



Sanford

Underground Research Facility

South Dakota Science and Technology Authority

Lockout/Tagout Standard

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Revision History

Rev	Date	Section	Paragraph	Summary of Change	Authorized by
01	10/4/2023	NA	NA	Initial Release	CCR 837

1.0 Purpose

This standard established the requirements for the control of hazardous energy through the development and implementation of hazardous energy isolation lockout/tagout procedures.

South Dakota Science and Technology Authority (SDSTA) references the following to fulfill this standard:

- 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
- ESH-(2000-S)-73320 Work Planning and Control Standard
- SOU-(3000-A)-209349 SURF Electrical Safety Manual
- SDSTA ESH-(9000-S)-73376 Electrical Safety Standard

2.0 Scope

This Standard applies to all SDSTA employees, users, and contractors who may be exposed to hazardous energy while performing any servicing, maintenance or modification activity. All work is subject to the ESH-(2000-S)-73320 Work Planning and Control Standard.

3.0 Definitions

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.

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 Standard.

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).

Electrical Department Lock – A blue lock that restricts access to non-qualified electrical workers.

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.

Equipment Specific Lockout Process (ESLP) – 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.

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.

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).

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.

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).

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 SURF. A lockout tag is not a substitute for a lockout device.

Lockout/Tagout (LOTO) – The method of applying a mechanical lockout device and/or 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.

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.

Qualified Electrical Worker (QEW) – An electrical worker designated by SURF 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 Standard.

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 unjamming 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.

4.0 Responsibilities

4.1. SDSTA Executive Director

- 4.1.1. Ensures accountability of the requirements of this document with direct reports.

4.2. Environment, Safety, and Health (ESH) Department

- 4.2.1. Reviews all new and revised SDSTA ESLPs.
- 4.2.2. Maintains, administers, and revises the LOTO standard as needed.
- 4.2.3. Ensures that LOTO equipment is available and consistent with SDSTA standards.
- 4.2.4. Develops and provides training with appropriate subject matter experts.
- 4.2.5. Reviews LOTO documents and plans for all LOTO activities.

4.3. Department Directors

- 4.3.1. Ensures accountability of the requirements of this document with direct reports.

4.4. Surface Operations and Utilities Director

- 4.4.1. Manages Electrical Department Locks.
- 4.4.2. Manages Administrative Locks.

4.5. LOTO-Authorized Employees

- 4.5.1. Perform work in accordance with this standard.
- 4.5.2. Recognize the conditions of work that require LOTO.
- 4.5.3. Assess all hazardous energy sources, using correct processes and materials to implement LOTO.
- 4.5.4. Maintain control over their key.
- 4.5.5. Apply and/or remove own lock and tag.
- 4.5.1. Complete periodic inspections at least annually on LOTO compliance. These inspections are maintained within the computerized maintenance management system (CMMS).

4.6. Supervisors

- 4.6.1. Ensures accountability of the requirements of this document with direct reports.
- 4.6.2. Prohibit employees from working on equipment requiring LOTO until the worker is trained in and authorized to perform LOTO.
- 4.6.3. Generate and maintain equipment specific written processes (ESLP) where required .
- 4.6.4. Assure ESLPs are appropriately posted within their work areas.
- 4.6.5. Assigning and documenting employee LOTO authorization, including:
 - Designate specific equipment or categories of equipment to be controlled.
 - Verify that workers are qualified to perform the necessary energy-control processes.

- 4.6.6.** Determine the appropriate level of training required for each employee.
- 4.6.7.** Remove LOTO devices in case of emergency and controlling emergency keys for LOTO locks.
- 4.6.8.** Ensure that necessary LOTO hardware is available.

4.7. Project Manager

- 4.7.1.** Ensures that all outside contractors (and any corresponding subcontractors) operating under their supervision are informed of, and adhere to, the SDSTA LOTO Standard.
- 4.7.2.** Submits all contractor LOTO documents and plans to ESH prior to work commencing.
- 4.7.3.** Ensures that all construction contractors and any corresponding subcontractors under their supervision are informed of SDSTAs LOTO Standard, processes, and devices as described in this document that pertain to the contractor's scope of work.
- 4.7.4.** Communicates information about the contractor's LOTO procedures to affected personnel.

4.1. Workers and Users

- 4.1.1.** Perform work in accordance with this standard.

5.0 Standard Instructions

5.1. Lockout/Tagout and Verification Process

- All LOTO operations shall utilize an equipment specific lockout process (ESLP) or follow the general LOTO processes, as applicable. It is important that the following LOTO principles are strictly adhered to (see ESH-(7000-WI)-209413 General LOTO Work Instruction):
 - All sources of hazardous energy must be isolated 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.
- An IMSM-(T-752-013)-209414 Equipment Specific Lockout Process Template must be developed and used whenever equipment or apparatus undergo servicing, modification, or maintenance that (see ESH-(7000-WI)-209412 Equipment Specific Lockout Process (ESLP) Work Instruction):
 - 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.
- Exceptions: ESLPs are not required when all the following elements exist:
 - The machine or equipment has no potential for stored or residual energy or re-accumulation of stored energy after shut down which could endanger employees;
 - The machine or equipment has a single energy source which can be readily identified and isolated;
 - The isolation and locking out of that energy source will completely deenergize and deactivate the machine or equipment;

- o The machine or equipment is isolated from that energy source and locked out during servicing or maintenance;
- o A single lockout device will achieve a locked-out condition;
- o The lockout device is under the exclusive control of the authorized employee performing the servicing or maintenance;
- o The servicing or maintenance does not create hazards for other employees; and
- o The employer, in utilizing this exception, has had no accidents involving the unexpected activation or reenergization of the machine or equipment during servicing or maintenance.
- Electrical Department Locks
 - o A blue lock that is only to be applied by QEWs to restrict access across the facility to ensure non-QEWs do not access potentially hazardous areas or electrical equipment.
- Administrative Locking or Tagging
 - o A careful distinction must be made between LOTO and various other locking or tagging practices, collectively referred to as “Administrative Locking”. 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).
 - o Administrative locking does not provide individual personal protection for at-risk workers as that achieved by LOTO.

5.2. Exclusions

- LOTO procedures do not apply under the following three conditions:
 - o 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.
- 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 a documented ESH-(2000-F)-198730 Job Hazard Analysis completed.
- Minor tool changes, adjustments, and other minor servicing activities that take place during normal operations, provided that:
 - o Such activities are routine, repetitive, and integral to the use of the equipment.
 - o The work is performed using alternative measures that provide effective personnel protection.

5.3. LOTO Equipment

- Locks
 - o 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.

- o LOTO locks may not be used for any purpose other than LOTO.
- o LOTO locks are red. Administrative locks are yellow.
- o The following are additional requirements pertaining to LOTO Locks:
 - ◆ A LOTO lock must always have a means to identify who it belongs to (e.g. engraved, name on approved tag, etc.).
 - ◆ 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

- Keys
 - o Key Control – Personal Locks
 - ◆ Each SDSTA 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.
 - o 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.
- Tags
 - o The following are requirements for LOTO tags:
 - ◆ Only SDSTA approved and provided tags may be used, see Figure 8 as an example.
 - ◆ A tag must always be used in conjunction with a lock, unless the lock has a means to identify who it belongs to. If an energy-isolating device is not physically capable of being locked, a tag shall be applied. The LOTO-Authorized Employee performing LOTO must write his/her name, contact number, 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 zip ties (cable ties).



Figure 8: Example LOTO Tag

- LOTO Lock Stations
 - o LOTO lock stations are located throughout the facility. These stations include locks, lock boxes, hasps, and tags.

5.4. Emergency Removal of LOTO Devices

WARNING: This is considered an emergency process only to be undertaken in extreme circumstances and with affected department supervisor 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 completing the ESH-(7000-F)-209411 Emergency Removal of LOTO Devices Form.

5.5. 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 General LOTO Work Instruction.

5.6. SURF Contractors

- All outside contractors involved in construction or maintenance at SURF shall be required to include in their safety plans LOTO activities shall be required to include in their safety plans LOTO procedures that conform to the requirements of this standard.

5.7. Training and Authorization

- Affected Employees
 - o General awareness training is accomplished in the SURF Safety Orientation videos and the General Safety Basic training and will be included in the annual refresher training in the Learning Management System. The general awareness training will ensure that personnel know and understand the purpose, contents, and application of LOTO to the level necessary for their job requirements.
- LOTO-Authorized Employees
 - o The training requirement for LOTO-Authorized Employees is obtained through the ESH Department's GSA Lockout/Tagout course. 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.

- o LOTO-Authorized Employees may also need to be Qualified and Authorized Electrical Worker to perform verification of electrical de-energization. Refer to the Electrical Safety Standard for detailed training requirements for Qualified and Authorized Electrical Workers.
- Reauthorization and Retraining
 - o Reauthorization is required when:
 - ◆ A LOTO-Authorized Employee's job changes or he or she is reassigned;
 - ◆ New equipment is to be used;
 - ◆ New hazards are introduced; or
 - ◆ New energy-control procedures are to be implemented.
 - o Retraining and/or reauthorization may be required when:
 - ◆

6.0 Documented Information/Related Document

- 6.1.** IMMSM-(T-752-013)-209414 Equipment Specific Lockout Process (ESLP)
- 6.2.** ESH-(9000-S)-15124 Electrical Safety Standard
- 6.3.** ESH-(7000-WI)-209412 Equipment Specific Lockout Process (ESLP) Work Instruction
- 6.4.** ESH-(7000-WI)-209413 General LOTO Work Instruction
- 6.5.** ESH-(7000-F)-209411 Emergency Removal of Lockout Devices
- 6.6.** ESH-(2000-F)-198730 Job Hazard Analysis
- 6.7.** GSA Lockout/Tagout
- 6.8.** 29 CFR Part 1910.147, The Control of Hazardous Energy (Lockout/Tagout)
- 6.9.** 29 CFR Part 1910.269, The Control of Hazardous Energy (Lockout/Tagout) for High Voltage Distribution Systems
- 6.10.** 29 CFR Part 1926, Safety and Health Regulations for Construction, Department of Labor
- 6.11.** NFPA 70, National Electrical Code, Latest Edition
- 6.12.** NFPA 70E, Standard for Electrical Safety in the Workplace, Latest Edition