ENGINEERING LAB SAFETY GUIDEBOOK

HERBERT WERTHEIM
COLLEGE of ENGINEERING
Engineered for Safety

WELCOME

College of Engineering Health and Safety Objectives

The College of Engineering is committed to providing a safe and healthy working and learning environment for its faculty, staff, students, and visitors.

We are dedicated to continuous improvement of our health and safety performance and culture by adhering to the following objectives, which align with our **Gator Engineering Attributes**:

- **Leadership:** Develop, implement, monitor and improve safety systems, programs and policies to meet or exceed University standards.
- **Integrity:** Hold all accountable for contributing to the improvement of our safety culture by taking appropriate actions to remove hazards, minimize risk, and learn from incidents, accidents and near-misses.
- **Professional Excellence:** Establish a culture that fosters sound decision making and standardized processes in order to achieve continuous improvement in safety outcomes.
- **Creativity:** Identify innovative techniques that encourage everyone to develop a safety-awareness mindset, affecting motivation, behavior and attitudes in a positive way.
- **Service to the Global Community:** Prepare faculty and students to become safety ambassadors, possessing knowledge and skill sets that can translate into leading safety practices globally.

ABOUT THIS GUIDE

This Engineering Lab Safety Guide is a resource to identify ways to meet the College's Health and Safety objectives.

All HWCOE Safety tools and resources can be found on our website at www.eng.ufl.edu/safety.

The guide will also assist you with getting started with many of the UF EHS programs which may apply to your research. However, because of the diverse nature of work being conducted in our laboratories, additional procedures or requirements may be necessary beyond what is covered in this guide.

Please contact us at safety@eng.ufl.edu with any questions.

ENGINEERING ROLES AND RESPONSIBILITIES

A full detailed description of the roles and responsibilities are outlined in the UF Lab Safety Manual http://webfiles.ehs.ufl.edu/labsafe.pdf. However, here is a brief summary:

The Principal Investigator's (PI) is ultimately responsible for everything that goes on in their lab. You must know and understand what hazards exist in your lab, establish a system to recognize hazards, reduce the risk through elimination or control, communicate this information to lab staff and ensure safe conditions are maintained through training, monitoring and enforcing (or encouraging) accountability and ownership by lab workers.

Laboratory Safety Manager Each active laboratory with hazardous materials or hazardous equipment in Engineering must have a designated laboratory safety manager (LSM). If a LSM is not assigned it defaults to the PI. The LSM serves as a resource for ensuring safe practices in the lab as well as serves as a role model for safety. The LSM serves as a resource for the lab and the PI. They coordinate efforts but are not responsible for all actions. Their main responsibility is to communicate with the PI about safety in the lab. The PI enforces the safety expectations for all lab members.

Individual laboratory workers are responsible for knowing and following all rules and regulations established by their PI. They are also responsible for reviewing changes to protocols with their PI before conducting the experiment, to ensure all potential changes have been evaluated for risk. In addition, lab workers should feel confident to take action to correct unsafe conditions or behaviors in the lab.

The research department and college are responsible for supporting the PI and research staff with all resources necessary to ensure safety compliance. As part of this support, the College has provided a dedicated Director of Laboratory Safety, to serves as a resource for the safety in your lab.

The College of Engineering Safety Office philosophy is to connect with the labs, not inspect them:

C – check-in
O – offer help
N – introduce new programs
N –k**NO**w the labs
E – evaluate hazards and assess risk
C – correct concerns (non-punitive)
T – tout (identify and recognize/reward best practices)

HERBERT WERTHEIM
COLLEGE of ENGINEERING
Engineered for Safety

LAB SAFETY KICK-STARTER

The Lab Safety Kick-starter can be found here:

https://www.eng.ufl.edu/safety/resources/lab-safety-kickstarter/

This is a guide to assist understanding many of the basic lab safety requirements here at UF. It was developed by the College of Engineering Safety office, with feedback and guidance from EHS. It describes the specific tasks to complete to meet the safety expectations. It also describes recommended *best practices* (in italics). You can use this guide to help establish your lab safety program, prepare for EHS inspections, as well as use as a self-inspection tool. The EHS inspection checklists can be found here: http://webfiles.ehs.ufl.edu/GT/LS.pdf

Following this guide does not guarantee you will be meeting all regulations and compliance expectations, nor does it mean that you have addressed all possible hazards present in your lab. If you have any questions, comments, or suggestions please contact HWCOE Safety at safety@eng.ufl.edu

TRAINING

The Engineering Laboratory Safety Guidelines and Training Checklist establishes basic safety rules and minimum training needs for working in the lab. This, used in conjunction with the Lab Safety Kick-starter should identify most safety training needs. Please find it here: https://www.eng.ufl.edu/safety/resources/engineering-laboratory-safety-guidelines-and-training-checklist/

However, the Division of Sponsored Research also has a very helpful Research Training Utility, which can be found here: http://research.ufl.edu/rtu.html This tool helps faculty, staff, and students identify what mandatory training must be completed in order to conduct research at the University of Florida. This tool does not address (a) optional training nor (b) all training required to do other functions at the University.

All EHS trainings and their triggers can be found here: http://www.ehs.ufl.edu/training/ehs-training-triggers-and-audiences/

All EHS trainings can be assigned and tracked using GatorTRACS. Instructions on how to do this can be found here: http://www.ehs.ufl.edu/programs/lab-research/gator-tracs/

HAZARD IDENTIFICATION & RISK ASSESSMENT

There are a number of hazards that may be present in the work environment, or generated as a result of the research activities. Your goal should be to identify those hazards, determine the risk associated with them and remove or reduce the risk by eliminating or controlling the hazards.

Look at each research protocol in a sequential, step-by-step manner. **First, identify hazards at each step**, those produced or associated with the work environment, or those connected to the research or procedure. This is considered a Job Safety Analysis.

Examples of hazards to consider:

- Health hazards of chemicals
- Physical properties of chemicals
- Energy produced by chemical reactions
- High pressure
- Temperature extremes
- Electrical hazards (shock, fire, short circuit, loss of power)
- Ergonomic hazards (lifting, bending, pushing, pulling, repetitive tasks)
- Vibration
- Noise
- Slip, trip or falls
- Fire
- Radiation
- Caught (in/on/between equipment or parts)
- Struck (by/against equipment or parts)

Try to identify potential mistakes, don't just consider the inherent hazards of doing the experiment as planned. **WHAT IF** the researcher forgets a step? Reverses two steps? Adds too much or too little of a material? Heats the temperature too high, has pressure too high, etc…? Ultimately, what are the ideal parameters of your experimental design and **WHAT IF** one of those variables is not met, what is the potential?

The second step is to determine the risk associated with this hazard, to prioritize what you should address first. This is the most difficult part of the process. The factors you want to consider are severity and probability. An example risk matrix chart is below. If you need help determining this please contact Amy.

RISK MATRIX

Occurrence	Severity of Consequence			
Probability	Catastrophic – 1	Serious – 2	Marginal – 3	Negligible - 4
A- frequent	1A	2A	3A	4A
B – probable	1B	2B	3B	4B
C- occasional	1C	2C	3C	4C
D- remote	1D	2D	3D	4D
E - improbable	1E	2E	3E	4E

HAZARD RISK INDEX	SUGGESTED CATEGORY
1A, 1B, 1C, 2A, 2B, 3A	UNACCEPTABLE RISK…
1D, 2C, 2D, 3B, 3C	UNACCEPTABLE RISK IF PERSONNEL ARE EXPOSED TO HAZARDS OR IF ENVIRONMENTAL DAMAGE MAY OCCUR….
1E, 2E, 3D, 3E, 4A, 4B	ACCEPTABLE WITH MANAGEMENT REVIEW
4C, 4D, 4E	ACCEPTABLE

Once you've categorized your hazards into risk categories – you have your priorities. All items in red should be addressed first, followed by yellow and then if there are time and resources, look at the green items.

To reduce the risk, hazards can be eliminated or controlled. Use the Hierarchy of Controls:

1. Elimination (example: chemical substitution)
2. Engineering (example: fixed guard on equipment, fume hood, or biosafety cabinet)
3. Administrative (example: training, inspection procedures or safety rules)
4. Personal Protective Equipment (examples: gloves, eye protection, or hearing protection)

Resources: The UF Chemical Hygiene Plan is completed in GatorTRACS by following the guidelines here: http://www.ehs.ufl.edu/programs/lab-research/gator-tracs/latch/

MAINTAINING SAFE CONDITIONS

After taking the time and effort to identify and control hazards in the lab, you need to maintain those controls and safe conditions. Don't rely on the annual EHS Lab Safety Survey to identify hazards present in your lab. The College expects you to keep them under control all year. The expectation is that your lab will conduct at least monthly safety and housekeeping inspections.

- In partnership with UF EHS we are using a cloud-based software called GatorTRACS to manage our Engineering Lab Self-Inspections.
- www.gatortracs.ehs.ufl.edu

TOOL FOR RISK ASSESSMENT · COMPLIANCE · SAFETY
GATOR TRACS
DIVISION OF ENVIRONMENTAL HEALTH & SAFETY
UNIVERSITY OF FLORIDA

- Management of Change
  - Managing changes in research, processes, materials, equipment, etc… can identify potential hazards and risks before they are a problem.
  - Set an expectation that changes will go through a review with the PI. Review the following for new hazards or training needed:
    - New chemicals
    - New protocols
    - New equipment
    - New students
    - New lab space

PROJECT SAFETY ASSESSMENT

Link to the PSA template can be found here: eng.ufl.edu/safety/resources

Basic steps:

- Identify the process to be analyzed
- Break the process into key components
- Identify the **hazards*** for each job component, evaluate risks, and rank the risks
    - Risk = probability x severity
- Eliminate the hazard or install controls to reduce risk
    - Remember **hierarchy of controls***
- Keep a record of the hazards identified and steps taken to control them
- Systematically revise controls to ensure they are working correctly
- Write the Standard Operating Procedure once you have completed the PSA

INCIDENT REPORTING

An incident is an unplanned event with an undesirable outcome. Injuries are the most common type of incident that comes to mind when people think of that term. However, so are equipment malfunctions, chemical, biological, radiation exposure or release, equipment damage, etc…

A Near-miss is the recognition that an incident could have occurred if conditions were right, but did not. Near misses should also be addressed. How will you prevent the conditions from developing that would result in an incident?

Actions to take when your lab has an incident:

- Handle the emergency situation as appropriate
  - 9-1-1
  - Medical Treatment
  - Spill response and clean up
  - Etc…
- Report the incident:
  - To the chair of your department and to the Director of Lab Safety for the College
  - You can report the incident through GatorTRACS
- Cooperate with follow-up investigation
- Communicate root cause and preventive actions with all lab staff
- Share lessons learned with the College

Action to take when your lab has a near-miss:

- Encourage all researchers to report near-misses
- Do an investigation to determine what happened
- Determine why it happened
- How it could have been worse
- How to prevent it from happening in the future
- Communicate to all involved the preventative action steps

ENHANCING SAFETY CULTURE

Experiences foster beliefs, beliefs influence actions, and actions produce results. – Peter Drucker

How can you foster a positive safety culture in your lab? Start by providing positive experiences. Your interactions, discussions and actions with your lab staff with begin to mold their beliefs around how you value safety in the lab, these beliefs will affect their actions – and actions will lead to results – good or bad.

Here are some ideas to get you started:

- Have safety be a standing agenda item at your lab group meetings
- Have students rotate bringing in a safety topic to discuss briefly at lab meetings
- Discuss openly with all lab members any incidents (not just accidents and injuries, but near-misses too) that occur, what caused them (don't place blame), and how to correct and prevent them in the future
- Be a ready resource for students, have a "there are no stupid questions" philosophy; allowing students to ask if they are unsure
- Be involved in the safety training of the new lab members, watch them demonstrate competency on a new technique or research method
- Review and approve all new protocols
- Don't allow students to change protocols without a review by you first
- Create a recognition system for students to be rewarded for safe behaviors
- Have the Lab LSM sits on departmental student safety committee
- Have students who are involved in an incident complete a lessons learned to share with the lab and the department, make it a learning opportunity instead of a punishment
- Host regular lunches as a reward for participating in safety enhancing activities, some examples:
    - Conducting a job hazard analysis of their research project
    - Conducting 6 lab self-inspections in 6 months
    - Recognizing a student for taking initiative for solving a safety problem

FACILITIES INFORMATION

UF HWCOE has its own dedicated Facilities office to assist you with your facility needs.

The services provided by this office are as follows:

- Monitor and analyze space utilization for all College of Engineering Departments.
- Coordination of College of Engineering property systems and accountable for Engineering Administration property.
- Interface with the UF Building Services Organization and the Environmental Health & Safety Division as needed.
- Interpret administrative rules, policies, and procedures related to safety, security, and ADA requirements.
- Coordinate with Physical Plant Division, Facilities Planning & Construction Management Division, architects, engineers and contractors concerning maintenance, renovation, remodeling, and new construction projects.
- Prepare project scope statements, cost estimates, bid documents, review of plans & specifications, and provide oversight of work in progress.

Other services from HWCOE Facilities:

- Operation of the College of Engineering Mailroom
- Equipment installation including window air conditioners/heat pumps
- Equipment modifications, repairs, and maintenance
- Sign and nameplate engraving
- Moving services
- Fabrication of custom shelving/Furniture
- Installation of multimedia equipment
- Approve all Minor Project/Construction Request (form 90) for renovation and remodeling projects by the College of Engineering.
- Approve all intended use (reservations) of the lobby/rotunda located in the New Engineering Building for special functions.
- Responsible for the administration of the reserved visitor's parking space by Weil Hall.

If you have a facilities issue, you can submit your own project request or work order.

https://www.facilitiesservices.ufl.edu/facility-maintenance-and-project-request/

HWCOE CONTACTS

GENERAL SAFETY

Amy Haberman	Director of Safety	294-7905	ahaberman@eng.ufl.edu	Weil 241
James Fleetwood	Radiation and Laboratory Safety Coordinator	294-7954	jfleetwood@eng.ufl.edu	Weil 239

FACILITIES SERVICES

Steven Vann	Director of Facilities	294-0428	svann@eng.ufl.edu	Weil 245