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: Dr. Brandon Krick	Phone #:	Dept.:	Start Date:	Revision number:
Project: Tribometer in Spacelike Conditions			Location(s): FSU AME Lab	
Team member(s): Madison Retherford, Branham Channell, Joshua Wesley, Javier Ibanez, Cobi Johnson			Phone #: 850-718-6906 412-592-9662 850-693-1193 850-980-1592 727-244-0927	Email: mar21@fsu.edu bgc19c@fsu.edu jwc20do@fsu.edu jai19@fsu.edu cnj14@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**
Prototyping	AME Lab	Team 501	Wiring and testing. Load cells.	Wire without power source plugged in. Verify load cells wired properly before receiving power.			HAZARD: 3 CONSEQ: Minor Residual: Low-med	Plan safety controls. Supervised. 2 qualified workers.
Load samples: Clean sample and counter sample. Mount in sample holders.	AME Lab	Adam DeLong and Kylie Van Meter	Hazardous substance (generally safe for skin, not eyes).		Gloves Glasses/ goggles/ face shield		HAZARD: 1 CONSEQ: Negligible Residual: Low	Plan safety controls. Will be supervised.
Lift vacuum chamber “lid”: Gas powered piston lift. Clamp to hold up.	AME Lab	Adam DeLong and Kylie Van Meter	Crushed by vacuum chamber if clamp is not tight and the gas happens to get cut off.	Clamp to keep lid in place. Make sure all clear until clamp is tight			HAZARD: 2 CONSEQ: Significant Residual: Medium	Get proper approvals. 2 qualified workers and limited number of people in area.

Insert sample holder into system: Careful not to touch anything inside the vacuum chamber with bare skin.	AME Lab	Adam DeLong and Kylie Van Meter	Crushed by vacuum chamber and 18-inch opening requiring poor posture.	Clamp to keep lid in place. Enable software safety feature.	Gloves		HAZARD: 4 CONSEQ: Significant Residual: Med-high	Get proper approvals. 2 qualified workers and limited number of people in area.
Remove clamp. Lower chamber lid.	AME Lab	Adam DeLong and Kylie	Hands/arms getting crushed.	Make sure all clear before lowering.			HAZARD: 2 CONSEQ: Significant	Get proper approvals. 2 qualified workers and
		Van Meter					Residual: Medium	limited number of people in area.

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**
Roughing pump pulls vacuum. After reaching 10^{-2} mbar pressure turn on cryo-pump.	AME Lab	Adam DeLong and Kylie Van Meter					HAZARD: 1 CONSEQ: Negligible Residual: Low	Plan safety controls. Will be supervised.
If using cooling system for stage: Liquid nitrogen will be used.	AME Lab	Adam DeLong and Kylie Van Meter	Chemical hazard, liquid nitrogen coming out liquid at the end instead of gas.	Insulated tubes for nitrogen transfer. Reheater to make sure gas comes out.		Fume hood to take out nitrogen gas	HAZARD: 3 CONSEQ: Severe Residual: Med-high	Get proper approvals. 2 qualified workers and limited number of people in area.
Run tests.	AME Lab	Adam DeLong and Kylie	Friction coefficient too high or other reasons for halt.	Software safety checkpoints on things such as voltage.			HAZARD: 1 CONSEQ: Negligible	Plan safety controls.

		Van Meter		Emergency stop.			Residual: Low	Will be supervised.
Test finished: Turn off all pumps. Vent chamber.	AME Lab	Adam DeLong and Kylie Van Meter	Frost ruining samples.	Make sure liquid nitrogen is off and stage/surfaces are room temperature.			HAZARD: 2 CONSEQ: Negligible Residual: Low	Plan safety controls. Will be supervised.
Open chamber and take out samples.	AME Lab	Adam DeLong and Kylie Van Meter	Crushed by vacuum chamber. Keeping bare skin off inner chamber.	Clamp to keep lid in place. Enable software safety feature.	Gloves.		HAZARD: 3 CONSEQ: Significant Residual: Med-high	Get proper approvals. 2 qualified workers and limited number of people in area.

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

Name	Signature	Date
Dr. Brandon Krick		11/21/23

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
Madison Retherford		11/21/23	Cobi Johnson		11/21/23
Branham Channell		11/21/23			
Joshua Wesley		11/21/23			
Javier Ibanez		11/21/23			

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

Types of Hazard	**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 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

Name of Project: Tribometer in Space-like Conditions		**Date of submission: 11/22/23**
Team member	**Phone number**	**e-mail**
Madison Retherford	850-718-6906	mar21@fsu.edu
Branham Channell	412-592-9662	bgc19c@fsu.edu
Joshua Wesley	850-693-1193	jwc20do@fsu.edu
Javier Ibanez	850-980-1592	jai19@fsu.edu
Cobi Johnson	727-244-0927	cnj14@fsu.edu
Faculty mentor	**Phone number**	**e-mail**
Dr. Brandon Krick		

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").

Prototyping

Any wiring of the system will be done without plugging into a power source. Wiring of load cells will be verified before plugging into a power source.

Loading samples into the system:

Clean sample and counter sample with a solvent, wear gloves and eye protection. Mount in sample holers.

Lift vacuum chamber lid:

Using gas powered piston lift, once lifted to desired height clamp to keep in place and avoid lid falling on anyone. Make sure all stay clear until clamp is tight.

Insert sample holder into system:

Enable software safety features while hands are near the system.

Wearing gloves, insert sample holder without touching inner chamber with bare skin.

Make sure everyone is clear of the chamber, remove the clamp, and lower the lid.

If a cooling system is required for the stage:

Make sure reheater is set so the liquid nitrogen isn't coming back out of the system liquid and spilling into the fume hood area.
Make sure all nitrogen gas is exiting through fume hood.

Run tests:

Software safety checkpoints being run to check voltage, temperature, friction coefficients, etc so the system's emergency stop will be triggered if necessary.

Testing finished:

Turn off all pumps, make sure liquid nitrogen is off and the stage and surfaces have returned to room temperature to avoid samples frosting.
Vent the vacuum chamber.

Open the vacuum chamber:

Lift and clamp chamber lid, enable software safety feature while hands are near the system, wear gloves to take out the samples making sure not to touch the inner chamber with bare skin.

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

If injury occurs from wiring anything while connected to power:

If severe, call 911 and emergency contacts. If not apply necessary first aid.

If vacuum chamber lid falls on anyone:

Raise lid, clamp in place, assess damage. If severe call 911 and emergency contacts.

If solvent gets on skin:

Wash off, solvents should not be harmful to skin.

If solvent gets in eyes:

Flush eyes, call 911 if necessary.

Emergency stop of system:

If temperature is out of the allowed range, pressure is out of the allowed range, friction coefficient is too high, or voltage is out of the allowed range the system will halt and begin moving to room temperature so the vacuum chamber can be opened.

Nitrogen Hazards:

Exposure: if skin comes in contact with liquid nitrogen, run the area of skin under cool or warm water for fifteen minutes (do not use hot or cold water). Any covering or clothing that may restrict circulation should be removed carefully, taking care not to remove skin.

Spills: do not attempt to clean up a spill of liquid nitrogen. Spills involving a large amount of a cryogen (especially in a confined space) can lead to a dangerously oxygen deficient atmosphere. In many cases, the best method of handling a spill is to isolate the area and allow the material to disperse over time. Personnel should be evacuated from the room and EHS contacted for assistance.

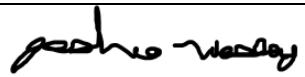
Oxygen deficiency: in the event the oxygen monitor alarms or symptoms of oxygen deficiency are suspected, evacuate the area and contact Public Safety.

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
Angela Channell	**412-692-0749**	**Dr. Brandon Krick**	

Scarlet Retherford	**850-718-6039**	**Dr. Shayne McConomy**	

Safety review signatures			
Team member	Date	Faculty mentor	Date
	**11/21/23**		**11/21/23**
	**11/21/23**		
	**11/21/23**		
	**11/21/23**		
	**11/21/23**		

Report all accidents and near misses to the faculty mentor.