4.0 ELECTRICAL AND MECHANICAL SAFETY

4.1 BACKGROUND

Electrical and mechanical safety are important components of a comprehensive Laboratory Environmental Health and Safety program. This section will outline regulatory requirements, risk and controls associated with electrical and mechanical hazards in laboratory facilities, and ways to minimize potential risks.

4.2 REGULATIONS

Machinery and Machine Guarding, 29 CFR 1910 Subpart O, requires machine guards to be in place on any equipment where machine parts and/or functions may cause injury, and prohibits the removal of guards from machinery.

The Control of Hazardous Energy (Lockout/Tagout), 29 CFR 1910.147, requires specific practices and procedures to safeguard employees from the unexpected energization or startup of machinery and equipment, or the release of hazardous energy during service or maintenance activities.

4.3 HIGH VOLTAGE

The National Electrical Code, NFPA 70 (2011), defines *high voltage* as any voltage over 600 Volts. The University laboratory employees will not perform work on high voltage circuits.

4.4 ALTERATIONS TO EXISTING EQUIPMENT

Alterations to existing equipment must not be made except by authorized and qualified employees, or without design and process input from appropriate professional experts, which may include the University EH&S and Facilities, electrical and/or mechanical engineers, and technical representatives of the manufacturer of the equipment.

No equipment may be altered by removing machine guards which were part of the equipment as designed and provided by the manufacturer.

4.5 MACHINE GUARDING

Machine guarding is required by OSHA under 29 CFR 1910.211. A guard is a barrier that prevents the entry of the operator's hands or fingers into any part of a machine or piece of equipment where they may be cut or caught between moving parts, between moving and stationary parts, or between the material and moving parts of the machine.

Guarding is required of machine tools. Hand-held, portable power tools, or manual tools are not required to be guarded.

Machine guarding provided by the manufacturer should never be removed from the machine.

4.6 LOCKOUT/TAGOUT

Listed below are general procedures and rules for lockout/tagout required by the OSHA standard.

- All equipment shall be locked or tagged out to protect against accidental or inadvertent operation when such operation could cause injury to personnel.

  No one shall attempt to operate any switch, valve, or other energy isolating device where it is locked or tagged out.

- Lockout (vs. tagout) must be used when the energy isolating device is capable of being locked out.

- Tagout without lockout shall only be used when the energy isolating device is not capable of being locked out. When tagout alone is used, the following conditions must be met:

  - The tagout device must be attached at the same location the lockout device would have been attached.

- The tagout procedure must provide protection equal to that provided by a lockout procedure through the implementation of additional measures. Examples of such measures are:

    - Removing an isolating circuit element.
    - Blocking a controlling switch.
    - Opening an extra disconnecting device.
    - Removing a valve handle to reduce the likelihood of inadvertent energization.
    - Positioning standby personnel at the tagout location.

- Whenever major replacement, repair, renovation, or modification of machines or equipment is performed, the energy isolating device shall be designed to accept a lockout device.

- No new machines or equipment shall be installed unless the energy isolating device is capable of accepting a lock.

- **Only authorized employees** are permitted to implement a lockout/tagout procedure. Authorized employees must be trained in accordance with the OSHA standard. The names of those authorized to implement lockout/tagout on a machine or a piece of equipment must be identified in writing.

- Lockout and tagout devices must be standardized for the facility. Each affected department is to have their own identifiable lockout/tagout device.

- All locks will be on the "One Lock—One Key" rule. Each lock and key must be singularly identified. The supervisors shall maintain a list of locks and keys and the names of the employees to whom they have been assigned.

- Each lockout/tagout device shall be removed from each energy isolating device by the employee who applied the original lock or tag. When the authorized employee who applied the lockout or tagout device is not available to remove it, only the supervisor, accompanied by another authorized employee, may remove that device.

Lockout/tagout removal under these circumstances may be performed only when the following conditions are met.

- The supervisor has verified that the authorized employee who applied the device is not at the facility.
- The supervisor has made all reasonable efforts to contact the authorized employee to tell him/her that his/her lockout or tagout device has been removed.
- The supervisor has ensured that the authorized employee is informed that his/her lockout or tagout device has been removed before the employee resumes work at this facility.

- If more than one authorized employee is required to lockout or tagout the equipment/machinery, each shall place their own personal lockout or tagout device on the energy isolating device(s).

- For shift or personnel changes during a lockout or tagout, there must be an orderly transfer of lockout or tagout devices between the first employee(s) and the relief employee(s).

- Whenever outside servicing personnel are engaged in lockout or tagout activities, the respective University department and the outside employer shall inform each other of their respective lockout/tagout procedures.

- If any laboratory employee performs lockout/tagout, training shall be given to all authorized, affected, and other personnel as follows.

  - Each authorized employee shall receive training in the recognition of applicable hazardous energy sources, type and magnitude of the energy available in their respective work places, and the method and means necessary for energy isolation and control.
  - Affected employees shall receive instructions in the purpose and use of the energy control procedures.

- All other employees who may be in areas where energy control procedures may be utilized will be informed of the lockout/tagout program, including the significance of attached tags.

- Retraining will be required whenever there is a change in lab assignments, equipment, or processes that present a new hazard, or in the energy control procedures.

- Retraining will also be required whenever the periodic inspections reflect deficiencies in an employee's knowledge or use of energy control procedures.

- Each department shall ensure that appropriate training of their employees has been accomplished and is being kept up-to-date. Training shall be documented to include the identity of persons trained and dates of training.

- All training shall be coordinated through the University EH&S office and conducted on an annual basis for those employees for whom training is necessary.