



School of Engineering Safety Manual

A Reference Guide for Faculty and Staff

*Drafted by Stephanie McChesney, School of Engineering Safety Coordinator,
Office of the Dean (August 2016)*

TABLE OF CONTENTS

1.0 SAFETY STANDARDS AND POLICIES 4

2.0 ROLES AND RESPONSIBILITIES 4

 2.1 Dean

 2.2 Department Chairs

 2.3 SoE Safety Coordinator

 2.4 Principle Investigators

 2.5 Laboratory Managers

 2.6 Faculty, Staff and Students Working in Laboratories

 2.7 Faculty, Staff and Students Not Working in Laboratories

3.0 HAZARD ASSESSMENT 6

 3.1 Hazard Assessments for Laboratories

 3.2 Hazard Assessment for Independent Student Projects, Clubs and Teams

4.0 HAZARD COMMUNICATION 7

 4.1 Hazard Signs

 4.2 Engineering Safety Porches

 4.3 Safety Newsletter

 4.4 Safety Orientation for New Faculty and Staff

 4.5 Safety Training

 4.5.1 EGR SAFETY Courses

 4.5.2 Training Matrix for SoE Laboratories

 4.5.3 Laboratory-Specific and Hazard-Specific Training

 4.5.4 Training for Visitors

TABLE OF CONTENTS (continued)

4.5.5	Annual Laboratory Safety Refresher Training	
4.5.6	Training Records	
5.0	ACCESS CONTROL	11
5.1	Keyttering Laboratories Building Access	
5.2	Laboratory Access	
5.3	Working Alone	
5.4	Laboratory Doors	
6.0	INVENTORY CONTROL	12
6.1	Procurement	
6.2	Storage	
6.3	Inventories	
6.4	Disposal	
7.0	PERSONAL PROTECTIVE EQUIPMENT	13
7.1	Proper Protective Clothing	
7.2	Eye Protection	
8.0	EQUIPMENT AND MACHINE READINESS	14
9.0	INCIDENT RESPONSE	14
9.2	Emergency Evacuation Plans	
9.3	Weather Emergencies	
9.4	Safety or Security Threats	
10.0	AUDITS	15
10.1	Department Safety Audits	
10.2	Laboratory Inspections	

LIST OF APPENDICES

- I. University of Dayton Chemical Hygiene Plan
- II. University of Dayton Laser Safety Policy
- III. Standard Operating Procedures Template
- IV. Student Project Statement/Hazard Assessment Form
- V. Laboratory Safety Training Matrices
- VI. Hazard-Specific/Laboratory-Specific Training Record
- VII. Building Access Form
- VIII. Hazardous Waste Disposal Form
- IX. Incident Reporting Forms
- X. Emergency Evacuation Plans
- XI. Laboratory Inspection Checklist

INTRODUCTION

The School of Engineering recognizes that safety is both an engineering practice and a culture that values the quality of life of all people. To this end, the School of Engineering is committed to providing a safe learning and working environment for its students, faculty, staff, custodial and maintenance personnel, and visitors. This goal is accomplished by the establishment and observance of safety practices designed to avoid injury and damage. Incoming students will be taught these practices and will join the School in accepting responsibility for contributing to this culture.

In this document the School of Engineering will may be referred to as “the School,” or abbreviated as the SoE. Additionally, the term “laboratory” will be used to describe both traditional laboratories, as well as other areas like machine shops or areas where potentially hazardous equipment or substances are used in research and/or instructional activities.

1.0 SAFETY REGULATIONS AND POLICIES

In consultation with the University of Dayton Environmental Health and Safety/Risk Management department, SoE safety policies and procedures have been developed in accordance with the following local, state, and federal standards:

- University of Dayton Safety Policies
- University of Dayton Chemical Hygiene Plan (Appendix I)
- University of Dayton Laser Safety Policy (Appendix II)
- OSHA Standard 29 CFR
- USEPA and Ohio EPA Regulations
- Ohio Building Codes
- Ohio Fire Code/NFPA
- ANSI Standards
- City of Dayton Regulations

2.0 ROLES AND RESPONSIBILITIES

All SoE administrators, faculty, staff and students are responsible for helping to promote a safety culture in offices, classrooms, and laboratories.

2.1 Dean

- Communicates to faculty, staff, students and visitors that health and safety is a top priority
- Ensures that all environmental health and safety regulations and policies are followed
- Determines penalties for non-compliance with health and safety policies

2.2 Department Chairs

- Ensure that all department faculty and staff complete required safety training
- Assist in distributing safety information to department faculty, staff and students
- Work with the SoE Safety Coordinator to address any department specific hazards, safety training, or safety equipment needs
- Approve key and key card access for all department laboratories and maintain a list of personnel and students with access to laboratories
- Report all incidents, accidents, potential chemical exposures and near miss situations

2.3 SoE Safety Coordinator

- Implement the SoE Safety Program
- Reviews and update safety policies and procedures at least annually
- Provide safety training to all SoE faculty, staff and students
- Investigates accidents and chemical exposures
- Acts as a liaison between the SoE and the university Environment, Health and Safety/Risk Management (EHS/RM) office
- Maintains safety training records
- Performs annual laboratory inspections and department audits
- Tracks safety incidents and close calls

2.4 Principal Investigators

Principle investigators (PIs) include faculty and staff conducting and/or supervising research projects and faculty and staff instructing laboratory courses.

- Attend annual Laboratory Safety Refresher Training
- Ensure all personnel (faculty, staff, and students) working in laboratories have attended required safety training
- Develop standard operating procedures for all activities involving hazards and provide hazard-specific and/or laboratory-specific training
- Provide appropriate engineering controls and personal protective equipment needed to work safely with hazardous materials and ensure such equipment is used correctly
- Employ and encourage good housekeeping techniques in laboratories
- Work with Laboratory Managers to address issues cited during annual laboratory inspections

2.5 Laboratory Managers

- Attend annual laboratory safety refresher training
- Maintain chemical inventories and Material Safety Data Sheets
- Maintain all laboratory equipment and safety equipment in proper working order
- Employ good housekeeping techniques in laboratories
- Address issues cited during annual laboratory inspections

2.6 Faculty and Staff Working/Teaching in Laboratories under the supervision of a PI

- Attend annual laboratory safety refresher training
- Attend required hazard-specific and laboratory-specific safety training
- Follow standard operating procedures provided by supervisors and/or principal investigators
- Use engineering controls and personal protective equipment
- Employ good housekeeping techniques in laboratories
- Report all incidents, accidents, potential chemical exposures and near miss situations

2.7 Faculty and Staff Not Working in Laboratories

- Complete required safety training
- Report all incidents, accidents, potential chemical exposures and near miss situations

3.0 HAZARD ASSESSMENT

The SoE defines a hazard as anything that can hurt you, others or the environmental now or in the future. Hazards typically encountered in the SoE include biological, chemical, mechanical and energy hazards.

3.1 Hazard Assessment for Laboratories

Hazard assessments should be completed for all laboratory activities involving hazardous equipment and/or materials. The health and safety information generated during hazard assessments should be incorporated into standard operating procedures (SOPs). A template for developing SOPs is included in Appendix III. Additionally, laboratory managers and PIs may obtain or reference existing general SOPs for chemicals, chemical classes, and equipment.

3.2 Hazard Assessment for Independent Student Projects, Clubs and Teams

All students working on independent projects or on projects with clubs or teams should complete a *Student Project Statement/Hazard Assessment* form (see Appendix IV). Students will provide information regarding:

- Project Details
- Hazard Identification
- Hazardous and Non-Hazardous Materials
- Tools and Equipment
- Trainings Verification
- Personal Protective Equipment
- Waste Disposal

Student Project Statement/Hazard Assessment forms should be reviewed by the students' faculty advisor and the SoE Safety Coordinator. Failure to complete a hazard assessment or to implement established safety practices may result in the suspension of the club or student group or loss of campus space.

HAZARD COMMUNICATION

4.1 Hazard Signs

All laboratories containing hazardous equipment or hazardous materials must have a blue hazard sign outside the entrance which details the hazards, emergency contact information, and personal protective equipment required. These signs are generated by the EHS/RM Office. To request or update a blue hazard sign, laboratory managers can complete a request form located on the EHS/RM office website at http://campus.udayton.edu/~UDCampusPlanning/EHSRM/index.php?option=com_content&view=article&id=97:room-signage-program&catid=3&Itemid=306.

Hazards located within laboratories must also be identified using recognized signage.

4.2 Safety Information on Porches

SoE faculty, staff and students can access information regarding the SoE Safety Program from the Engineering Porches page, which will have links to the following information:

- Safety Policies and Guidance
- Student Project and Hazard Assessment Forms
- Training Records
- SoE Safety Newsletter

Announcements will be posted identifying new information added to the site and when information is updated.

4.3 Safety Newsletter

The SoE Safety Coordinator will develop safety newsletters that will be distributed to all faculty and staff.

4.4 Safety Orientation for New Faculty and Staff

New faculty and staff are required to meet with the SoE Safety Coordinator to receive an orientation to the SoE safety programs. During this meeting, the SoE Safety Coordinator will develop a safety training schedule for new faculty or staff members based on their job duties.

4.5 Safety Training

4.5.1 EGR SAFETY Courses

EGR SAFETY courses have been developed by the SoE to instruct faculty, staff and students on how to 1) recognize hazards, 2) minimize risks associated with hazards and 3) respond appropriately when incidents occur. EGR SAFETY courses also outline university and SoE safety programs and policies. EGR SAFETY courses cover broad safety topics and are meant to set the foundation for laboratory-specific and hazard-specific training. See additional information about laboratory-specific and hazard-specific training below.

The following safety training courses have been developed by the School of Engineering and can be taken in-person or on-line. Faculty, staff and students are provided access to on-line safety training courses on their Isidore page.

<p>EGR SAFETY 0.0 General Safety & Emergency Evacuation Training Must be completed by all non-engineering student workers and other administrative staff, as applicable</p>
<p>EGR SAFETY 1.0 Introduction to Engineering Safety Must be completed by all engineering undergraduate students. This training is a pre-requisite for all additional safety training.</p>
<p>EGR SAFETY 1.1 Tool Safety Must be completed by all students taking EGR103, senior design and working in certain engineering labs. <i>PREREQUISITE – EGR SAFETY 1.0</i></p>
<p>EGR SAFETY 2.0 Engineering Safety Review Must be completed by engineering students as determined by their department. Transfer students may use this training to satisfy EGR SAFETY 1.0 requirement.</p>
<p>EGR SAFETY 3.0 Engineering Safety for Student Teams Must be completed by student team members when using SOE laboratory or other facilities. <i>PREREQUISITE – EGR SAFETY 1.0 and/or 2.0</i></p>

<p>EGR SAFETY 3.1 Welding/Hot Work Safety Must be taken by faculty, staff and students as directed by supervisor, instructor or SoE Safety Coordinator. <i>PREREQUISITE – EGR SAFETY 1.0, 2.0, 5.0 and/or 6.0 and EGR SAFETY 1.1</i></p>
<p>EGR SAFETY 3.2 Soldering Safety Must be taken by faculty, staff and students as directed by supervisor, instructor or SoE Safety Coordinator. <i>PREREQUISITE – EGR SAFETY 1.0, 2.0, 5.0 and/or 6.0 and EGR SAFETY 1.1</i></p>
<p>EGR SAFETY 3.3 Router Safety Must be taken by faculty, staff and students as directed by supervisor, instructor or SoE Safety Coordinator. <i>PREREQUISITE – EGR SAFETY 1.0, 2.0, 5.0 and/or 6.0 and EGR SAFETY 1.1</i></p>
<p>EGR SAFETY 3.4 Mill and Lathe Safety Must be taken by faculty, staff and students as directed by supervisor, instructor or SoE Safety Coordinator. <i>PREREQUISITE – EGR SAFETY 1.0, 2.0, 5.0 and/or 6.0 and EGR SAFETY 1.1</i></p>
<p>EGR SAFETY 4.0 Engineering Safety for Senior Design Must be completed by students registered for Senior Design. <i>PREREQUISITE – EGR SAFETY 1.0 and/or 2.0 and EGR SAFETY 1.1</i></p>
<p>EGR SAFETY 5.0 Introduction to Engineering Safety Must be completed by all graduate students who work in or teach in engineering labs.</p>
<p>EGR SAFETY 5.1 Laser Safety Must be taken by faculty, staff and students as directed by supervisor, instructor or SoE Safety Coordinator. <i>PREREQUISITE – EGR SAFETY 1.0, 2.0, 5.0 and/or 6.0</i></p>
<p>EGR SAFETY 5.2 Chemical Safety Must be taken by faculty, staff and students as directed by supervisor, instructor or SoE Safety Coordinator. <i>PREREQUISITE – EGR SAFETY 1.0, 2.0, 5.0 and/or 6.0</i></p>
<p>EGR SAFETY 5.3 Biohazard Safety Must be taken by faculty, staff and students as directed by supervisor, instructor or SoE Safety Coordinator. <i>PREREQUISITE – EGR SAFETY 1.0, 2.0, 5.0 and/or 6.0</i></p>
<p>EGR SAFETY 6.0 Introduction to Engineering Safety Must be taken by all School of Engineering Faculty and Staff who work in or teach in laboratories or around potential hazards.</p>

4.5.2 Training Matrix for SoE Laboratories

Across SoE laboratories, faculty, staff and students participate in a wide variety of activities that have associated hazards from chemical exposure, to robotics, to lasers, to nanomaterials and biohazards. In order to provide laboratory users with applicable safety training that is narrowly focused on the hazards that they will encounter in their labs, the SoE has developed a training matrix for each SoE lab outlining the EGR SAFETY

courses that must be completed for lab users. Training requirements for each lab, grouped by department, are included in Appendix V.

4.5.3 Laboratory-Specific and Hazard-Specific Training

While EGR SAFETY courses provide basic safety training, it is critical that PI's and instructors provide laboratory-specific and hazard-specific training to faculty, staff, students and visitors working in and taking classes in laboratories. This training should include information regarding:

- Laboratory standard operating procedures (SOPs)
- Physical and health hazards
- Specific hazard instruction for chemical, biological, mechanical and electrical hazards
- Personal protective equipment
- Proper labeling storage and disposal of hazardous substances
- Emergency equipment locations and use
- Additional site-specific hazards

Laboratory-specific and hazard-specific training must be documented. PI's and lab instructors may use the *Hazard-Specific/Laboratory-Specific Training Record* form located in Appendix VI, training logs in SOPs or other forms of documentation. Laboratory-specific and hazard-specific training and documentation will be evaluated during annual laboratory inspections.

4.5.4 Training for Visitors

Visitors who plan to work in laboratories must complete basic safety training. Visitors attending camps, workshops or seminars that will be supervised by SoE faculty, staff and/or students must be given hazard-specific training prior to any activities in laboratories. Please contact the SoE Safety Coordinator for assistance in developing safety training for visitors and special functions.

4.5.5 Annual Laboratory Safety Refresher Training

All PI's, Laboratory Managers, and faculty and staff teaching in or working in laboratories are required to complete annual Laboratory Refresher Training. This training will be administered by the SoE Safety Coordinator during the month of October.

4.5.6 Training Records

The SoE Safety Coordinator will generate all EGR SAFETY training course records and will maintain a database for all faculty, staff, and students. Faculty and staff can access

training records on the Engineering Safety Porches site. Laboratory-specific training and hazard-specific training records should be kept in laboratories or in the department and should be made available for review during annual laboratory inspections.

5.0 ACCESS CONTROL

5.1 Kettering Laboratories Building Access

The entrance doors to Kettering Laboratories are locked overnight, on weekends and on university holidays. The building may be accessed during these times using a key card. As a general rule, undergraduate students should not be provided unlimited key card access to the building.

Faculty advisors wishing to request key card access to the building for graduate students or researchers must complete a *Building Access Form* (Appendix VII) and submit it to the Dean for approval. Building access will not be allowed for individuals who have not completed required safety training.

5.2 Laboratory Access

All students (graduate and undergraduate) must get authorization from their department before they are given key card access or keys to laboratories. Departments should verify that students have completed all required safety training by checking training records on Porches or by contacting the SoE Safety Coordinator.

5.3 Working Alone

The University of Dayton has a policy that no students are allowed to work alone where a hazard is present. No undergraduate students or student workers should ever work alone in a laboratory. Graduate student researchers, however, may have special circumstances due to the nature of their work when they will need to work alone. Graduate students may only work alone in laboratories if they provide prior notification to their faculty advisor and/or department. Graduate students should be discouraged from working alone or unsupervised around hazards after normal business hours, on weekends, and on holidays.

5.4 Laboratory Doors

Laboratory doors must remain closed at all times. Work performed in laboratories may be dangerous and any accidental releases, explosions or fires will be contained by keeping doors to laboratories closed. Additionally, laboratory doors should remain closed in order to maintain proper air flow between the laboratories and outside public spaces.

Doors to laboratories should never be propped open by wood blocks, cement, boxes, or any other object that obstructs the doorway. Object used to prop open a door are tripping hazards and may become an obstacle to personnel exiting the room during an emergency.

6.0 INVENTORY CONTROL

6.1 Procurement

Laboratory personnel must verify the following before procuring hazardous chemical or materials:

- It is the least hazardous material that can be used for the project
- The material is not already available in the laboratory
- The smallest quantity needed for the project is being procured
- The laboratory has proper storage space for the material

- The laboratory is equipped for a spill or release of the material
- Laboratory personnel are trained on how to properly handle the materials

Laboratory personnel should work with department laboratory managers and administrative assistants to procure materials using the university on-line procurement system. Students are only allowed to order hazardous materials with written permission from PI's or instructors.

6.2 Storage

Chemicals stored in laboratories should be segregated by hazard class and compatibility, at a minimum. The Ohio Fire Code regulates storage of chemicals based on occupancy, classification, building construction, availability of flammable storage cabinets, quantities and location of the laboratory. Contact the EHS/RM office for assistance with the interpretation of the fire codes.

All containers used for chemical storage should be labeled properly. Chemicals should not be stored on floor, on lab benches, or under hoods. Laboratory managers should routinely review chemical inventories to determine whether they can dispose of any excess chemicals and waste materials.

6.3 Inventories

All laboratories must keep an inventory of hazardous chemicals and materials. This list is to be submitted to the EHS/RM office so that emergency response personnel can be made aware of the contents of the room.

6.4 Disposal

The EHS/RM office will pick up hazardous waste for disposal. The following steps should be taken to ensure the proper disposal of hazardous waste and chemicals.

Process for Disposing Hazardous Waste

Step 1. Segregate waste by hazard class

Step 2. Seal the waste in a primary and secondary container

Step 3. Label the waste with a Hazardous Waste Label

Step 4: Fill Out a *Hazardous Waste Disposal Form* and submit it to the EHS/RM Office

Step 5: Coordinate with the EHS/RM office for pick-up of the waste

A copy of the *Hazardous Waste Disposal Form* can be found in Appendix VII and is also located on the Engineering Safety Porches Group site.

7.0 PERSONAL PROTECTIVE EQUIPMENT**7.1 Proper Protective Clothing**

All faculty, staff, students and visitors should wear proper clothing when working in laboratories. The following guidelines should be followed:

- Sturdy shoes that completely cover the foot must be worn at all times; no sandals, flip-flops, crocs, slippers, open-backed, or open-toed shoes
- No loose-fitting clothing, hanging jewelry, or sweatshirts with hanging drawstrings should be worn when working around equipment with rotating parts
- No shorts or skirts should be worn when operating cutting or welding tools or machines
- Laboratory coats, long pants and gloves should be worn when working with hazardous chemicals

Information regarding proper protective clothing required in each laboratory and shop is included on the blue hazard signs. Faculty, staff, students and visitors not wearing proper clothing may be prohibited from working in a laboratory or shop. PIs and laboratory instructors are responsible for ensuring that their students and staff are wearing proper protective clothing in laboratories.

7.2 Eye Protection

Proper eye protection is required for faculty, staff, students, and visitors to laboratories. All faculty, staff and students working in a laboratory should wear safety glasses when using tools and machinery. Chemical goggles, splash goggles or a full face shield should be worn during chemical transfer and handling operations. PIs and laboratory instructors are responsible for ensuring that their students and staff are wearing proper eye protection in laboratories.

8.0 MACHINE AND EQUIPMENT READINESS

Machines and equipment used in the SoE should be maintained by laboratory managers and/or maintenance personnel at the interval required by the manufacturer and after any damage or modifications have occurred. Machine and equipment should also be calibrated according to manufacturer specifications. All equipment maintenance and calibration records should be readily accessible in the laboratory or in the Department office.

9.0 INCIDENT RESPONSE

9.1 Reporting

The SoE Safety Coordinator and the university EHS/RM office track all incidents that involve faculty, staff, students and visitors. When an incident occurs, a *UD Incident and Hazard Report* form should be completed and submitted to the SoE Safety Coordinator and the EHS/RM office. A *Worker Compensation Form* should also be completed if the incident involves an injury to a university employee. These forms can be found in Appendix X and on the Engineering Safety Porches site.

The SoE Safety Coordinator and the university EHS/RM office periodically review incident reports to determine if institutional controls, engineering controls, personal protective equipment or training needs to be revised to protect against future incidents.

9.2 Emergency Evacuation Plan

The SoE have offices, classrooms and laboratories located in Kettering Laboratories, the Science Center and Fitz Hall. All SoE faculty, staff and students must evacuate these buildings during a fire alarm and meet in a designate area outside of the buildings. The Emergency Evacuation Plans for each building are attached (Appendix X).

9.3 Weather Emergencies

The university will notify all faculty, staff and students when a severe weather warning has been issued for our area. In the event of a tornado or high wind warning, all faculty, staff and students in must take shelter in the basement or lowest level of a building.

9.4 Safety or Security Threats

The university will notify all faculty, staff and students when there is a campus-wide safety or security threat. All faculty, staff and students should shelter in place away from doors and windows and monitor e-mail and/or cell phone messages for updates.

10.0 AUDITS

10.1 Department Safety Audits

In-depth safety audits of SoE departments will be completed periodically, as determined by the SoE Safety Coordinator and/or following any major safety incident.

10.2 Laboratory Inspections

All SoE laboratories are inspected annually. Inspections are performed by members of the university EHS/RM office, the SoE Safety Coordinator and a representative from each department.

Laboratory/shop inspections include the review of the following:

- Emergency information and equipment
- Fire Extinguishers
- Electrical panels and cords
- First Aid and Safety Equipment
- Compressed Gases
- Laboratory Hoods
- Personal Protective Equipment
- Chemical Storage, Chemical Inventory and Chemical Waste
- Other general items: housekeeping, food/drink, etc.

The *Laboratory Inspection Checklist* used by university EHS/RM office is located in Appendix XI. Following the inspections, laboratory inspection reports are sent to the department chairs and laboratory managers identifying safety issues identified during the inspections. Laboratory managers must address these issues and provide the information regarding corrective actions to the SoE Safety Coordinator.

APPENDIX I

UNIVERSITY OF DAYTON CHEMICAL HYGIENE PLAN

APPENDIX II
UNIVERSITY OF DAYTON LASER SAFETY POLICY

APPENDIX III
STANDARD OPERATING PROCEDURES TEMPLATE

APPENDIX IV

STUDENT PROJECT STATEMENT/HAZARD ASSESSMENT FORM

APPENDIX V
LABORATORY SAFETY TRAINING MATRICES

APPENDIX VI

HAZARD-SPECIFIC/LABORATORY-SPECIFIC TRAINING RECORD

APPENDIX VII
BUILDING ACCESS FORM

APPENDIX VIII
HAZARDOUS WASTE DISPOSAL FORM

APPENDIX IX
INCIDENT REPORTING FORMS

APPENDIX X

EMERGENCY EVACUATION PLANS

Kettering Laboratories

Science Center (*in progress*)

Fitz Hall (*in progress*)

APPENDIX XI
LABORATORY INSPECTION CHECKLIST