

## Lab Safety Expectations/ Rules

Senior design projects provide wonderful hands-on experiences for students. The following safety rules will help to ensure every student has a safe, rewarding and valuable educational experience in the lab.

- At least two people should be present in the lab when equipment and/or tools are in use.
- Always ask if you are unsure about something.
- Long pants and closed toed shoes are required in the lab when equipment and/or tools are in use.
- In the event of an injury or exposure to a chemical, regardless of severity, the lab user must report to the instructor and complete an accident report. In the event of serious/severe injuries or exposures call 9-1-1 immediately for medical attention.
- Do not attempt to remove foreign objects from the eye or body. Seek medical attention immediately. If chemicals are splashed into the eyes, utilize an eyewash station to rinse eyes for 15 minutes before seeking medical attention.
- Report any damage or missing parts to tools/equipment to the instructor immediately.
- During repair, cleaning or oiling, machines and equipment MUST be shut off and locked out to ensure unauthorized startup does not occur.
- Neck ties, loose clothing, jewelry, gloves, etc. are prohibited around moving or rotating machinery. Long hair must be tied back or covered to keep it away from moving machinery.
- A brush, hook or specialized tool is preferred for removal of chips, shaving, etc. from work areas. Never use hands to clear work areas.
- Maintain the lab in a clean and orderly manner.
- Keep the floor clean, dry and free from trip and slip hazards.
- Food and drinks are prohibited in the lab.
- Review the Safety Data Sheet (SDS) for all chemicals used.
- Store oily rags in approved containers only.
- Used chemicals should never be poured down the drain or disposed outdoors. Contact Environmental Health & Safety for chemical disposal services.
- Clean up solvent and chemical spills immediately. In the event of a large spill, contact Environmental Health & Safety emergency response team for cleanup services.
- Know the location of the fire extinguisher, eyewash station, first aid kit, and fire escape route for your room.

**FAMU-FSU College of Engineering  
Project Hazard Assessment Policy and Procedures**

**INTRODUCTION**

University laboratories are not without safety hazards. Those circumstances or conditions that might go wrong must be predicted and reasonable control methods must be determined to prevent incident and injury. The FAMU-FSU College of Engineering is committed to achieving and maintaining safety in all levels of work activities.

**PROJECT HAZARD ASSESSMENT POLICY**

Principal investigator (PI)/instructor are responsible and accountable for safety in the research and teaching laboratory. Prior to starting an experiment, laboratory workers must conduct a project hazard assessment (PHA) to identify health, environmental and property hazards, and the proper control methods to eliminate, reduce or control those hazards. PI/instructor must review, approve, and sign the written PHA and provide the identified hazard control measures. PI/instructor continually monitors projects to ensure proper controls and safety measures are available, implemented, and followed. PI/instructor are required to reevaluate a project anytime there is a change in scope or scale of a project and at least annually after the initial review.

**PROJECT HAZARD ASSESSMENT PROCEDURES**

It is FAMU-FSU College of Engineering policy to implement followings:

1. Laboratory workers (i.e., graduate students, undergraduate students, postdoctoral, volunteers, etc.) performing research in FAMU-FSU College of Engineering are required to conduct PHA prior to commencement of an experiment or any project change in order to identify existing or potential hazards and to determine proper measures to control those hazards.
2. PI/instructor must review, approve, and sign the written PHA.
3. PI/instructor must ensure all the control methods identified in PHA are available and implemented in the laboratory.
4. In the event laboratory personnel are not following the safety precautions, PI/instructor must take firm actions (e.g., stop the work, set a meeting to discuss potential hazards and consequences, ask personnel to review the safety rules, etc.) to clarify the safety expectations.
5. PI/instructor must document all the incidents/accidents that happened in the laboratory along with the PHA document to ensure that PHA is reviewed/modified to prevent reoccurrence. In the event of PHA modification a revision number should be given to the PHA, so project members know the latest PHA revision they should follow.
6. PI/instructor must ensure that those findings in PHA are communicated with other students working in the same laboratory (affected users).
7. PI/instructor must ensure that approved methods and precautions are being followed by:
  - a. Performing periodic laboratory visits to prevent the development of unsafe practice.
  - b. Quick reviewing of the safety rules and precautions in the laboratory members meetings.
  - c. Assigning a safety representative to assist in implementing the expectations.
  - d. Etc.
8. A copy of this PHA must be kept in a binder inside the laboratory or PI/instructor's office (if experiment steps are confidential).

**Project Hazard Assessment Worksheet**

PI/instructor: Dr. McConomy	Phone #: 850-410-6624	Dept.: Mechanical	Start Date: 11/16/2022	Revision number: 1
Project: Team 518 Lunar Surface 2			Location(s): FAMU-FSU College of Engineering	
Team member(s): Joshua Baldwin, Enrique Chocron, Emily Dawson, Andres Hernandez, Joseph Way			Phone #: 303-810-9341	Email: erd18b@fsu.edu

Experiment Steps	Location	Person assigned	Identify hazards or potential failure points	Control method	PPE	List proper method of hazardous waste disposal, if any.	Residual Risk	Specific rules based on the residual risk
3D Printing	ME - Senior Design Lab  Room: A212	Joshua	Burns from hot PLA material, breathing harmful materials.	Operating the printer with proper air circulation.	N/A	Dispose of <a href="#">the material into the</a> appropriate waste receptacle.	HAZARD: 1 CONSEQ: Negligible  Residual: Low	All PPE must be applied before the soldering device is turned on. Safety controls are planned by both the worker and supervisor. Proceed with supervisor authorization
Machining Parts	Machine shop room number	All team members	Frayed or damaged electrical cords, machinery with exposed moving parts. Sharp corners from materials may cause minor cuts and bruises.	If a group member is doing the metal work, another person will be present. Members will not wear loose clothing or jewelry while machining. <a href="#">Mmbers must also work</a> in a well-ventilated environment	Safety glasses, close-toed shoes, long pants	Wipe down all tables and sweep the floors to ensure no metal scraps are left behind.	HAZARD: 3 CONSEQ: Significant  Residual: Medium High	OSHA requires safety glasses to be worn when the user may be subjected to flying particles
Regolith Simulant Resistive Media	NASA – MSFC  Huntsville, AL	All team members	There are two types of regolith simulant. Health	The larger grain regolith can be used in an enclosed but well	Mask, gloves, and safety glasses.	N/A	HAZARD: 2 CONSEQ: Minor	PPE for the dusty regolith will be worn including safety glasses and a

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			hazards occur with the fine dust-like simulant. It can cause eye and lung irritation.	vented environment. The dusty regolith needs to be in an open-air facility.			Residual: Low Medium	mask. <a href="#">NASA and NIOSH recommend being in a well-ventilated area and using an approved dust respirator for longer exposures times.</a>
Assembly	ME - Senior Design Lab  Room: A212	Andres	Receiving cuts from tools, Soldering burn/fumes, and electrocution.	The system has chassis grounding to route unwanted and potentially dangerous current away from the system elements and to protect anyone. Use of a heat shrink and proper insulation to prevent short circuits.	Safety glasses, gloves, masks, and closed-toed shoes.	Battery disposal and Disposing material in their appropriate waste/recycling receptacle	HAZARD: 2 CONSEQ: Minor  Residual: Low Medium	Safety controls are planned by both the worker and supervisor. A second worker must be in place before work can proceed (buddy system). Proceed with supervisor authorization.
General Prototyping	ME - Senior Design Lab  Room: A212	All team members	Eye and skin irritation and small cuts.	Use the buddy system as well as being in an isolated environment.	N/A	Wipe down all tables and dispose of any extra materials.	HAZARD:1 CONSEQ: Negligible  Residual: Low	Safety controls are planned by both the worker and supervisor. Proceed with supervisor authorization.
Testing	AME Building	All team members	Pinching, minor cuts and bruises, small debris. May also cause eye and lung irritation	Testing should be done in the designated testing apparatus.	Mask, closed-toed shoes, long pants, safety glasses.	N/A	HAZARD:3 CONSEQ: Moderate	Cautionary steps to complete testing with thorough analysis. This is done with planning steps

							Residual: Medium	beforehand and preparing needs.
CAD and Coding	Multiple locations	Joseph Joshua Andres	Prolonged exposure to looking at a computer screen for more than 20 minutes can cause eye irritation, headaches, dry eyes, and neck/back pain	Take breaks every 20 minutes. Walk around and stretch	N/A	N/A	HAZARD: 1 CONSEQ: Negligible	Drawings are done through computer aided design. This could have long term effects on muscles and eye strain.
							Residual: Low	
Transportation of Equipment	Multiple locations	Emily	Car collision	A safe, non-distracted driver, everyone is wearing seatbelts	Seatbelts	N/A	HAZARD: 2 CONSEQ: Significant	Seatbelts are to be worn while driving and protective coverings on materials will be used.
							Residual: Medium	

**Principal investigator(s)/ instructor PHA:** I have reviewed and approved the PHA worksheet.

Name	Signature	Date	Name	Signature	Date
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**Team members:** I certify that I have reviewed the PHA worksheet, am aware of the hazards, and will ensure the control measures are followed.

Name	Signature	Date	Name	Signature	Date
<u>Joshua Baldwin</u>	<u>Joshua Baldwin</u>	<u>03/03/2023</u>	<u>Emily Dawson</u>	<u>Emily Dawson</u>	<u>03/03/2023</u>
<u>Enrique Chocron</u>	<u>Enrique Chocron</u>	<u>03/03/2023</u>	<u>Andres Hernandez</u>	<u>Andres Hernandez</u>	<u>03/03/2023</u>

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## DEFINITIONS:

**Hazard:** Any situation, object, or behavior that exists, or that can potentially cause ill health, injury, loss or property damage e.g. electricity, chemicals, biohazard materials, sharp objects, noise, wet floor, etc. OSHA defines hazards as “*any source of potential damage, harm or adverse health effects on something or someone*”. A list of hazard types and examples are provided in appendix A.

**Hazard control:** Hazard control refers to workplace measures to eliminate/minimize adverse health effects, injury, loss, and property damage. Hazard control practices are often categorized into following three groups (priority as listed):

1. **Engineering control:** physical modifications to a process, equipment, or installation of a barrier into a system to minimize worker exposure to a hazard. Examples are ventilation (fume hood, biological safety cabinet), containment (glove box, sealed containers, barriers), substitution/elimination (consider less hazardous alternative materials), process controls (safety valves, gauges, temperature sensor, regulators, alarms, monitors, electrical grounding and bonding), etc.
2. **Administrative control:** changes in work procedures to reduce exposure and mitigate hazards. Examples are reducing scale of process (micro-scale experiments), reducing time of personal exposure to process, providing training on proper techniques, writing safety policies, supervision, requesting experts to perform the task, etc.
3. **Personal protective equipment (PPE):** equipment worn to minimize exposure to hazards. Examples are gloves, safety glasses, goggles, steel toe shoes, earplugs or muffs, hard hats, respirators, vests, full body suits, laboratory coats, etc.

**Team member(s):** Everyone who works on the project (i.e. grads, undergrads, postdocs, etc.). The primary contact must be listed first and provide phone number and email for contact.

**Safety representative:** Each laboratory is encouraged to have a safety representative, preferably a graduate student, in order to facilitate the implementation of the safety expectations in the laboratory. Duties include (but are not limited to):

- Act as a point of contact between the laboratory members and the college safety committee members.
- Ensure laboratory members are following the safety rules.
- Conduct periodic safety inspection of the laboratory.
- Schedule laboratory clean up dates with the laboratory members.
- Request for hazardous waste pick up.

**Residual risk:** Residual Risk Assessment Matrix is used to determine a project’s risk level. The hazard assessment matrix (table 1) and the residual risk assessment matrix (table2) are used to identify the residual risk category.

The instructions to use hazard assessment matrix (table 1) are listed below:

1. Define the workers familiarity level to perform the task and the complexity of the task.
2. Find the value associated with familiarity/complexity (1 – 5) and enter value next to: HAZARD on the PHA worksheet.

**Table 1. Hazard assessment matrix.**

		Complexity		
		Simple	Moderate	Difficult
Familiarity Level	Very Familiar	1	2	3
	Somewhat Familiar	2	3	4
	Unfamiliar	3	4	5

The instructions to use residual risk assessment matrix (table 2) are listed below:

1. Identify the row associated with the familiarity/complexity value (1 – 5).
2. Identify the consequences and enter value next to: CONSEQ on the PHA worksheet. Consequences are determined by defining what would happen in a worst-case scenario if controls fail.
  - a. Negligible: minor injury resulting in basic first aid treatment that can be provided on site.
  - b. Minor: minor injury resulting in advanced first aid treatment administered by a physician.
  - c. Moderate: injuries that require treatment above first aid but do not require hospitalization.
  - d. Significant: severe injuries requiring hospitalization.
  - e. Severe: death or permanent disability.
3. Find the residual risk value associated with assessed hazard/consequences: Low –Low Med – Med– Med High – High.
4. Enter value next to: RESIDUAL on the PHA worksheet.

**Table 2. Residual risk assessment matrix.**

Assessed Hazard Level	Consequences				
	Negligible	Minor	Moderate	Significant	Severe
5	Low Med	Medium	Med High	High	High
4	Low	Low Med	Medium	Med High	High
3	Low	Low Med	Medium	Med High	Med High
2	Low	Low Med	Low Med	Medium	Medium
1	Low	Low	Low Med	Low Med	Medium

**Specific rules for each category of the residual risk:**

Low:

- Safety controls are planned by both the worker and supervisor.
- Proceed with supervisor authorization.

Low Med:

- Safety controls are planned by both the worker and supervisor.
- A second worker must be in place before work can proceed (buddy system).
- Proceed with supervisor authorization.

Med:

- After approval by the PI, a copy must be sent to the Safety Committee.
- A written Project Hazard Control is required and must be approved by the PI before proceeding. A copy must be sent to the Safety Committee.
- A second worker must be in place before work can proceed (buddy system).
- Limit the number of authorized workers in the hazard area.

Med High:

- After approval by the PI, the Safety Committee and/or EHS must review and approve the completed PHA.
- A written Project Hazard Control is required and must be approved by the PI and the Safety Committee before proceeding.
- Two qualified workers must be in place before work can proceed.
- Limit the number of authorized workers in the hazard area.

High:

- The activity will not be performed. The activity must be redesigned to fall in a lower hazard category.

#### Appendix A: Hazard types and examples

Types of Hazards	Example
Physical hazards	Wet floors, loose electrical cables objects protruding in walkways or doorways
Ergonomic hazards	Lifting heavy objects Stretching the body Twisting the body Poor desk seating
Psychological hazards	Heights, loud sounds, tunnels, bright lights
Environmental hazards	Room temperature, ventilation contaminated air, photocopiers, some office plants acids
Hazardous substances	Alkalis solvents
Biological hazards	Hepatitis B, new strain influenza
Radiation hazards	Electric welding flashes Sunburn
Chemical hazards	Effects on central nervous system, lungs, digestive system, circulatory system, skin, reproductive system. Short term (acute) effects such as burns, rashes, irritation, feeling unwell, coma and death. Long term (chronic) effects such as mutagenic (affects cell structure), carcinogenic (cancer), teratogenic (reproductive effect), dermatitis of the skin, and occupational asthma and lung damage.
Noise	High levels of industrial noise will cause irritation in the short term, and industrial deafness in the long term.
Temperature	Personal comfort is best between temperatures of 16°C and 30°C, better between 21°C and 26°C. Working outside these temperature ranges: may lead to becoming chilled, even hypothermia (deep body cooling) in the colder temperatures, and may lead to dehydration, cramps, heat exhaustion, and hyperthermia (heat stroke) in the warmer temperatures.
Being struck by	This hazard could be a projectile, moving object or material. The health effect could be lacerations, bruising, breaks, eye injuries, and possibly death.
Crushed by	A typical example of this hazard is tractor rollover. Death is usually the result
Entangled by	Becoming entangled in machinery. Effects could be crushing, lacerations, bruising, breaks amputation and death.
High energy sources	Explosions, high pressure gases, liquids and dusts, fires, electricity and sources such as lasers can all have serious effects on the body, even death.
Vibration	Vibration can affect the human body in the hand arm with 'white finger' or Raynaud's Syndrome, and the whole body with motion sickness, giddiness, damage to bones and audits, blood pressure and nervous system problems.



Slips, trips and falls	A very common workplace hazard is from tripping on floors, falling off structures or downstairs, and slipping on spills.
Radiation	Radiation can have serious health effects. Skin cancer, other cancers, sterility, birth deformities, blood changes, skin burns, and eye damage are examples.
Physical	Excessive effort, poor posture and repetition can all lead to muscular pain, tendon damage and deterioration to bones and related structures
Psychological	Stress, anxiety, tiredness, poor concentration, headaches, back pain and heart disease can be the health effects
Biological	More common in the health, food and agricultural industries. Effects such as infectious disease, rashes and allergic response.

## Project Hazard Control- For Projects with Medium and Higher Risks

Name of Project:		Date of submission:
<b>Team member</b>	<b>Phone number</b>	<b>e-mail</b>
Joshua Baldwin	407-403-2086	jpb18@fsu.edu
Enrique Chocron	954-544-8810	eac17e@fsu.edu
Emily Dawson	303-810-9341	erd18b@fsu.edu
Andres Hernandez Chapa	786-860-3175	ahernandezchapa@fsu.edu
Joseph Way	850-273-2911	joseph1.way@famuc.edu
<b>Faculty mentor</b>	<b>Phone number</b>	<b>e-mail</b>
Shayne McConomy	850-410-6624	smcconomy@eng.famuc.edu

**Rewrite the project steps to include all safety measures taken for each step or combination of steps. Be specific (don't just state "be careful").**

During General Prototyping, the possible risks include small cuts, skin and inhalation irritation. The safety measures include being in a closed, well-ventilated environment and having multiple people working on the project simultaneously.

CAD presents negligible risk; however possible long-term issues could arise such as eye strain and back problems. We will take breaks to mitigate problems occurring in this stage.

3D Printing presents low risk, but situations involving burns from hot components can happen. We will satisfy the safety in this stage by avoiding touching scalding parts and working in a well-ventilated environment.

Any testing for the rover has a medium risk. Potential injuries include minor cuts, bruises, pinching, and debris injuries. Safe distances during testing and proper clothing including closed-toed shoes will be worn to help combat these possible risks.

Machining Parts presents a medium-high risk. Potential injuries may include cuts, bruises, pinches, and other injuries from debris. To help mitigate these risks, a minimum of two people will be present in the machine shop. Also, the people machining parts will wear the proper PPE, including close-toed shoes, safety glasses, and no loose-fitting clothing. Another step to help mitigate injuries is proper clean-up. Once the parts are done being machined, all metal shaving will be cleaned up and thrown away.

Assembling the project presents a minor risk. Potential injuries include cuts from tools, as well as burns from soldering or electrical aspects. Mitigation will be done using PPE, grounding all circuits, and ensuring more than one person is working on the assembly at a time.

Regolith Simulant Resistive Media presents a low-medium risk while using two different simulants. The first simulant is a larger grain size and presents negligible risk. The second type of regolith simulant is more dust-like and issues can occur when it is inhaled. To combat the risk of the dusty simulant, anyone around the simulant while tests are being conducted will wear safety glasses and a mask. The testing involved with the dusty regolith needs to occur in a non-enclosed facility.

At the end of the semester, this project may be transported up to the NASA-MSCF facility for final testing and validation. Transportation of equipment presents a medium risk. Potential injuries include any injury that could occur in a car accident: cuts, bruises, broken bones etc. To limit the possibility of injury, safe driving techniques will be observed by the driver, and everyone will wear their seatbelts.

**Thinking about the accidents that have occurred or that you have identified as a risk, describe emergency response procedures to use.**

- Remove the injured individual from the area if safe and possible
- Immediately shut down and stop the activity that caused an injury
- Secure the area to ensure no one else can get injured.
- If it is a minor injury, treat with first aid knowledge
- Contact proper authority (FSUPD, Supervisor, etc)
- Contact the individual's emergency contact and update them on the situation.
- Create an Accident Report

**List emergency response contact information:**

- Call 911 for injuries, fires or other emergency situations
- Call your department representative to report a facility concern

Name	Phone number	Faculty or other COE emergency contact	Phone number
Connie Baldwin	321-228-9331	Shayne McConomy	850-410-6624
Maria Hernandez	713-775-3223	Jonathan Clark	850-410-6608
Christine Dawson	720-244-3735		
Nicole Richardson-Way	904-240-6924		
Eduardo Chocron	954-544-8842		

**Safety review signatures**

Team member	Date	Faculty mentor	Date
<i>Joshua Baldwin</i>	03/03/2023		
<i>Enrique Chocron</i>	03/03/2023		
<i>Emily Dawson</i>	03/03/2023		
<i>Andres Hernandez</i>	03/03/2023		
<i>Joseph Way</i>	03/03/2023		

**Report all accidents and near misses to the faculty mentor.**