**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 :
   1. Performing periodic laboratory visits to prevent the development of unsafe practice.
   2. Quick reviewing of the safety rules and precautions in the laboratory members meetings.
   3. Assigning a safety representative to assist in implementing the expectations.
   4. 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).

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| **Project Hazard Assessment Worksheet** | | | | |
| PI/instructor: Dr. Carl Moore | Phone #: (850) 410-6367 | Dept.: ME | Start Date: 11/09/2022 | Revision number: 1 |
| Project: RE-RASSOR Shoulder Phase II | | | Location(s): FAMU-FSU College Of Engineering | |
| Team member(s): Morgan Causey, Megan Kimsey, Ibrahim Nabulsi, Gissel Reynoso, Joseph Vogl | | | Phone #: N/A | Email: N/A |

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| **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** |
| Tensile Testing PLA | Room B217 | MK/JV | -Heavy machinery  -Deformation of parts producing plastic shards  -Getting long hair caught in machine  -Getting jewelry or clothing caught in machine  https://www.osha.gov/sites/default/files/publications/OSHA3404laboratory-safety-guidance.pdf | -Stand a safe distance away from the machine  -Follow machine operation manual  -Follow directions from supervisor Dr. Campbell  -Wear proper PPE | -Safety goggles  -Closed-toed shoes  -Long pants  -Remove hanging jewelry, ties, or any loose clothing  -Tie long hair back | N/A | HAZARD:4  CONSEQ: Significant | -Get approval from Dr. Moore to conduct testing  -Send approval copy to the safety committee  -Megan and Joseph will be in place, along with supervisor Dr. Campbell  -Limit the number of other workers in the area |
| Residual: Med High |
| 3D-Printing Using PLA | Senior Design Lab Room A212, Room B216, Innovation Hub | MK | -Hot molten plastic  -High temperatures  -Machinery  https://www.cdc.gov/niosh/topics/advancedmnf/additivemnf.html | -Follow the operation manual  -Use proper precautions when handling high temperature materials  -Do not touch the nozzle of the extruder when the printer is powered on  -Use proper PPE if necessary | -Hot gloves (if needing to touch the nozzle when the printer is powered on) | N/A | HAZARD:1  CONSEQ: Minor | -Safety controls planned by Megan and Dr. McConomy  -Proceed with Dr. McConomy’s authorization |
| Residual: Low |
| Post Processing 3D-Printed Parts | Senior Design Lab Room A212 | MK/MC | -Sharp tools  -High temperatures  https://www.osha.gov/sites/default/files/publications/osha3080.pdf | -Never use sharp tools pointed towards someone  -Avoid touching parts of tools that may be high temperatures  -Wear proper PPE | -Safety goggles  -Hot gloves  -Closed-toed shoes | N/A | HAZARD:1  CONSEQ: Minor | -Safety controls planned by Morgan, Megan, and and Dr. McConomy  -Proceed with Dr. McConomy’s authorization |
| Residual: Low |
| Soldering Wires | Senior Design Lab room A212 | GR/IN | -High temperatures  -Possibility of shock  <https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.133>  https://www.osha.gov/welding-cutting-brazing/hazards-solutions | -Take precaution before operating soldering iron  -Have proper training before operating  -Remove any liquids from the area  -Wear proper PPE | -Safety goggles  -Insulat-ed gloves  -Remove hanging jewelry  -Tie long hair back | N/A | HAZARD:2  CONSEQ: Moderate | -Safety controls planned by Gissel and Dr. McConomy  -Ibrahim must be in place before work can proceed (buddy system)  -Proceed with Dr. McConomy’s authorization |
| Residual: Low Med |
| Handling Weight | Senior Design Lab room A212 | MC/JV | -Potential to drop the weight onto toes/fingers  -Possibility of straining back  https://www.osha.gov/sites/default/files/2018-12/fy08\_sh-17792-08\_struck\_by\_english\_r6.pdf | -Firmly grasp weight before lifting  -Lift in proper manner to avoid back straining  -Keep toes and fingers out of area directly below hanging weight  -Wear proper PPE | -Closed-toed shoes | N/A | HAZARD:1  CONSEQ: Significant | -Safety controls are planned by both Morgan and Dr. McConomy  -Joseph must be in place before work can proceed (buddy system)  -Proceed with Dr. McConomy’s authorization |
| Residual: Low Med |
| Wiring Arduino and Motor | Senior Design Lab room A212 | GR/IN | -Potential electrical fire  -Potential shock  https://www.cdc.gov/niosh/docs/2009-113/pdfs/2009-113.pdf?id=10.26616/NIOSHPUB2009113 | -Ensure voltage supplied does not exceed capacity of Arduino/motor  -Remove all liquids from the surrounding area  -Wear proper PPE if necessary | -Insula-ted gloves | N/A | HAZARD:3  CONSEQ: Minor | -Safety controls planned by Gissel, Ibrahim, and Dr. McConomy  -Ibrahim will be in place before work can proceed (buddy system)  -Proceed with Dr. McConomy’s authorization |
| Residual: Low Med |
| 3D Printing of Toxic Materials | Senior Design Lab room A212 | GR/IN | -Release of toxic fumes that could cause health concerns  https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.133 | -Ensure area has some method of ventilation  -Make sure ventilation equipment is powered on before beginning  -Wear proper PPE when in the printing area | -Fume hood, N95 mask or respirator  -Safety goggles | -Properly collect ventilation debris, and send to the appropriate disposal location | HAZARD:3  CONSEQ: Severe | -After approved by Dr. Moore, a copy must be sent to the Safety Committee  -Write a Project Hazard Control, which must be approved by Dr. Moore and sent to the Safety Committee  -Gissel and Ibrahim must be in place before work can proceed  -Limit the number of other workers in the hazard area |
| Residual: Med High |
| Assembling Gearbox | Senior Design Lab room A212 | MC/JV | -Sharp edges  -Tight-fitting pieces  -Tools may be required for assembly  -Extruding parts such as screws  -Moving parts  -Choking on the BBs  -Getting hair, jewelry, ties, or any loose clothing caught in the gearbox  -Pinch points  https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.212 | -Use the proper tools for assembly  -Refrain from any forceful motions  -Wear proper PPE  -Keep skin clear from parts being assembled  -Keep small parts away from mouth | -Safety glasses  -Close-toed shoes  -Remove hanging jewelry, ties, or any loose clothing  -Tie long hair back | N/A | HAZARD:2  CONSEQ:  Negligible | -Safety controls are planned by Morgan, Joseph, and Dr. McConomy  -Proceed with Dr. McConomy’s authorization |
| Residual: Low |
| Using Glue and Epoxy | Senior Design Lab room A212 | IN | -Damaging skin  -Gluing body parts together  -Gluing body parts to other objects  -Unintention-ally getting glue/epoxy in the eyes or mouth  -Getting hair, jewelry, ties, or any loose clothing caught in the gearbox  https://www.osha.gov/chemical-hazards | -Keep skin, eyes, and mouth clear from any epoxy or glue when applying such materials  -Make sure to close glue/epoxy entirely when returning it to its storage container  -Know where closest eye washing station is, for if contact with eye happens to occur  -Have poison control phone number prepared in case of ingestion  -Wear proper PPE | -Gloves  -Safety goggles  -Remove hanging jewelry, ties, or any loose clothing  -Tie long hair back | N/A | HAZARD:1  CONSEQ: Minor | -Safety controls are planned by both Ibrahim and Dr. McConomy  -Proceed with Dr. McConomy’s authorization |
| Residual: Low |
| Using a Power Drill | Senior Design Lab room A212 | MC/IN | -Getting long hair caught  -Body parts in the way  -Drill not assembled properly  https://www.osha.gov/sites/default/files/publications/osha3080.pdf | -Ensure safety mode is engaged  -Follow operation manual  -Keep finger off trigger until ready to drill | -Safety glasses | N/A | HAZARD:2  CONSEQ: Significant | -After approval by Dr. Moore, a copy must be sent to the safety committee  -A written Project Hazard Control is required and must be approved by Dr. Moore and sent to the Safety Committee  -Ibrahim must be in place before work can proceed (buddy system)  -Limit number of other workers in the hazard area |
| Residual: Medium |
| Sitting at a Computer for Extended Periods of Time | College of Engineering | GR | -Back and neck strain  -Eye strain  -Headaches  https://www.osha.gov/etools/computer-workstations | -Take intermittent breaks to stretch  -Look away from computer every 20 minutes | -Blue Light Glasses | N/A | HAZARD:1  CONSEQ: Minor | -Safety controls are planned by both Gissel and Dr. McConomy  -Proceed with Dr. McConomy’s authorization |
| Residual: Low |

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

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| --- | --- | --- | --- | --- | --- |
| **Name** | **Signature** | **Date** | **Name** | **Signature** | **Date** |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_ |

**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** |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_ |
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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.
   1. Negligible: minor injury resulting in basic first aid treatment that can be provided on site.
   2. Minor: minor injury resulting in advanced first aid treatment administered by a physician.
   3. Moderate: injuries that require treatment above first aid but do not require hospitalization.
   4. Significant: severe injuries requiring hospitalization.
   5. 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**

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| --- | --- |
| **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. |