

# Sanford

## Underground Research Facility



## **ENVIRONMENT, HEALTH AND SAFETY**

## **LOCKOUT/TAGOUT**

**Document-73361**

**Version 3**

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## Version Control

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Responsible Person	Document Control Number	Document Version	Publication Date	Description of Change
Jason Rosdahl & Chris Bauer	Document-73361	1	06/21/2010	Initial release.
Jim Hanhardt	Document-73361	2	09/02/2014	Re-write to add administrative LOTO requirements, remove appendices, and general updates throughout.
Jim Hanhardt	Document-73361	3	12/16/2014	Update LOTO tag shown in Section 5.3.3.

## 1. POLICY

It is the Sanford Underground Research Facility (SURF, hereafter referred to as Sanford Lab) policy to prevent the unintended or unexpected start-up or release of hazardous energy during servicing, maintenance, or modification activities. No person shall install, service, remove, or perform maintenance on any equipment or machinery that may involve an energy hazard, until that equipment has been de-energized, locked, tagged, and verified to be in a zero energy state in accordance with this document. The equipment will only be started when each person performing the work removes his or her lock and tag.

The purpose of this policy is to establish minimum safety requirements for the lockout and tagout of hazardous energy sources and the verification of energy isolation through the use of isolating devices and techniques during service or maintenance on equipment.

## 2. SCOPE

This program applies to all employees, contractors, scientists, vendors, and visitors (otherwise known as ‘Laboratory Personnel’) who may be exposed to hazardous energy while performing any servicing, maintenance, or modification activity.

The lockout/tagout and verification procedures identified in this document must be strictly followed when it is necessary to work on any equipment that generates, holds, or may release, any form of hazardous energy while the equipment is shut down, including, but not limited to:

- Electrical (see [Electrical Safety Policy](#))
- Electromagnetic (UV, RF, Magnetic Field)
- Radioactive
- Chemical/Fuels
- Pressure or Vacuum
  - Pneumatic/Compressed Gasses
  - Water/Liquid under pressure
  - Hydraulic
- Mechanical
  - Kinetic/Rotational
  - Gravity
  - Springs
- Thermal
- Other

### 2.1 Where Required

LOTO is required whenever service, maintenance, or modification is being performed on equipment or apparatus in which the unexpected energization or start-up of the equipment, or the release of stored energy, could cause injury to people or damage to equipment.

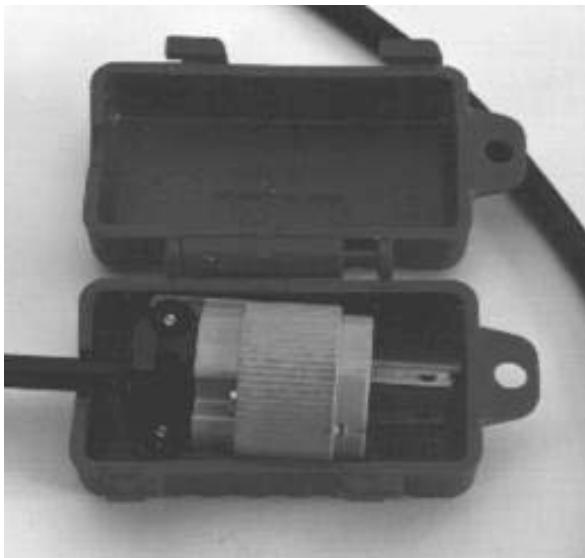
### 2.2 Exclusions

LOTO procedures do not apply under the following three conditions:

- A. Work on cord and plug connected electrical equipment, in which:
  - there is a single energy source;

- all of the hazardous energy is controlled by unplugging the equipment; and
- the plug remains under the continuous positive control of the worker performing the servicing, maintenance, or modification.

**The use of a plug LOTO device is strongly recommended, see Figure 1.**



**Figure 1: Lockout Box for Plugs**

- B. Operations on energized equipment (e.g., measuring, troubleshooting, calibration), where continuity of service is essential to safety or shutdown of the system cannot be reasonably accomplished. Supervisor approval is always required for such operations, and **documented safety procedures that provide an equivalent level of safety must be established and followed.**

**Special safety equipment may be required. (See [Electrical Safety Policy](#))**

- C. Minor tool changes, adjustments, and other minor servicing activities that take place during normal operations, provided that: (a) such activities are routine, repetitive, and integral to the use of the equipment and that (b) the work is performed using alternative measures that provide effective personnel protection.

### **3. RESPONSIBILITIES**

#### **3.1 All Workers**

Each worker is responsible for his or her own safety. Never undertake a task that you feel is unsafe. All workers are responsible for recognizing when LOTO is being used, the general reasons for LOTO, and the importance of not tampering with or removing a lock and tag.

#### **3.2 LOTO-Authorized Employees**

LOTO –Authorized Employees have responsibility for recognizing the conditions of work that require LOTO, assessing all of the hazardous energy sources, using correct procedures and materials to implement LOTO, and maintaining control over their key.

Each LOTO-Authorized Employee performing servicing, maintenance, or modification is responsible for applying his or her own lock and tag.

**NEVER apply LOTO for anyone else.  
See Section 5.7 for Group LOTO Procedures.**

### 3.3 *Supervisors*

Supervisors are responsible for:

- Prohibiting employees from working on equipment requiring LOTO until the worker is trained in and authorized to perform LOTO.
- Generating and maintaining equipment specific written procedures where required per Section 5.1.1 and inspecting these procedures at least annually.
- Assigning and documenting employee LOTO authorization per Section 5, including:
  - Designating specific equipment or categories of equipment to be controlled.
  - Verifying that workers are qualified to perform the necessary energy-control procedures.
- Determining the appropriate levels of training required for each employee.
- Ensuring consistent policy implementation and reinforcing LOTO rules.
- Removing LOTO devices in case of emergency and controlling emergency keys for LOTO locks per Section 5.5.
- Keeping accurate LOTO logs, when required.
- Ensuring that necessary LOTO hardware is available.

### 3.4 *EHS Department*

The EHS Department is responsible for:

- Maintaining, administering, and revising the LOTO program as needed.
- Ensuring that LOTO equipment is available and consistent with Sanford Laboratory standards.
- Developing and implementing training.
- Periodically auditing LOTO compliance.
- Upon request, reviewing LOTO documents and plans for Project Managers, Contractors and Laboratory employees.
- Maintaining electronic and hardcopy files of completed Equipment Specific Lockout Procedures and providing notice for annual audits.

### 3.5 *Project Manager*

The Project Manager is responsible for ensuring that all outside contractors (and any corresponding subcontractors) operating under their supervision are informed of, and adhere to, the Sanford Laboratory LOTO policy (see Section 5.9. Sanford Lab Contractors).

## 4. DEFINITIONS

**Lockout/Tagout (LOTO):** The method of applying a mechanical lockout device and a tag on an energy isolating device by an LOTO-Authorized Employee in accordance with established written procedures, in order to control hazardous energies and prevent the equipment from being operated until the lockout device is removed.

**Group Lockout/Tagout:** A procedure to coordinate the servicing or maintenance work assignment of several groups, multiple energy sources, or multiple LOTO procedures extending over more than one shift (days or weeks).

**Isolated:** A condition where all sources of hazardous energy have been controlled by physically stopping the energy path so that the energy cannot flow to workers. The term “isolated” is commonly used with electrical circuits and fluid lines.

**Blocked:** A condition where a mechanical device is inserted into the energy path to physically prevent movement. Most commonly used with mechanical machinery or fluid filled lines.

**Zero Energy State:** A condition that is reached when all energy sources to or within equipment are isolated, blocked, or otherwise relieved, with no possibility of re-accumulation. Equipment is not safe to work on until it is in a zero energy state.

**Energy isolating device:** A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following:

- Manually operated electrical circuit breaker
- Manually operated disconnect switch
- Manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors, and, in addition, no pole can be operated independently
- Line valve, block, or any similar device used to block or isolate energy

Energy-isolating devices must be capable of allowing a lock to be installed, with few exceptions. Push buttons, selector switches, software interlocks, or control circuit type devices are not energy isolating devices and cannot be used to isolate hazardous energy.

**Capable of being locked out:** An energy-isolating device is capable of being locked out if it has a hasp or other means of attachment to which, or through which, a lock can be affixed with the device in the “off” or de-energized position, or it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out if lockout can be achieved without the need to dismantle, rebuild, or replace the energy-isolating device or permanently alter its energy control capability.

**Lockout Device:** A device that utilizes a positive means, such as a single key LOTO lock, to hold an energy isolating device in the safe position and prevent the energizing of equipment or apparatus. Included are lockout hasps (a device to which multiple locks may be applied), blank flanges (caps a pipe at an end, likewise, cutting off materials feeds) and bolted slip blinds (slips into gap in pipe and bolts in place--cuts off materials feeds into a process).

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**Individual Lock (Also known as LOTO Lock):** A lock issued to an LOTO-Authorized Employee for which no other employee has the key or means of opening without using destructive force. Locks used for control of hazardous energies shall be unique in design and color, shall not be used for any other purpose, and shall be easily distinguishable from other standard locks (Administrative Lock, multi-key, combination, and other non-LOTO locks).

**Gang Lock Box:** A box used to contain the LOTO lock key(s) of designated LOTO-Authorized Employee(s) during a group LOTO procedure. Individual LOTO locks are placed on the gang box by each LOTO-Authorized Employee covered under the designated LOTO-Authorized Employee. The gang lock box shall be constructed in such a way as to permit multiple individual LOTO locks to be attached to the outside of the enclosure, preventing it from being opened except by removal of every individual LOTO lock.

**Administrative Lock:** Any lock that is used for a purpose other than LOTO. The lock may serve a safety function other than LOTO, a configuration control function, or other purpose. An administrative lock, unlike a LOTO lock, may be controlled by one or more individuals. An administrative lock shall not be labeled with a danger tag or sticker. An administrative lock is not a substitute for a LOTO lock. A LOTO lock cannot be used as an administrative lock.

**Tagout Only Device:** A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout only device is removed. Tags must be durable and able to withstand the environment to which they are exposed for the maximum time exposure is expected. These tags shall not be used for other purpose.

**Lockout Tag:** A distinctive, durable tag attached to the LOTO lock shackle, that identifies it as a lockout device and identifies the individual who placed the lock, the individual's phone number, and the time and date it was placed. The tag shall be of a standard shape and size for use throughout Sanford Laboratory. A lockout tag is not a substitute for a lockout device.

**Employees:**

**Note:** The terms 'employee' and 'worker' as used in this document refer to any person engaged with machinery / equipment involving energy hazards.

**LOTO-Authorized Employee:** A person who has completed the required hazardous energy control training (general and procedure-specific) and is LOTO-Authorized by the supervisor to lockout and tagout energy control points for a specific equipment or apparatus to perform service or maintenance. A person must be an LOTO-Authorized Employee to apply a lock or tag to control hazardous energy.

**Affected Employee:** A person whose job requires him or her to be near or around the hazard zone (but not within the hazard zone) when equipment or apparatus is being maintained or serviced under a locked-out or tagged-out condition. An affected employee may become a LOTO-Authorized employee when that employee's duties include performing servicing or maintenance covered under this policy.



**Other Employee:** Employee other than an Affected Employee or a LOTO-Authorized Employee who may in the course of their duties happen upon a LOTO situation and thus needs training to recognize LOTO items (locks, tags, etc.) and procedures. All employees will receive Lockout/Tagout awareness training as part of General Safety Basic and Annual Refresher Training.

**Qualified Electrical Person:** An electrical worker designated by Sanford Laboratory supervision, who by reason of experience and instruction has demonstrated familiarity with the construction, installation, maintenance, and operation of the electrical equipment and installations and the electrical hazards involved. This employee is also required to be current with all required qualification training. See [Electrical Safety Policy](#).

**Continuous positive control:** The piece of equipment, such as a cord and plug, are in the physical possession or in the control of the LOTO-Authorized Employee performing service or maintenance (such as the cord is in their hand or the plug is in their pocket).

**Hazard Zone:** The space near a source of hazardous energy where a person could be harmed if the hazardous energy was suddenly or unexpectedly released, such as the unexpected release of stored pressure, the unexpected movement of a machine, or the spray from a hazardous chemical that was unexpectedly released.

**Equipment Specific Lockout Procedure:** A written document that contains equipment specific information and procedural steps that a LOTO-Authorized Employee must follow in order to safely control hazardous energy during servicing or maintenance of equipment or apparatus.

**Servicing and/or maintenance:** Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or un jamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the **unexpected** energization or startup of the equipment or release of hazardous energy.

## 5. PROCEDURE/REQUIREMENTS

### 5.1 LOCKOUT/TAGOUT AND VERIFICATION PROCEDURES

All LOTO operations shall utilize either an equipment specific written procedure (Section 5.1.1 below) or the General LOTO procedure (Section 5.1.2 below), as applicable. Regardless of the procedure used, it is important that the following LOTO principles are strictly adhered to:

- All sources of hazardous energy must be shut off and secured.
- LOTO must be performed at each identified hazardous energy control point by each LOTO-Authorized Employee who works on the equipment.
- Each LOTO-Authorized Employee must apply their personal LOTO device whenever servicing, maintaining, or modifying machinery or equipment, regardless of the duration of the job or their proximity to the energy-isolating device (e.g., circuit breaker, switch, or valve).
- Each LOTO-Authorized Employee must personally witness or verify the absence of hazardous energy or assure that the verification has been performed.

#### 5.1.1 Equipment Specific Written Energy Control Procedure

An equipment specific written energy control procedure, [FORM Equipment Specific Lockout Procedure](#), must be developed and used whenever equipment or apparatus undergo servicing, modification, or maintenance that:

- Has more than one hazardous energy source, or
- Requires the operation of more than one device to isolate the hazardous energy, or
- Has potential for stored, residual, or accumulated hazardous energy.

When the premises have multiple pieces of the same equipment, the specific LOTO procedures will be located in central locations at the discretion of the appropriate department supervisor. The location for specific written procedures will be discussed in the LOTO employee awareness training course (General Safety Basic and Annual Refresher Training).

**The procedure must be posted on or near the equipment, or provided in such a manner as to ensure that all LOTO-Authorized Employees are provided this information before starting the work.**

##### 5.1.1.1 Preparing and Posting Equipment Specific Written Procedures

A written energy-control procedure must be generated by the department, group, or LOTO-Authorized Employee most familiar with the equipment. This procedure must be used by any LOTO-Authorized Employee who will LOTO the equipment.

**The procedure must be reviewed and updated as necessary any time there is a change in the equipment or associated hazards.**

Supervisors must ensure that equipment requiring written procedures is so identified and that the procedure is posted on the equipment or is readily available to the worker(s) authorized to LOTO the equipment.

##### 5.1.1.2 Elements of an Equipment Specific Written Procedure

The written hazardous energy control procedure must be specific to each piece of equipment (by model number or type of equipment) or apparatus, and must be inclusive of all energy types it contains. More complex equipment may require a separate procedure for each type of hazardous energy to be controlled, or a separate procedure for

each type of maintenance or servicing task expected to take place. Maintenance and service manuals must be consulted to ensure accuracy and sufficient level of detail.

### 5.1.1.3 *Required Content*

A form for the preparation of an Equipment specific Written Energy Control Procedure is provided: [FORM Equipment Specific Lockout Procedure](#). This procedure must incorporate all of the applicable elements of each step in Section 5.1.2 General LOTO Procedure. It is essential that the specific application of each LOTO step be clearly explained in the context of the specific equipment or apparatus. In addition, each written procedure must identify the specific equipment or apparatus to which the procedure applies, and must identify the following elements:

1. The procedure that will be performed that requires the control of hazardous energies.
2. The components or locations that are generating the hazardous energies to be controlled.
3. The energy types that will be controlled.
4. The specific locations for shutting down, isolating, blocking, safe releasing, and securing all potentially stored or residual hazardous energies.
5. The type of LOTO hardware to use, see Figure 2.
6. How to test for verification of hazardous energy control.



*Figure 2: LOTO Lock Station*

The [FORM Equipment Specific Lockout Procedure](#) is divided into three sections:

1<sup>st</sup> Sec. 1<sup>st</sup> page contains procedure and equipment identification, procedure and annual audit approvals, LOTO-authorized persons, and LOTO devices. 1<sup>st</sup> Sec. 2<sup>nd</sup> page contains the LOTO procedure. These first two pages will be the posted procedure (laminated and posted on the equipment) and will be a training item for the persons listed as LOTO-Authorized.

2<sup>nd</sup> Sec. 1<sup>st</sup> page is a worksheet to 1) identify hazardous energies, 2) note magnitude and type of energies, 3) determine isolation methods, and 4) establish isolation sequence. 2<sup>nd</sup> Sec. 2<sup>nd</sup> page is a table of energy considerations to aid in worksheet determinations.

3<sup>rd</sup> Sec. provides procedure annual audit direction and documentation/certification. Thus the FORM document: 1) contains the procedure, 2) provides training, 3) provides a worksheet to develop the procedure, and 4) serves to document annual audits. EHS will maintain electronic (DocuShare) and hardcopy files and provide notice for annual audits.

### **5.1.2 General LOTO Procedure**

Before starting any LOTO procedure, the LOTO-Authorized Employee(s) performing the work shall physically locate and identify all isolating devices to be sure which switches, valves, or other energy isolating devices apply to the equipment or apparatus to be locked out. Any questionable identification of electrical or other energy sources shall be resolved by the LOTO-Authorized Employee(s) with their supervisor before proceeding.

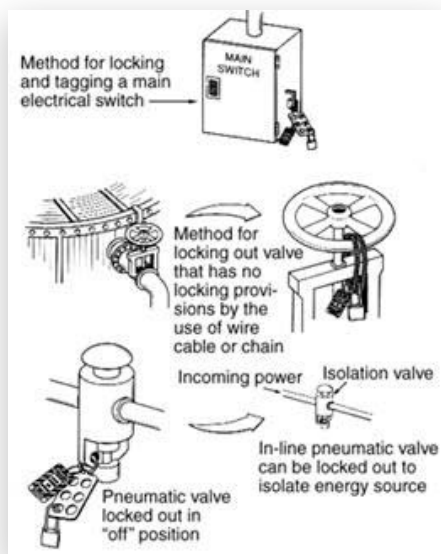
If safety would be compromised by following this prescribed sequence of procedures, the LOTO-Authorized Employee, with supervisor approval, may modify the sequence. However, all steps must be performed.

#### **5.1.2.1 LOTO Application Steps**

##### **Step 1 – Preparation**

- a. **Review the written procedure, if applicable.** The LOTO-Authorized Employee must determine if an Equipment Specific Lockout Procedure is required for the task. (See Section 5.1.1 Equipment Specific Written Energy Control Procedures). If so, the LOTO-Authorized Employee must obtain and follow the Equipment Specific Lockout Procedure. If a new written procedure must be generated, or an existing procedure needs to be changed or updated, the LOTO-Authorized Employee must contact his or her supervisor.
- b. **Assess energy type and magnitude.** The LOTO-Authorized Employee must assess the type, magnitude, and hazards of the energy to be controlled.
- c. **Determine methods of energy isolation.** The LOTO-Authorized Employee must determine the appropriate methods of controlling the hazardous energy. Methods for energy isolation may include circuit breakers, disconnect switches, or valves. See examples in Figure 3.
- d. **Obtain Personnel (or Gang) lock:** All lockout devices must be signed out and recorded in the [LOG Lockout Device Checkout](#) located at each LOTO lock station (see Section 5.3.4.)

**Push buttons, selector switches, and control circuits are not energy-isolating devices.**



*Figure 3: Lockout/Tagout Methods*

### *Step 2 – Notification*

**Notify all affected employees.** The LOTO-Authorized Employee must notify all Affected Employees of the impending shutdown. These persons must be informed that they are not to disturb the lockout device or attempt to re-start the equipment until they are informed that the lockout has been cleared and it is safe to resume normal operations.

### *Step 3 – Shutdown*

- a. **Verify that it is safe to shut down equipment.** The LOTO-Authorized Employee must verify that it is safe to shut down the equipment.
- b. **Perform normal equipment shutdown.** The LOTO-Authorized Employee must turn off or shut down the equipment using established methods for that equipment.

### *Step 4 – Isolation and Verification*

- a. **Isolate all energy sources.** The LOTO-Authorized Employee must operate (switch off, valve off, etc.) energy-isolating device(s). In the case of normally pressurized equipment, pressurized fluids or gases are isolated upstream of the equipment. In the case of mobile equipment, equipment is chocked or blocked and all moving parts lowered or secured in a safe position before work commences.
- b. **Verify that the correct energy isolation device has been operated.** The LOTO-Authorized Employee must take steps to ensure that the means used (disconnect, valve, etc.) for energy isolation correctly correspond to the equipment on which LOTO is being performed.

**Note:** For verification of electrical energy isolation, a best practice procedure (if safe to do so) may include an “on-off-on-off” procedure, wherein: (1) the equipment is placed in an operating condition; (2) the disconnect is operated;

(3) the equipment is confirmed to have switched off; (4) the disconnect is re-energized; (5) the equipment is confirmed to have switched on; (6) the disconnect is operated; (7) equipment is confirmed to have switched off.

#### ***Step 5 – LOTO Device Application***

- a. **Lock out energy sources.** A red lock must be affixed so as to hold the energy-isolating device in an off or safe position that physically prohibits normal operation of the energy-isolating device. If multiple authorized employees are working on the same equipment, follow the Group Lockout/Tagout procedure (See Section 5.7).
- b. **Write name, date, contact (phone) number, purpose of LOTO, and any other relevant information on the [SURF LOTO tag](#), and apply with lock or plastic locking tie (cable tie, zip tie, tie wrap).** If the placement of the tag would compromise safety by obscuring indicator lights or controls, the tag may be located as close as is safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.

#### ***Step 6 – Additional Measures if Necessary***

- a. **Insert physical restraints or disconnect components.** Insert blocks or chocks for moving or raised parts, insert blind flanges for pressurized piping, disconnect springs (only if safe to do so), etc., to ensure potential moving parts are physically restrained or disconnected.
- b. **Release stored energy.** The LOTO-Authorized Employee must completely release or otherwise control any stored energy and block any unexpected motion. **The presence of stored energy usually indicates that an Equipment Specific Lockout Procedure is required.** The equipment must be in a zero energy state (See "Definitions," Section 4).
  - In the case of stored mechanical energy, vent valves, spring releases, blocking devices, or equipment repositioning (as appropriate) must be utilized. See example in Figure 4.



***Figure 4: Placement of a Blocking Device***

- In the case of stored electrical energy, approved grounding wands or discharge devices must be used. If there is a possibility of re-accumulation of stored energy to a hazardous level, verification of isolation (such as leaving the ground wand in place) must be continued until the servicing, maintenance, or modification is completed. **This can only be accomplished by an Electrically Qualified and LOTO-Authorized Person.** (See [Electrical Safety Policy](#))

#### *Step 7 – Isolation Verification Confirmation ("Try-Out")*

- a. **Attempt to restart the equipment.** First checking that no personnel are exposed, the LOTO-Authorized Employee must physically attempt to operate the energy-isolating device and attempt to restart the equipment using the normal equipment controls.
- b. **Test equipment for zero-energy state.** The LOTO-Authorized Employee must test potential energy sources using appropriately rated instruments. Any instrument used to test for voltage, pressure, or temperature must be checked for proper operation both before and after use. If the LOTO-Authorized Employee is not qualified to test the energy being isolated, he or she must ensure that the energy is tested by a qualified person. **Only Electrically Qualified and LOTO-Authorized Persons can test for verification of electrical de-energization.** (See [Electrical Safety Policy](#))

**The qualified tester, if other than the LOTO-Authorized Employee, must be identified in the Remarks section on the tag.**

**All energy is to be treated as present until positively proven otherwise.**

#### *Step 8 – Keeping Devices in Place*

**The lock and tag shall remain in place until work on the equipment is 100 percent complete.** In rare circumstances, it may be necessary to temporarily remove LOTO devices before work is 100 percent completed (such as for adjustment or repositioning equipment). See Section 5.4 Temporary Removal of LOTO Devices.

#### *5.1.2.2. Release from LOTO Steps*

##### *Step 1 – Preparation & Notification*

- a. **Notify all Affected Persons that the system is to be returned to service.** Ensure all persons remain clear of the equipment point of operation or hazard zone.
- b. **Clear all tools and personnel.** The LOTO-Authorized Employee must check the work area to ensure that all tools, debris, and personnel are at a safe distance from the equipment.
- c. **Replace safety guards.** The LOTO-Authorized Employee must check the equipment to ensure that any removed guards are reinstalled.

##### *Step 2 – Removal of Additional Devices*

- a. **The LOTO-Authorized Employee must remove any additional devices applied under LOTO Application, Step 6.**
- b. **Remove all safety grounding devices.**
- c. **Verify that it is safe to reenergize.** The LOTO-Authorized Employee must verify that the work for which the LOTO was applied has been completed and that it is safe to reenergize equipment.

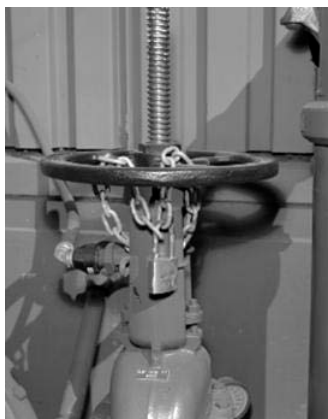
### *Step 3 – Removal of All Locks and Tags*

- a. **Remove lock(s) and tag(s).** Each LOTO device must only be removed by the LOTO-Authorized Employee who applied it. If the person who placed the locks and tags is not available, the procedure for Emergency Removal of LOTO Devices must be followed (see Section 5.5).
- b. **Notify all Affected Employees that the lockout condition has been cleared.**
- c. **Energize the equipment and restore the equipment to the normal condition.**

### **5.1.3 LOTO VS. ADMINISTRATIVE LOCKING OR TAGGING**

A careful distinction must be made between LOTO and various other locking or tagging practices, collectively referred to as “Administrative Locking,” see Figure 5. While LOTO locks are placed by individual workers to protect themselves against inadvertent energization of equipment, Administrative Locks are used when there is the need to provide “operational control” (control of a system, utility, or facility).

**Administrative Locking does not provide individual personal protection for at-risk workers as that achieved by LOTO.**



*Figure 5: Example of Administrative Locking*

Examples of Administrative Locking may include:

- Maintenance shut down and lockout of the controller for an HVAC chiller because it will be serviced by an outside contractor. In this case, SDSTA Facilities personnel first shut down and apply Administrative Locking to the controller. Then, each LOTO-Authorized Employee of the chiller contractor applies LOTO to each source of hazardous energy to protect them from accidental startup.



- Facilities electrician shuts down and applies Administrative Locking on a main electrical panel to prepare for a lab user to hook up equipment. Lab personnel are not LOTO-Authorized to shut down the main panel, but they must apply their personal LOTO locks and tags to the individual circuit breaker to provide hazardous energy control.

In these types of situations, the purpose of Administrative Locking is vastly different from the control of hazardous energies for the protection of the worker in the hazard zone. An employee applying Administrative Locking is not near the hazard zone, and therefore does not need to use the specific personalized locks and tags required by traditional LOTO requirements.

**If the employee applying the Administrative Lock in any way becomes exposed to the controlled hazardous energies, he or she must first apply his or her LOTO lock and tag. Administrative locks are YELLOW. LOTO locks are RED.**

Only YELLOW padlocks are used when performing Administrative Locking. All YELLOW padlocks, regardless of manufacturer, shape, size, etc., are considered administrative locks. Administrative Locks can be common locks with more than one key, so that anyone with access to the keys can open the control point as needed. The lock is not specific to an individual, but to a specialized working group or trade. Administrative Tags, likewise, are YELLOW and are common to multiple people and do not need to have an individual's name shown. See example in Figure 6.



*Figure 6: Example of Administrative Tag*

If the person removing the Administrative Lock is not the same person who placed it, a documented understanding must exist between the two persons of the intent behind the placement of the lock and the conditions necessary for its safe removal.

Other examples of Administrative Locking are:

- Locked fences around high-voltage transformers.
- Locks on overhead-crane disconnect switches.
- A locked door to a laboratory containing hazardous equipment.

In many applications, it is appropriate to use a combination of Administrative Locking and LOTO controls. For example, if one group or shop must retain oversight of a utility while others are performing work associated with that system, an Administrative Lock may be placed by the oversight group in parallel with the individual LOTO locks and tags placed by each LOTO-Authorized Employee.

The term 'tagged out' refers to the placement of a tag on equipment for safety or operational

defects that pose no ‘control of hazardous energy’ threat to personnel. The ‘tag’ is used to communicate the defect and to indicate the equipment is not to be used for its normal service. An example would be where a warning device (horn, back-up alarm, lights) on a unit of mobile equipment may not work properly but the unit may be driven to a shop for repairs provided proper safety procedures are followed to afford warnings. The term ‘tagout only’ is reserved for situations where hazardous energy must be isolated but a lock cannot be applied (Section 5.6)

## 5.2 TRAINING AND AUTHORIZATION

### 5.2.1 General Requirements

General awareness training shall be done to ensure that every Lab employee knows and understands the purpose, contents, and application of this program to the level necessary for their job requirements. The awareness-level LOTO course described below for Affected and Other Employees fulfills this initial training requirement.

**Reminder: LOTO may only be performed by LOTO-Authorized Employees:**

- **who have completed formal classroom training per Section 5.2.3.1;**
- **have received task and equipment specific on-the-job training; and**
- **have been authorized by their supervisor per Section 5.2.3.2.**

### 5.2.2 Affected and Other Employees

Affected and Other Employees are required to be trained in LOTO awareness, which describes the use of this energy control program, how to recognize LOTO, how to recognize when LOTO is needed, why LOTO is implemented, and about the prohibition of attempts to restart or re-energize equipment that has been locked and tagged out.

**Tampering with or removing someone else’s LOTO devices can cause serious injury or fatalities, and is a serious safety violation!**

LOTO awareness training is obtained through required OSHA 10-hr training and General Safety Basic/Annual Refresher Training.

### 5.2.3 LOTO-Authorized Employees

A LOTO-Authorized Employee is a worker who is:

1. trained and
2. specifically authorized by their Supervisor or Line Management to perform LOTO.

#### 5.2.3.1 LOTO-Authorized Employee Training Requirements

The classroom training requirement for LOTO-Authorized Employees is obtained through the EHS Department’s [GSA MOD Lockout/Tagout](#). As the outcome of LOTO training, LOTO-Authorized Employees will be able to recognize applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and procedures for their isolation and control.

**LOTO-Authorized Employees may also need to be Qualified and Authorized Electrical Workers to perform verification of electrical de-energization. Refer to [Electrical Safety Policy](#) for detailed training requirements for Qualified and Authorized Electrical Workers.**

### 5.2.3.2 *Supervisor Authorization*

Specific authorization is to be provided by the supervisor after the employee satisfies the classroom training requirement ([GSA MOD Lockout/Tagout](#)) and has received equipment-specific training ([ESLPs \(Equipment Specific Lockout Procedures\)](#)). The supervisor must ensure that the employee is thoroughly familiar with the equipment (within the context of his or her job function) and with the energy-control procedures. A practical exercise may be required by the supervisor to demonstrate proficiency. The content of this exercise will depend on the types of hazardous energy control and the complexity of the procedure's steps.

Once satisfied that both the training and authorization requirements have been met, the supervisor may authorize an employee to perform LOTO. This authorization stipulates the specific equipment or types of equipment on which the LOTO-Authorized Employee may perform LOTO.

### 5.2.4 *Reauthorization and Retraining*

Reauthorization is required when:

1. a LOTO-Authorized Employee's job changes or he or she is reassigned;
2. new equipment is to be used;
3. new hazards are introduced; or
4. new energy-control procedures are to be implemented.

Retraining and/or reauthorization may be required when:

1. a supervisor has reason to believe that an employee has insufficient knowledge of LOTO procedures or policy; or
2. a periodic inspection shows a deficiency in the LOTO-Authorized Employee's ability or interest to implement LOTO policy correctly.

## 5.3 *LOTO EQUIPMENT*

### 5.3.1 *Locks*

Only RED padlocks are used when performing LOTO, see Figure 7. All RED padlocks, regardless of manufacturer, shape, size, etc., are considered personal LOTO locks. Any other lock may be used for configuration management or other administrative purposes. It is permissible to paint or tape a padlock red.

**LOTO locks may *not* be used for any purpose other than LOTO.  
LOTO locks are RED. Administrative locks are YELLOW.**

The following are additional requirements pertaining to LOTO Locks:

- A LOTO lock must always be accompanied by a [Sanford Lab-approved LOTO tag](#). (See Section 5.3.3 Tags.)
- A LOTO lock shall be durable and substantial, shall be unique in design and color, shall not be used for any other purpose, and shall be easily distinguishable from other standard locks.
- Supervisors may authorize the purchase of a group of locks to be distributed to his or her LOTO-Authorized Employees.

- A supervisor may elect to use a checkout system that allows LOTO-Authorized Employees to borrow locks from a common local supply.



*Figure 7: Examples of RED Padlocks*

### 5.3.2 Keys

#### 5.3.2.1 Key Control – Personal Locks

Each Sanford Lab-approved LOTO padlock shall have one key only. The key must be in the control of the LOTO-Authorized Employee who applied the lock. There are to be no spare or emergency keys.

#### 5.3.2.2 Key Control – Personal Locks Keyed Alike

A group of locks with a common key may be used for equipment with multiple energy-isolation devices, if desired. If a group of locks are keyed alike for this purpose, **one key only** may be issued for use by the LOTO-Authorized Employee.

### 5.3.3 Tags

The following are requirements for LOTO tags:

- Only [Sanford Lab-approved LOTO tags](#) may be used, see Figure 8.
- The Sanford Lab-approved LOTO tag is 140 mm X 76 mm (5-1/2" X 3"), states "DANGER DO NOT OPERATE" on the front, and "This Energy Source Has Been Locked Out" on the back. The tag is reusable. The attachment (nylon zip tie) is not reusable.
- A tag must always be used in conjunction with a lock unless the energy-isolating device is not physically capable of being locked. (See Section 5.6 *Tagout Only*.)
- The LOTO-Authorized Employee performing LOTO must write his/her name, telephone extension, and the date on the tag. The back of the tag is reserved for any other information relevant to the lockout.
- Tags will be attached with nylon zip ties (cable ties) which are to be stocked in the LOTO Lock Stations



Figure 8: Sanford Laboratory LOTO Tag

#### 5.3.4 LOTO Lock Stations

LOTO lock stations are located throughout the facility. An example is shown in Figure 2. These stations include locks, lock boxes, hasps, tags, and LOTO checkout logs.

#### 5.4 TEMPORARY REMOVAL OF LOTO DEVICES

When LOTO devices must be temporarily removed from the energy-isolating device so that the equipment or component can be reenergized for adjustment or positioning, the following sequence of eight actions must be taken:

1. Notify the Affected Employees and area supervisor.
2. Clear the equipment of tools and materials.
3. Remove all employees from the machine or equipment area, and ensure that required tools are safely and properly positioned.
4. Remove all repositioning and blocking devices, and return all vents and valves to their normal operating positions.
5. Remove all grounding/shorting conductors, hooks, or wands.
6. Put on any required PPE.
7. Energize and proceed with testing or positioning.
8. De-energize all systems and reapply lockout/tagout measures to continue the servicing, maintenance, or modification of the equipment.

## 5.5 EMERGENCY REMOVAL OF LOTO DEVICES

### WARNING:

**This is considered to be an emergency procedure only to be undertaken in extreme circumstances and with Department approval.**

When the LOTO-Authorized Employee who applied a LOTO device is not available to remove it, that device may be removed by his or her supervisor if it is safe to do so, and only after the following emergency removal procedure has been implemented:

Extreme care must be taken, and the following four steps must be performed:

1. The supervisor must verify that the LOTO-Authorized Employee is not at the Sanford Laboratory facility.
2. The supervisor must make every reasonable effort to contact the LOTO-Authorized Employee. This may include a telephone call to the employee's home or other location.
  - These efforts must be documented (email, registered letter, voicemail, telephone verbal assurance to the supervisor and one other person, etc.).
  - If the employee is contacted, the supervisor must inform the employee that his or her LOTO devices are being removed.
3. The supervisor must verify that it is safe to remove the LOTO devices.
  - The supervisor may then cut off the lock or have it cut off by the Operations Department.
4. Before the worker returns to **any work duty**, the supervisor must ensure that the LOTO-Authorized Employee is presented with the removed lock upon returning to work and is informed of the reasons for the emergency removal.
  - The emergency procedure must be duly recorded in the department's records and signed by both the Supervisor and LOTO-Authorized Employee:  
[FORM Emergency Removal of Lockout Devices.](#)

**Note:** If the LOTO-Authorized Employee's immediate supervisor is not available, the emergency removal may be performed by one level of management above the LOTO-Authorized Employee's supervisor, or by a delegated individual with documented authorization by the supervisor to perform this function, using the above steps. Contact the Facility Infrastructure Director if no authorized person is available to implement the emergency removal procedure.

## 5.6 TAGOUT ONLY

In the rare cases that a device is not capable of being locked out, a "tagout only" procedure may be used, subject to the following conditions. The following criteria must be met before using a "tagout only" procedure:

- A justifiable and verifiable need must be identified; and
- Formal approval must be obtained from the immediate supervisor or other Line Management.

To conduct a tagout only procedure, the LOTO-Authorized Employee must follow all of the steps outlined in Section 5.1.2 General LOTO Procedure, with the following two changes:

1. Omit the placement of the lock.

2. Instead, the LOTO-Authorized Employee must utilize a second means of isolating the hazardous energy. Removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnect device, or removal of a valve handle are all examples of secondary measures. The second means of isolation must be identified on [Sanford Lab-approved LOTO tag](#), and the tag must be affixed as in Step 8 of the General LOTO Procedure.

**Extra caution must be exercised when using a Tagout Only Procedure.  
Tags may evoke a false sense of security by the at-risk employee.  
Tags are warning devices and do not provide the physical restraint provided by a lock.**

### **5.7 GROUP LOTO PROCEDURE**

When multiple LOTO-Authorized Employees perform servicing, maintenance, or modification on the same piece of equipment or apparatus, the Supervisor may determine that the use of a group LOTO procedure is appropriate.

1. The Supervisor determines that a group LOTO procedure is appropriate.
2. The Supervisor must convene a meeting of all members of the group to be covered under the procedure.
  - The Supervisor must describe the tasks to be performed.
  - The Supervisor must delegate primary responsibility to a designated LOTO-Authorized Employee for a specified group of employees working under the protection of the group LOTO procedure.
  - Each member of the specified group must be trained and LOTO-Authorized, as described in Section 5.2 Training and Authorization.
3. The designated LOTO-Authorized Employee is responsible for ensuring that each step of the equipment specific written procedure has been completed.
4. The designated LOTO-Authorized Employee must apply his or her personal LOTO lock(s) and tag(s) to the energy-control device(s) and indicate on the tag(s) that a group LOTO is in effect.
5. The designated LOTO-Authorized Employee shall place his/her key(s) inside of a gang lock box, see Figure 9. The gang lock box shall be constructed in such a way as to permit multiple locks to be attached to the outside of the enclosure, preventing it from being opened until all locks are removed.
6. The designated LOTO-Authorized Employee shall also place a LOTO lock and tag on the outside of the gang lock box.
7. All other workers performing work on the equipment shall assure that each step of the equipment specific written procedure has been completed, and then lock and tag the gang lock box in a manner that prevents access to the key inside until all locks have been removed.
8. When the work has been completed and after each worker has removed his or her respective lock from the gang lock box, the designated LOTO-Authorized Employee removes his or her LOTO lock from the outside of the gang lock box, obtains the keys from the lock box, and returns the equipment to service as described in Section 5.1.2.2 Release From LOTO Steps.



*Figure 9: Gang Lock Boxes*

## 5.8 *SHIFT CHANGES*

If equipment will remain de-energized after the end of a shift and work will continue by the oncoming shift, an orderly transfer of LOTO devices between LOTO-Authorized Employees from the off-going and oncoming shifts must be performed, subject to the following conditions:

The following criteria must be met before using a shift change procedure:

- A justifiable and verifiable need must be identified; and
- Line Management formal approval must be obtained.

### 5.8.1 *Shift Change LOTO Procedure*

1. The LOTO-Authorized Employees from both shifts must both be present at the lockout device.
2. The off-going LOTO-Authorized Employee(s) must remove his or her (their) lock and tag, and the oncoming LOTO-Authorized Employee(s) must immediately place his or her (their) lock and tag on the LOTO (group) device.
3. The LOTO-Authorized off-going employee(s) must inform the LOTO-Authorized oncoming employee(s) of any potential hazards.
4. Before work begins, the oncoming worker(s) shall:
  - a. re-verify that all safety devices (such as blocking) are in place;
  - b. re-verify that there is zero energy in the system; and
  - c. attempt to restart or re-energize the system before anyone enters the hazard zone.

### 5.8.2 *When there is a Gap between Shifts*

#### 5.8.2.1. *Leaving Locks in Place*

If the meeting between off-going and oncoming shift workers does not occur, the off-going shift employee's LOTO devices shall remain in place. The oncoming employee who will be working on that equipment shall add his or her LOTO lock and tag to a multiple lock adaptor and proceed with the work, following the requirements of this document. This worker shall remove his or her LOTO when finished working on the equipment.

#### 5.8.2.2. *Unforeseen Shift Change Problems*

If the orderly transfer of LOTO devices is not possible because of a gap in shifts, contact the Facility Infrastructure Director for further direction.



## **5.9 SANFORD LAB CONTRACTORS**

All outside contractors involved in construction or maintenance for Sanford Lab who engage in Lockout/Tagout activities shall be required to include in their safety plans LOTO procedures that conform to the requirements of the [Construction EHS Manual](#), Section 12.

All contractor employees are responsible for personally locking out and tagging out the equipment that they work on. All contractor LOTO locks shall be red, with only one key per lock. Spare, master, or emergency keys are not permitted on the site.

### **5.9.1 Project Manager Responsibilities**

The Sanford Lab Project Manager is responsible for ensuring that all construction contractors and any corresponding subcontractors under their supervision are informed of Sanford Lab's LOTO policy, procedures, and devices as described in this document that pertain to the contractor's scope of work. They are also responsible for obtaining the Construction EHS Plan/JHAs/SOPs as required, and for working with the contractor to identify when an Equipment Specific Lockout Procedure is needed (see Section 5.1.1). The Project Manager is responsible for communicating information about the contractor's LOTO procedures to all Laboratory Personnel who are affected by the contractor's LOTO activities.

### **5.9.2 Construction Contractor Responsibilities**

If LOTO is involved in the planned work, contractors must include their company's LOTO procedures in their Construction EHS Plan. A contractor operating under an approved Construction EHS Plan will provide their own LOTO equipment. If the contractor does not own LOTO equipment, the Sanford Lab will make provision to supply the LOTO equipment to the contractor.

### **5.9.3 Maintenance, Repair, Servicing, and Equipment Installation – Contractors and Vendors**

All service contractors who perform servicing, maintenance, or modifications on equipment or facilities that fall under the scope of Section 2.0 of this document are required to provide a safety plan/JHA/SOP that includes LOTO. Service contractors will follow SURF Lockout/Tagout policy as specified in the "owner escorted" contract language. The Sanford Lab point of contact for the contractor has all of the responsibilities described for Project Managers, as described in Section 5.9.1, above.

## **5.10 OTHER LABORATORY PERSONNEL**

All Laboratory Personnel who work in areas in which LOTO is utilized are considered Affected or Other Employees and must receive LOTO awareness training in accordance with Section 5.2.1.

However, Laboratory Personnel who perform service, maintenance, or equipment modification are required to be trained as a LOTO-Authorized Employee in accordance with Section 5.2.3.1. As such, they must be specifically LOTO-Authorized in accordance with Section 5.2.3.2, and must adhere to LOTO procedures as described in Section 5.1.2 General LOTO Procedure.

The Sanford Lab supervisor responsible for a visitor has all of the responsibilities of a supervisor, as described in this document.

### **5.11 PERIODIC AUDITS**

Each department is responsible for auditing its [ESLPs \(Equipment Specific Lockout Procedures\)](#) annually. EHS will serve as a resource to provide assistance to each department as well as ensure that these reviews are completed in a timely manner. EHS will also conduct an annual audit of the general LOTO program, which may include random compliance audits of individual departments.

The annual Equipment Specific Lockout Procedure audit must be performed and documented by a LOTO-Authorized Employee other than the one utilizing the procedures being inspected. Specifically, the inspector must be able to determine whether:

1. the inspected procedures are adequate;
2. they are understood; and
3. are being followed by employees.

The annual Equipment Specific Lockout Procedure audit must be designed to correct any deviations or inadequacies observed. The audit should provide for a demonstration of the procedures and should review employees' responsibilities for the energy control procedure that was audited.

The certification must state that the annual audit has been performed. The certification must identify the machine(s) or equipment on which the energy-control procedure was utilized, the date of the audit, the employees included in the audit, and the employee performing the audit.

### **5.12 TAG-ON**

Sump pumps, emergency lights, refrigerators, or equipment that must be shut down in a controlled manner fall into a class of equipment that should not be accidentally de-energized.

When a circuit breaker, disconnect switch, or energy-securing device is readily accessible to any employee, the circuit breaker or disconnect switch may be tagged to indicate that it is not to be turned off, see Figure 10.

The energy-securing device must not be locked by any means that would prevent the device from being used as an emergency disconnect.

The tag must include the name of the responsible person and an alternate, date, and phone number.



*Figure 10: Tag-On*

## 6. REFERENCE AND RELATED DOCUMENTS

### 6.1 *Standards*

- 29 CFR Part 1910, *Subpart S, Electrical*
- 29 CFR Part 1910.147, *The Control of Hazardous Energy (Lockout/Tagout)*
- 29 CFR Part 1910.269, *The Control of Hazardous Energy (Lockout/Tagout) for High Voltage Distribution Systems*
- 29 CFR Part 1926, *Safety and Health Regulations for Construction*, Department of Labor
- NFPA 70, *National Electrical Code*, Latest Edition
- NFPA 70E, *Standard for Electrical Safety in the Workplace*, Latest Edition

### 6.2 *Related Documents*

- [POLICY Electrical Safety](#)
- [FORM Equipment Specific Lockout Procedure \(ESLP\)](#)
- [LOG Lockout Device Checkout](#)
- [SURF LOTO Tag](#)
- [GSA MOD Lockout/Tagout](#)
- [FORM Emergency Removal of Lockout Devices](#)
- [Construction EHS Manual](#)
- [ESLPs \(Equipment Specific Lockout Procedures\)](#)

## 7. SIGNATURE/APPROVAL

Approved By:

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EHS Director	Date
SURF	