If you have any questions or need assistance please let me know.

Thank you,

Jill Rand
Safety Coordinator
Safety & Environmental Management
5784 York Village Bldg #7
Orono, Maine 04469-5784
Appendix H. (Annual Basic Safety Test)
(Unofficial for Students and Guests Only)

Name: ___________________________ Date: ________________

The following questions are designed to test your understanding of Basic Safety. This test is Not for UMaine Employee’s and is not acceptable for annual certification.

Question 1: What phone number do you call in case of emergency?

a. SEM  
b. Your supervisor  
c. Facilities Management  
d. Your emergency number

Question 2: You must be trained BEFORE you are permitted to work with any hazardous chemicals.

a. True  
b. False

Question 3: Fire doors may be propped open:

a. for delivery of multiple packages or moving  
b. when additional ventilation is needed  
c. only while the building is occupied  
d. never

Question 4: Which response below is true regarding labeling?

a. Only chemicals having a hazard level 3 or 4 must be labeled.  
b. Hazardous chemical labels are required if the chemical has a physical or health hazard.  
c. Only for opaque containers that obscure the contents  
d. Hazardous chemical labels are not required if the chemical is to be used within 30 days

Question 5: At your computer workstation, how should the mouse be positioned?

a. On the same level and as close to the keyboard as possible
b. Slightly above the keyboard, but keeping at least 4 inches away
c. On the wrist rest, but keeping at least 4 inches away from the monitor
d. On the same level and as close to the computer monitor as possible

Question 6: The minimum egress (aisle space) required is:

a. 36 inches
b. 18 inches
c. 48 inches
d. 28 inches

Question 7: Which of the following should be done prior to using any tool?

a. obtain appropriate training
b. select the proper tool
c. inspect the tool
d. all of the above

Question 8: If you come across a pipe with the insulation wrap peeling off you should:

a. remove the broken insulation wrap and throw it away
b. call your local emergency number
c. notify your supervisor
d. tape it with duct tape

Question 9: Which of the following statements is NOT correct regarding ladders?

a. Do not use metal ladders while working on electricity.
b. The top step may be used for sitting or standing.
c. Keep your body centered between the rungs.
d. Conduct a pre-use inspection prior to using the ladder.

Question 10: If a device you need to use is connected to an electrical panel that has been labeled with a lockout/tag out device you may remove the lockout/tag out device and power up.

a. true
b. false

Question 11: A MSDS (Material Safety Data Sheet) contains which of the following information:

a. an emergency number to call for information
b. the hazardous chemicals found in the product
c. personal protective equipment that should be employed when using the product
d. all of the above

Question 12: Flexible cords (extensions cords) may be:

a. used in place of fixed/permanent wiring where needed
b. used temporarily, not to exceed 90 days
c. plugged into another extension cord
d. temporarily plugged into a power strip, not to exceed 30 days

Question 13: When ordering chemicals it is best to:

a. buy large quantities so that you get the best price
b. look for less toxic alternatives before ordering and order the minimum quantity needed
c. always buy the extra-strength, concentrated, industrial version
d. buy the newest product available from a local contracted source

Question 14: If you see blood or other bodily fluids you should report the incident to your supervisor.

a. true
b. false

Question 15: Upon hearing an evacuation alarm (or signal) you should:

a. immediately leave the building and report to your rally point
b. wait for further evacuation instructions
c. investigate the source of the alarm
d. all of the above

Question 16: If asked to sign for a package containing hazardous chemicals or a
diamond shaped label on it, you should:

- a. store the package in your office
- b. place the package in the corner of the hallway so no one trips over it
- c. take the package to a public area in your department where it can be monitored
- d. examine it for leaks and put it in an appropriate hazardous material storage area

Question 17: All of the following are hazardous waste EXCEPT:

- a. mercury thermometers
- b. lead-acid batteries
- c. fluorescent bulbs
- d. toner cartridges

Question 18: Which of the following is not a "route of entry" for chemicals into your body?

- a. ingesting
- b. absorbing
- c. inhaling
- d. poisoning

Question 19: The sign or label that indicates the highest level of concern is?

- a. red-danger
- b. yellow-caution
- c. blue-notice
- d. orange-warning

Question 20: Which of the following might be considered an ergonomic concern?

- a. Poorly designed hand tools
- b. Working in an awkward position
- c. Working a limb forcefully or repeatedly
- d. All of the above

Please print if you need documentation.
References:
1-Civil and Environmental Engineering Laboratory Safety Plan (October 2010), Civil and Environmental Engineering, College of Engineering, University of Main, Orono, ME 04469 (Courtesy of Dr. Eric Landis, Chair of CIE)