

## **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 monitor 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 a 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 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: Shayne McConomy	Phone #: 850-410-6624	Dept.: Mechanical Engineering	Start Date: 11/19/2021	Revision number: 0
Project: Team 502 – Material Handling of Ceramics (Sponsored by Corning)			Location(s): FAMU FSU College of Engineering (COE)	
Team member(s): Makada Browne, Erich Noack, Charles Stubbs, Amelia Veith			Phone #: 850-653-5170	Email: <a href="mailto:ces17f@my.fsu.edu">ces17f@my.fsu.edu</a>

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
Assembly  Including: Fastening, Lifting, Assembling System and Test Fixture	ME Senior Design Lab	Erich Noack	Lifting heavy objects, pinching appendages	Design proper joints for connection, minimize pinch points, no team member lifts heavy objects alone.	Gloves, Safety Glasses, Closed Toed Shoes	N/A	HAZARD:3 CONSEQ: Minor	Safety controls are planned by both the worker and supervisor. A second must be in place before work can proceed (buddy system). Proc supervisor authorization.
							Residual: Low-Med	
Part Fabrication  Including: Machining, Touchups, 3d Printing, Drilling, Cutting	ME Senior Design Lab, COE Machine Shop	Makada Browne	Dust, sharp edges	The College of Engineering machine shop professionals will perform most of the wood working and metal working.	Safety Glasses, Closed Toed Shoes	N/A	HAZARD: 2 CONSEQ: Significant	After approval by the PI, a copy must be sent to the Safety Committee. . . . Project Hazard Control is required and must be approved by the PI 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.
							Residual: Medium	

Circuit Fabrication  Including: Soldering, Connecting, Crimping	ME Senior Design Lab	Amelia Veith	Electrocution, Burn from soldering, shock from wires, toxic fumes	Leadless solder, using a fan during soldering. Design circuit and print with PCB to avoid excessive soldering.	Safety Glasses, Shoes		HAZARD: 1 CONSEQ: Minor	Safety controls are planned by both the worker and supervisor. Proc supervisor authorization.
							Residual: Low	
Detailed Software and CAD Design	Remote	Charles Stubbs	Radiation emission, exposure to Musculoskeletal Disorder risk factors	Using appropriate eyewear can minimize this radiation hazard. Comfortable seating.	Blue Light Glasses, Ergonomic Seating	N/A	HAZARD: 3 CONSEQ: Negligible	Safety controls are planned by both the worker and supervisor. Proc supervisor authorization.
							Residual: Low	
Test Operation  Including: Startup, Each Test Condition and Shutdown	ME Senior Design Lab, COE Courtyard	Charles Stubbs	Electrocution, shock hazard, collision hazard	Using appropriate eyewear when running tests, not standing too close to the effector during operation. Operation protocol and test procedure must be followed. Test procedure will consider failure points.	Safety Glasses, Closed Toed Shoes	N/A	HAZARD: 3 CONSEQ: Minor	Safety controls are planned by both the worker and supervisor. Proc supervisor authorization.
							Residual: Low	

Teardown Including: Disassembly, Inspection, Waste Disposal	ME Senior Design Lab	Erich Noack	Heavy lifting hazard, sharp edges	No heavy lifting alone, properly disposes of waste.	Safety Glasses, Closed Toed Shoes	Take to Marpan, Give ceramic blanks to Dr. Hellstrom	HAZARD: 2 CONSEQ: Minor	Safety controls are planned by both the worker and supervisor. Proc supervisor authorization.
							Residual: Low	

**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
Makada Browne	<u>Makada Browne</u>	11/19/21	Charles Stubbs	<u>Charles Stubbs</u>	11/19/21
Erich Noack	<u>Erich Noack</u>	11/19/21	Amelia Veith	<u>Amelia Veith</u>	11/19/21

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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 are used to determine 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**

<b>Types of Hazard</b>	<b>Example</b>
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 from tripping on floors, falling off structures or down stairs, 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

<b>Name of Project: Material Handling of Ceramics</b>		<b>Date of submission: 11/19/2021</b>
<b>Team member</b>	<b>Phone number</b>	<b>e-mail</b>
Makada Browne	(786) 266 - 2428	msb16f@my.fsu.edu
Erich Noack	(813) 545 - 5771	ean18f@my.fsu.edu
Charles Stubbs	(850) 653 – 5170	ces17f@my.fsu.edu
Amelia Veith	(850) 206 -2282	afv17@my.fsu.edu
<b>Faculty mentor</b>	<b>Phone number</b>	<b>e-mail</b>
Shayne McConomy	(850) 410 - 6624	smcconomy@eng.famu.fsu.edu
<p><b>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").</b></p>		
<p><b>Fabrication: The parts that compose the system and test fixture must be fabricated prior to assembly. The risks identified include potential electrical hazards, physical hazards, cutting hazards, chemical hazards and ergonomic hazards. The system will be designed to reduce the amount of soldering, cutting and time spent on a computer. There will be required PPE such as eyeglasses and closed toed shoes. Design considerations will be taken to primarily include parts that can be ordered off the shelf and can be produced by professionals.</b></p>		
<p><b>Assembly: While assembling the project, the parts should be laid out and a plan must be followed. The risks identified include lifting heavy objects, pinching appendages, and using a knife to unbox parts. There will be required PPE such as gloves, safety glasses, and closed toed shoes. Multiple people must be involved in the assembly process to reduce risk of injury.</b></p>		
<p><b>Operation: While the project is in operation, the system is designed to ensure everyone is safe. The risks identified include electrocution, shock, and collision. There will be required PPE such as safety glasses and closed toed shoes. All people involved must follow the provided operating procedure and test procedure.</b></p>		
<p><b>Teardown: During teardown, the project must be completely without power. The risks identified include heavy lifting and handling sharp edges. There will be required PPE such as safety glasses and closed toed shoes.</b></p>		
<p><b>Thinking about the accidents that have occurred or that you have identified as a risk, describe emergency response procedures to use.</b></p>		
<p><b>Shut off equipment</b>  <b>Call for an ambulance</b>  <b>Call for a faculty member from the COE</b></p>		

**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	Team Member	Faculty or other COE emergency contact	Phone number
<b>Lyra Browne</b>	<b>(786)581-9230</b>	<b>Makada Browne</b>	<b>1. Dr. Shayne McConomy</b>	<b>850-410-6624</b>
<b>Demi Noack</b>	<b>(813)465-4950</b>	<b>Erich Noack</b>	<b>2. Beth Gray</b>	<b>850-410-6625</b>
<b>Chuck Stubbs</b>	<b>(850) 545-5975</b>	<b>Charles Stubbs</b>	<b>3. Donald Hollett</b>	<b>850-410-6600</b>
<b>Olivia Veith</b>	<b>(850) 207-2912</b>	<b>Amelia Veith</b>	<b>4. Keith Larson</b>	<b>850-410-6108</b>

**Safety review signatures**

Team member	Date	Faculty mentor	Date
<b>Makada Browne</b> <i>Makada Browne</i>	<b>11/19/2021</b>		
<b>Erich Noack</b> <i>Erich Noack</i>	<b>11/19/2021</b>		
<b>Charles Stubbs</b> <i>Charles Stubbs</i>	<b>11/19/2021</b>		
<b>Amelia Veith</b> <i>Amelia Veith</i>	<b>11/19/2021</b>		

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