Control of Hazardous Energy (Lockout/Tagout)

NIST S 7101.56
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1. PURPOSE

The purpose of this suborder is to define the requirements and associated roles and responsibilities to protect NIST employees and covered associates[2] from exposure to hazardous energy during the servicing or maintenance of machines or equipment (hereafter referred to as "equipment").

2. BACKGROUND

a. NIST must meet or exceed the requirements established by Occupational Safety and Health Administration in 29 Code of Federal Regulations (CFR) 1910.147, The Control of Hazardous Energy. Implementation of this suborder fulfills those requirements.

b. This suborder supersedes NIST Health and Safety Instruction (HSI) 21, Control of Hazardous Energy (Lockout/Tagout), June 1994.

3. APPLICABILITY

a. The provisions of this suborder apply to equipment servicing and maintenance activities, conducted by NIST employees, covered associates, and non-Research-and-Development (non-R&D) contractors that could harm an individual if the equipment being serviced or maintained were to unexpectedly energize, start up, or release stored energy.

[1] For revision history, see Appendix A.
[2] As per NIST O 7101.00: Occupational Safety and Health Management System, a NIST associate permitted to perform work at a NIST workplace and subject to NIST policies and procedures to the extent allowed by law and the terms of the associate's agreement. Covered associates include Foreign and Domestic Guest Researchers (including contractors who perform NIST R&D/technical work); Research Associates; Intergovernmental Agency Personnel Act assignees; Facility Users; Volunteer Students; and other federal employees who perform work at NIST workplaces.

b. When servicing or maintenance activities are conducted exclusively by non-R&D contractors, Organizational Units (OUs) need only follow Section 6.g and meet the Affected-Employee training requirements in Section 6.j.

c. Applicability to Normal Production Operations.

(1) The provisions of this suborder apply to servicing and maintenance that takes place during normal production operations only when:

(a) A NIST employee or covered associate is required to remove or bypass a guard or other safety device; or

(b) A NIST employee or covered associate is required to place any part of his/her body into an area on a machine or piece of equipment where work is actually performed upon the material being processed (point of operation) or where an associated danger zone exists during an equipment operating cycle.

(2) The provisions of this suborder do not apply to minor tool changes and adjustments and other minor servicing activities that take place during normal production operations if these activities are routine, repetitive, and integral to the use of the equipment for production, provided that the work is performed using alternative measures, such as machine guarding, that provide effective protection.

d. Control of hazardous energy operations, also known as Lockout/Tagout or "LOTO", with potential exposure[3] to electrical hazards (*e.g.*, shock, arc flash) from work on, near, or with conductors or equipment in electric-utilization installations are covered by this suborder. Please see Section 6 of NIST S 7101.64 for additional electrical safety requirements.

e. Exclusions. The provisions of this suborder do NOT apply to:

(1) The act of taking equipment out of service in accordance with NIST S 7101.73.

(2) Work on cord- and plug-connected electrical equipment that meets **ALL** of the following conditions:

(a) The equipment has a single energy source;

[3] Exposed (as applied to energized electrical conductors or circuit parts) – Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to electrical conductors or circuit parts that are not suitably guarded, isolated, or insulated.

(b) All hazardous energy to which employees could be exposed can be controlled by unplugging the equipment; and

(c) The plug is under exclusive control of the employee servicing or maintaining the equipment.

(3) Hot-tap operations involving transmission and distribution systems for substances such as gas, steam, water, or petroleum products are performed on pressurized pipelines, provided that it can be demonstrated that:

(a) Continuity of service is essential;

(b) Shutdown of the system is impractical;

(c) Special equipment (*e.g.*, bolted blinds and blank flanges) is used which will provide proven effective protection for NIST employees and covered associates; and

(d) Documented procedures are followed.

4. REFERENCES

a. 29 CFR 1910.147, The Control of Hazardous Energy (lockout/tagout).

b. 29 CFR 1910.333, Selection and Use of Work Practices.

c. ANSI Z535.5, Safety Tags and Barricade Tapes (for Temporary Hazards) (most recent version).

5. APPLICABLE NIST OCCUPATIONAL SAFETY AND HEALTH DIRECTIVES

a. NIST O 7101.00: *Occupational Safety and Health Management System*

b. NIST S 7101.20: *Work and Worker Authorization Based on Hazard Reviews*

c. NIST S 7101.23: *Safety Education and Training*

d. NIST N 7101.64: *Electrical Safety*

e. NIST S 7101.73: *Out of Service*

6. REQUIREMENTS

a. General Requirements

(1) OUs shall establish energy-control procedures, employee training, and annual inspections prior to conducting servicing or maintenance on equipment where the unexpected energizing, startup, or release of stored energy could occur and cause injury.

(2) Locks and tags used for LOTO shall not be used for any other purpose (*e.g.*, removing equipment from service per NIST S 7101.73).

NOTE: Please see NIST S 7101.73 for requirements for taking equipment out of service.

(3) Tagout without Lockout

(a) If an energy-isolating device is not capable of being locked out by any means, a tagout system shall be used.

(b) If an energy-isolating device is capable of being locked out, lockout shall be used unless it can be demonstrated that the utilization of a tagout system will provide employees and covered associates with full protection, which requires that **ALL** of the following be met:

i. The tagout device shall be attached at the same location that the lockout device would have been attached;

ii. Full compliance with all tagout-related provisions of this suborder shall be demonstrated; and

iii. Such additional elements as are necessary to provide the equivalent safety available from the use of a lockout device shall be demonstrated. Additional means to be considered shall include the implementation of additional safety measures such as removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or removal of a valve handle to reduce the likelihood of inadvertent energization.

(c) At least one additional safety measure shall be utilized for tagout activities involving potential exposure to electrical hazards (*e.g.*, shock, arc flash). Examples of additional safety measures include the removal of an isolating circuit element, blocking of a controlling switch, or opening of an extra disconnecting device.

(d) Whenever replacement or major repair, renovation, or modification of equipment is performed, and whenever new equipment is installed, energy-isolating devices for such equipment shall be designed to accept a lockout device whenever the unexpected energization or startup of the equipment, or release of stored energy, could cause injury to employees.

b. Requirements for Written LOTO Procedures

(1) Written LOTO procedures are required unless ALL of the following circumstances pertain:

(a) The equipment has no potential for stored or residual energy or re-accumulation of stored energy after shutting down which could endanger employees;

(b) The equipment has a single energy source which can be readily identified and isolated;

(c) The isolation and locking out of that energy source will completely de-energize and deactivate the equipment;

(d) The equipment is isolated from that energy source and locked out during servicing or maintenance;

(e) A single lockout device will achieve a locked-out condition;

(f) The lockout device is under the exclusive control of the Authorized Employee performing the servicing or maintenance;

(g) The servicing or maintenance does not create hazards for Other Employees; and

(h) The OU, in utilizing this exception, has had no accidents involving the unexpected activation or re-energization of the equipment during servicing or maintenance.

(2) If a written procedure is required, the Authorized Employee shall:

(a) Ensure that the procedure clearly and specifically outlines the scope, purpose, authorization, rules, and techniques to be utilized for the control of hazardous energy, and the means to enforce compliance, including, but not limited to, the following:

i. A specific statement of the intended use of the procedure;

ii. Specific procedural steps for shutting down, isolating, blocking, and securing the equipment to control hazardous energy;

iii. Specific procedural steps for the placement, removal, and transfer of LOTO devices and the responsibility for them; and

iv. Specific requirements for testing the equipment to determine and verify the effectiveness of LOTO devices and other energy-control measures.

c. Conduct of LOTO

(1) LOTO shall be performed only by trained Authorized Employees in the following sequence.

(a) Notifications shall be initiated prior to LOTO to ensure area supervisors and affected personnel are aware of the energy source being locked out or controlled. This notification should also include the anticipated duration of the shutdown. Authorized Employees will also advise on any support equipment that may be impacted, additional safety precautions being taken, and the type of control device(s) being used.

(b) Preparations for the shutdown shall begin after all notifications have been made. Authorized Employees must be fully aware of the type and magnitude of the energy, associated hazards, and control methods of the energy involved. Authorized Employees shall refer to owner/service manuals of the equipment they are working on to ensure they are fully aware of any and all associated hazards.

(c) In performing the shutdown, Authorized Employee shall first advise Affected Employees that shutdown is taking place. They shall then locate the energy source(s) (always looking for hidden energy sources) and follow the procedures established to shut down the equipment as prescribed. An orderly shutdown must be utilized to avoid any additional or increased hazard(s) to employees as a result of the equipment stoppage.

(d) All energy-isolating devices that are needed to control the energy to the equipment shall be physically located and operated by an Authorized Employee in such a manner as to isolate the equipment from the energy source(s).

i. Authorized Employees isolating electrical disconnects and breakers must comply with the requirements in Section 6 of NIST S 7101.64.

(e) LOTO devices shall be affixed to energy-isolating devices by Authorized Employees.

i. Lockout devices, where used in accordance with this suborder, shall be affixed in a manner that will hold the energy-isolating devices in a "safe" or "off" position.

ii. A lock and a tag shall be placed on each disconnecting means used to de-energize equipment on which work is to be performed. The lock shall be attached so as to prevent persons from operating the disconnecting means unless they resort to undue force or the use of tools.

iii. Tagout devices, where used in accordance with this suborder, shall be affixed in such a manner as will clearly indicate that the operation or movement of energy-isolating devices from the "safe" or "off" position is prohibited. Where tagout devices are used with energy-isolating devices designed with the capability of being locked, the tag attachment shall be fastened at the same point at which the lock would have been attached. Where a tag cannot be affixed directly to the energy-isolating device, the tag shall be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.

(f) After LOTO devices have been applied to energy-isolating devices, all potentially hazardous stored or residual energy shall be relieved, disconnected, restrained, or otherwise rendered safe. If there is a possibility of re-accumulation of stored energy to a hazardous level, verification of isolation shall be continued until the servicing or maintenance is completed, or until the possibility of such accumulation no longer exists.

(g) Prior to starting work on equipment that has been locked or tagged out, the Authorized Employee shall verify that isolation and de-energization of the equipment have been accomplished.

i. Verification of de-energization for electrical conductors and circuits where potential exposure to electrical hazards (*e.g.*, shock, arc flash) could occur must be conducted in accordance with the requirements of Section 6.d of NIST S 7101.64.

(h) Before LOTO devices are removed and energy is restored to the equipment, actions shall be taken by the Authorized Employee(s) to ensure that:

i. The work area is inspected to ensure that any nonessential items have been removed and that the equipment components (*e.g.*, guards) are operationally intact;

ii. The work area is checked to ensure that all employees have been safely positioned or removed;

iii. After LOTO devices have been removed by the Authorized Employee(s) who applied them but before energy is restored to the equipment, Affected Employees are notified of the removal of the LOTO devices; and

iv. When the Authorized Employee who applied a LOTO device is unavailable to remove it, that device may be removed under the procedures outlined in Section 6h.

d. Temporary Removal of LOTO Devices
In situations in which LOTO devices must be temporarily removed from the energy-isolating device and the equipment energized to test or position it or a component thereof, the following steps shall be taken in sequence:

(1) Clear the equipment of tools and materials;

(2) Remove employees from the equipment area;

(3) Remove the LOTO devices;

(4) Energize and proceed with testing or positioning; and

(5) De-energize all systems and reapply energy-control measures in accordance with Section 6c of this suborder to continue the servicing and/or maintenance.

e. Group LOTO Procedure
When multiple Authorized Employees (including servicing contractors) perform service or maintenance on the same piece of equipment, a supervisor or Primary Authorized Employee may determine that a group LOTO procedure is appropriate.

(1) General Requirements

(a) When more than one employee would be required to apply a LOTO device to the same isolation point, a group LOTO device shall be utilized to allow each employee's LOTO lock to be affixed at the disconnecting device.

(b) When it is not practical to have all authorized employee LOTO locks to be attached at the energy isolation device, a group lockbox shall be utilized.

(c) When LOTO is required to be performed and doing so requires securing multiple energy sources with multiple authorized employees, a lockbox shall be utilized.

(2) When servicing or maintenance is performed by a crew, craft, department, or other group, that entity shall utilize a procedure that affords the employees a level of protection equivalent to the implementation of a personal LOTO device.

(3) When a group lockbox is required, all of the following requirements apply:

(a) A group LOTO lock shall be applied to each disconnecting device;

(b) The group LOTO lock keys shall be placed in the lockbox;

(c) All employees, including the Principal Authorized Employee, shall affix their LOTO locks to the lockbox; and

(d) The Principal Authorized Employee shall then affix a Job LOTO lock and tag to lockbox.

(4) The Principal Authorized Employee shall convene a meeting of all group members covered under the LOTO procedure.

(5) The Primary Authorized Employee may delegate a Principal Authorized Employee the primary responsibility for a specified group working under the protection of the group LOTO procedure. Supervisory responsibility is then vested in the Principal Authorized Employee for the specific employees working under the protection of the group LOTO devices.

(6) Each member of the specified group shall be trained and Authorized as described in this suborder's training requirements.

(7) The Principal Authorized Employee shall ensure that each step of the written LOTO procedure has been completed and shall ascertain the exposure status of individual group members with regard to the lockout or tagout of the equipment.

(8) Each Authorized Employee performing work on the equipment shall ensure every step of the written procedure has been completed prior to placing their personal LOTO device on the group LOTO device, group lockbox, or comparable mechanism when he/she begins work.

(9) When the work has been completed, and after each employee has removed his/her respective lock or tag from the group LOTO device, the Principal Authorized Employee shall remove his/her LOTO lock or tag from the group LOTO device and return the equipment to service as described in the procedure.

f. LOTO Procedures for Shift Changes

The following procedures shall be utilized during shift or personnel changes to ensure the continuity of LOTO protection, including provision for the orderly transfer of LOTO device protection between departing and oncoming employees, to minimize exposure to hazards from the unexpected energization or start-up of the equipment, or the release of stored energy.

(1) The requirements for group LOTO apply.

(2) The group LOTO lock shall remain attached to each energy control device.

(3) The job lock shall remain affixed to the lockbox or other approved group LOTO device.

(4) All off-going shift employees shall remove their individual LOTO locks and tags from the lockbox or other approved group LOTO device.

(5) The off-going principal authorized employee shall brief the oncoming person in charge of the status of the project and inform all oncoming employees of any potential hazards.

(6) The person in charge of the off-going shift shall transfer custody of the key for the job LOTO lock attached to the lockbox or approved group LOTO device to the oncoming person in charge.

(7) All oncoming Authorized Employees shall place their locks and/or tags onto the group LOTO device.

(8) Before work begins, the oncoming Authorized Employees shall verify isolation and de-energization of the equipment that has been locked or tagged out prior to restarting work.

g. LOTO Conducted by Non-R&D Contractors

(1) Contracting Officers (COs) or Contracting Officer Representatives (CORs) overseeing non-R&D contractor shall ensure non-R&D contractors are not permitted to commence work on NIST equipment when LOTO is required until:

(a) They have been provided with a copy of this suborder by the controlling NIST organization and understand the requirements for LOTO devices;

(b) They have exchanged LOTO programs with the controlling NIST organization;

(c) The exchange of LOTO programs has been documented using the exchange-of-LOTO-programs form provided by the Office of Safety, Health, and Environment (OSHE); and

(d) Information concerning non-R&D contractor LOTO procedures has been communicated to NIST Affected Employees.

(2) When LOTO is performed by non-R&D contractors, the CO or COR shall ensure the following:

(a) Prior to the non-R&D contractor performing their LOTO steps, the NIST organization responsible for the system and/or equipment being turned over to the contractor shall:

i. Document and obtain the non-R&D contractor's agreement via the COR on the condition/status of the system and/or equipment being turned over; and

ii. Affix their LOTO device(s) on all sources of energy and verify zero energy.

(b) The non-R&D contractor has applied their LOTO devices in accordance with their contractor safety plan accepted by NIST.

(c) Prior to any testing of any system or equipment that requires re-introducing the system or equipment into the NIST infrastructure, the NIST organization responsible for the system and/or equipment shall ensure by applicable means that doing so would have no impact to the NIST infrastructure.

(d) Prior to acceptance and the introduction or re-introduction of any system into the NIST infrastructure by a non-R&D contractor, the NIST organization responsible for the system or equipment shall ensure by applicable means that doing so would have no impact to the NIST infrastructure.

(e) The LOTO lock and tag from the responsible NIST organization for the system and/or equipment shall be the last to be removed.

h. LOTO Device Emergency Removal

WARNING: This is considered to be an emergency procedure only to be undertaken in extreme circumstances with a supervisor's approval and using extreme care.

(1) When an Authorized Employee who has applied a LOTO device is not available to remove it, someone in his/her immediate supervisory chain may authorize its removal in accordance with this emergency removal procedure. If the Authorized Employee's immediate supervisor is not available, the emergency removal may be performed by one level of management above the Authorized Employee's immediate supervisor or by a delegated individual with documented authorization from the immediate supervisor.

(2) The following steps must be performed and documented using the Emergency LOTO Lock Removal form provided by OSHE.

(a) The supervisor must verify the Authorized Employee is not at the NIST facility. The supervisor must make every reasonable effort to contact the Authorized Employee. This may include a telephone call to the employee's home or other location. These efforts must be documented (*e.g.*, email, registered letter, voicemail, or telephone verbal assurance, etc.) by the supervisor.

(b) If the Authorized Employee is contacted, the supervisor must inform the employee that his/her LOTO device is being removed.

(c) The supervisor must verify that it is safe to remove the LOTO device.

(d) The supervisor may then authorize another Authorized Employee to remove the LOTO device.

(e) The supervisor must ensure that before the LOTO device owner returns to work, he/she is presented with the removed device and is informed of the reasons for the emergency removal.

(f) The emergency procedure form must be signed by the supervisor and the Authorized Employee who removed the lock and be retained in the OU's LOTO records.

i. Locks, Tags, and Devices

Locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware shall be provided by the OU for isolating, securing, or blocking of equipment from hazardous-energy sources.

(1) General lockout device and tag requirements include:

(a) Locks and tags must be singularly identifiable;

(b) LOTO locks and tags must be the only devices used for controlling hazardous energy during LOTO activities and not be used for any other purpose (*e.g.*, for restricting access, removing from service);

(c) LOTO locks and tags must be durable enough to withstand wet, damp, and corrosive environments while they are in use on equipment, including ensuring the print on the tag does not become illegible;

(d) LOTO locks must be substantial enough to prevent removal without the use of excessive force or unusual techniques such as using bolt cutters or other metal cutting tools;

(e) LOTO tags must be substantial enough to prevent inadvertent or accidental removal, which means that they must have an attachment means of a non-reusable type, be attachable by hand, be self-locking, and be non-releasable with a minimum unlocking strength of no less than 225 N (50 lbf)), *i.e.*, they must have characteristics similar to those of a one-piece all-environment-tolerant nylon cable tie; and

(f) LOTO locks and tags shall be standardized in at least one of the following criteria: color, shape, or size; additionally, in the case of tagout devices, print and format shall be standardized.

(2) NIST's LOTO device requirements are as follows:

(a) Personal locks shall have red bodies and singular keys.

i. Authorized Employees with multiple personal locks may have them keyed alike.

ii. Personal locks must contain the identity of the Authorized Employee who applies them.

iii. Supervisors of Authorized Employees may maintain copies of the keys to the Authorized Employees' personal locks to be used for emergency device removal only.

(b) Group locks shall have red bodies and be keyed alike for each work group.

i. Group locks must contain the identity of the responsible organization that applies them.

ii. Supervisors shall maintain copies of the keys to the group locks to be used for emergency device removal only.

(c) Job locks shall have red bodies and may be keyed alike.

i. Job locks must contain the identity of the responsible organization that applies them.

ii. Supervisors may maintain copies of the keys to the job locks to be used for emergency device removal only.

(d) Lockout tags must meet the following ANSI Z535.5 criteria:

i. Danger tags shall have the word "Danger" in safety white letters on a rectangular safety red background;

ii. Danger tags will be on a safety white stock;

iii. Danger tags must contain the action statement, "Do Not Operate," and, at a minimum, the Authorized Employee's name and phone number; pictures and other information may also be applied to the tags;

iv. Tag message lettering should be typed; if printed messages are applied, they must be legibly printed; and

v. Backs of tags may be used to give additional operating instructions, emergency procedures, emergency telephone numbers, or to reinforce the

critical role that the LOTO tag holds; the back side of the tag should refer to the front side of the tag and vice versa.

vi. Locks and tags used in conducting group LOTO shall:

(i) Have a distinguishing identifier to identify it as a group LOTO lock and tag;

(ii) Locks shall be keyed alike to a single master for each work group; and

(iii) Each lock shall be individually numbered.

vii. Locks and tags used as job locks and tags shall:

(i) Have a distinguishing identifier to identify them as a job LOTO lock and/or tag;

(ii) Locks shall not be keyed alike; and

(iii) Each lock shall have an identifier indicating the organization to which it belongs.

j. Training

(1) Training shall be provided, documented, and recorded in accordance with the requirements of NIST S 7101.23.

(2) Training of Authorized, Affected, and Other Employees and their Official First-Level Supervisors

(a) Authorized Employees shall complete:

i. The training provided by OSHE on the Control of Hazardous Energy (LOTO) program;

ii. The activity-specific training required by hazard reviews applicable to the work to be conducted, including:

(i) The recognition of applicable hazardous-energy sources;

(ii) The types and magnitudes of those hazardous-energy sources; and

(iii) The methods and means necessary for energy isolation and control, and where tagout only is used, review of the following key points:

[i] Tags are essentially warning devices and do not provide physical restraint like a lock.

[ii] When a tag is attached to an energy-isolating device, it is not to be removed without authorization from the Authorized Employee identified on the tag, and it is never to be bypassed, ignored, or otherwise defeated.

[iii] Tags shall be legible and understandable by all employees.

[iv] Tags and their means of attachment shall be made of materials that will withstand environmental conditions encountered while on equipment.

[v] Tags may evoke a false sense of security and their meaning needs to be understood as part of the overall energy-control program.

[vi] Tags shall be securely attached to energy-isolating devices so they cannot be inadvertently or accidentally detached during use.

(b) Affected Employees shall complete activity-specific training on the purpose and use of the energy-control procedures applicable to their assigned duties and work locations and of the prohibition of attempts to re-start or re-energize equipment that is locked or tagged out.

(c) When non-R&D contractors perform LOTO, Affected Employees shall be provided with information concerning the non-R&D contractor's energy control procedures.

(d) The activity-specific training for Authorized and Affected Employees shall be provided by Authorized Employees who have successfully completed training on the Control of Hazardous Energy (LOTO) program and who are familiar with the applicable energy sources and the methods and means of energy isolation and control.

(e) Official First-Level Supervisors of Authorized Employees shall complete the training provided by OSHE on the Control of Hazardous Energy (LOTO) program.

(f) Other employees shall complete training provided by OSHE on the general purpose and use of energy-control procedures and of the prohibition of attempts to re-start or re-energize equipment that is locked or tagged out.[4]

(3) Retraining of Authorized and Affected Employees

(a) Authorized and Affected Employees shall complete activity-specific retraining whenever:[5]

i. A change in their job assignment requires Authorized and Affected Employees to service and maintain or operate additional equipment or introduces them to new energy sources;

ii. A change in equipment or its operation presents a new hazard;

iii. A change in LOTO procedures is introduced;

iv. A LOTO annual inspection points to a systemic deficiency warranting retraining; or

v. A LOTO annual inspection, observation, or other condition reveals deviations from LOTO procedures or a employee is found to lack knowledge of those procedures.

k. LOTO Annual Inspections

(1) Annual Inspection of LOTO Procedures.

(a) Each energy-control procedure shall be separately inspected annually to ensure that the energy-control procedure is adequate and is being properly implemented by Authorized Employees.

[4] This training is part of training assigned automatically by the NIST electronic safety-training application to all employees and covered associates entering on duty.
[5] The requirements in Sections 6j(2)(a)i-iii coincide with requirements in the Hazard Review suborder (a) to conduct hazard reviews when changes to existing activities introduce new or increase existing hazards, and (b) for the authorization of employees.

(b) At a minimum, these inspections shall include a demonstration of the procedures by Authorized Employees while servicing and/or maintaining equipment.

(c) The inspector, who must be an Authorized Employee other than the one(s) utilizing the energy-control procedure being inspected, shall observe the implementation of the energy-control procedure for the servicing and/or maintenance being evaluated and talk with employees and covered associates implementing the procedure to determine that all the requirements of this suborder are understood and being followed.

(d) The Authorized Employee performing the inspection may be someone who previously has or currently implements the energy-control procedure being inspected, as long as he/she is not implementing any part of the energy-control procedure while it is being inspected.

(e) The inspector must be able to determine whether:

i. The steps in the energy-control procedure are being followed;

ii. The employees involved know their responsibilities under the procedure; and

iii. The procedure is adequate to provide the necessary protection, and, if inadequate, what modifications are needed.

(f) Procedures may be reviewed together during one inspection as long as they involve the same or similar types of energy-control methods.

i. If procedures are grouped together for annual inspection, it is recommended that one or more of the individual procedures (from the same group or from similar procedures from the previous year) be reviewed on its own so that over time each procedure is reviewed individually.

(g) Annual inspections shall be recorded using the LOTO inspection form provided by OSHE and maintained by the OU until the completion of the next annual inspection. If inspections reveal inadequate or improper LOTO procedures, the hazard or discrepancy must be mitigated immediately and Authorized and Affected Employees must be retrained as indicated in Section 6j.

l. Records Required by this Suborder

Records required by this suborder are to be kept for one year.

7. DEFINITIONS

a. Affected Employee – Any employee who uses equipment subject to being serviced or maintained under LOTO, or whose job requires him or her to work in an area in which such servicing or maintenance is being performed.

b. Authorized Employee – A person who has completed the required hazardous-energy-control training (general and procedure-specific) and is authorized by their Division Chief or designee to lock and tag out the energy-control points in specific equipment or apparatus in order to perform service or maintenance. A person must be an Authorized Employee to apply a lock or tag to control hazardous energy.

c. Capable of Being Locked Out – An energy-isolating device is considered capable of being locked out if it has a hasp or other means to attach a lock, has a locking mechanism built into it, or can be locked without dismantling, rebuilding, or replacing the energy-isolating device or permanently altering its energy-control capability.

d. Energized – Connected to an energy source or containing stored energy.

e. Energy-Isolating Device – A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: a manually operated electrical-circuit breaker; a disconnect switch; a 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; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches, and other control-circuit-type devices are not energy-isolating devices.

f. Energy-Isolation Point – A location at which the flow or release of hazardous energy can be prevented when a mechanism such as a valve, breaker, switch, blank off, or block-out is placed in the "OFF" position. Control circuits such as computer-control circuitry and software are not energy-isolation points.

g. Exclusive Control – A condition in which a employee has taken actions or is continuously in a position to prevent (exclude) other individuals from re-energizing or starting equipment while it is being serviced or maintained.

h. Group Lock Box – A key box containing the key(s) used to lock out equipment being serviced by multiple Authorized Employees. Each Authorized Employee involved in the servicing places his/her personal locks on the group lock box. The keys to the equipment cannot be accessed until all Authorized Employees remove their locks.

i. Group LOTO – A procedure to coordinate service or maintenance work by several Authorized Employees on locked/tagged out equipment. More than one Authorized Employee may need access to the locked/tagged out equipment because it has multiple energy sources, requires multiple LOTO procedures, or the work to be performed extends across shifts.

j. Group Lockout Devices – Locks and tags used for group LOTO.

k. Hazardous Energy – Energy capable of causing personal harm or property damage if it is not controlled. Types of hazardous energy include, but are not limited to, electrical, mechanical, rotational, gravitational, chemical, radioactive, hydraulic, pneumatic, and thermal.

l. Hazardous-Energy Control – The process of systematically implementing engineering and administrative means to prevent hazardous energy from flowing to a person.

m. Hazardous-Energy-Control Procedure – An equipment-specific procedure Authorized Employees must follow to safely control hazardous energy during servicing or maintaining of the equipment.

n. Hazardous-Energy Source – Equipment, machine, apparatus, process piping, and so on, which is a source of hazardous energy.

o. Hot Tap – A procedure used in servicing and/or maintenance that involves welding on a piece of equipment (pipelines, vessels, or tanks) under pressure, in order to install connections or appurtenances. Hot taps are commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam, and petrochemical distribution systems.

p. Job Lock – A lock used in the performance of LOTO to allow for maintaining continuity of a lockout/tagout condition between shift or workgroup changes.

q. Lockout – The placement of a lockout device on an energy-isolating device, in accordance with an established procedure, to ensure the energy-isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

r. Lockout Device – Any device that uses a positive means such as a lock, blank flanges, and bolted slip blinds to hold an energy-isolating device in a safe position to prevent equipment from unexpectedly energizing.

s. Non-R&D Contractor – A NIST associate who performs non-R&D work at a NIST workplace in accordance with the safety requirements of a contract or other legal arrangement, such as a Memorandum of Understanding, with NIST Non-R&D contractors include, but are not limited to, construction contractors; facilities contractors; equipment installation, service, and maintenance contractors; Health Unit contractors; contract cafeteria employees; and janitorial contractors.

t. Normal Operations – The utilization of equipment to perform intended functions.

u. Other Employee – An employee with duties that are or may be in an area where energy-control procedures may be utilized.

v. Personal Lock (or Locks) – A singularly keyed lock, or singularly keyed locks, issued to an Authorized Employee used exclusively for the control of hazardous energy.

w. Personal Lockout Devices – Locks and tags used for personal LOTO.

x. Personal LOTO – LOTO performed by a single Authorized Employee on equipment with one of more sources of hazardous energy.

y. Primary Authorized Employee – A primary authorized employee would coordinate authorized employee changes and affected workforces (multiple work crews) with equipment operators before and after completion of servicing and maintenance operations that require LOTO. He/she also has the responsibility to ensure continuity of protection with respect to multi-shift energy isolation (*e.g.*, through the use of a "Job Lock".

z. Principal Authorized Employee – Principal authorized employee(s) would be designated for each workforce or crew. When more than one crew, craft, department, etc., is involved, one principal authorized employee would account for a single group of servicing/maintenance personnel. Each principal employee is responsible (to the primary authorized employee) for maintaining accountability and for the individual exposure status of each employee in that specific group in conformance with the company procedure.

aa. Servicing and/or Maintenance – Workplace activities such as constructing, installing, setting up, adjusting, inspecting, and modifying equipment that could expose employees to the unexpected release of hazardous energy. Maintenance activities may also include lubrication, cleaning, or unjamming equipment, and making adjustments or tool changes.

bb. Setting up – Any work performed to prepare equipment to perform its normal operation.

cc. Stored Energy – Energy located within any device after equipment is shut down. This includes, but is not limited to, capacitors, tanks, pipes, springs, and flywheels.

dd. Tagout – The placement of a tagout device on an energy-isolating device, in accordance with an established procedure, to indicate that the energy-isolating device and the equipment being controlled shall not be operated until the tagout device is removed.

ee. Tagout Device – A prominent warning device, such as a tag and a means of attachment that 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 device is removed.

8. ACRONYMS

a. CO – Contracting Officer

b. COR – Contracting Officer Representative

c. LOTO – Lockout/Tagout

d. OSHE – Office of Safety, Health, and Environment

e. OU – Organizational Unit

f. R&D – Research and Development

9. ROLES AND RESPONSIBILITIES

Roles and responsibilities common to all NIST OSH suborders can be found in Section 8 of NIST O 7101.00. The roles and responsibilities specific to this suborder are as follows:

a. OU Directors are responsible for:

(1) Establishing policies and procedures, as needed, for the requirements of this program to be met as it applies to their employees and covered associates and to LOTO procedures performed during their OU operations and ensuring that those policies and procedures are implemented; and

(2) Ensuring subordinate managers have the authority, resources, and training needed to implement OU-established policies and procedures.

b. The Chief Safety Officer is responsible for ensuring the training specified in Section 6.j for Other Employees is included in the NIST General Safety Training.

c. Division Chiefs (or Equivalents)[6] are responsible for:

(1) Implementing this program as it applies to activities involving their personnel in accordance with any applicable OU-established policies and procedures;

(2) Allocating budgetary and other resources capable of ensuring the health and safety of employees, covered associates, and visitors in divisional work areas;

(3) Providing support to group leaders, safety personnel, employees, and covered associates in carrying out their responsibilities with respect to implementing the requirements of this suborder and managing LOTO procedures within the division; and

(4) Acting on all incidents involving LOTO and related safety concerns reported by personnel quickly and completely to protect employees and covered associates from the health and physical hazards.

d. Line Management is responsible for:

(1) Ensuring LOTO procedures are developed for work that requires these procedures;

(2) Ensuring required training has been completed by affected employees and covered associates;

(3) Ensuring LOTO inspections are conducted at the proper frequency by the appropriate personnel; and

(4) Providing oversight as necessary aimed at ensuring that employees and covered associates who perform LOTO do so in accordance with this suborder.

e. Employees and Covered Associates are responsible for:

(1) Completing the training required by this program and their OUs/divisions;

(2) Requesting additional training as needed or as conditions change; and

[6] Some NIST OUs do not have Division Chiefs; these OUs shall designate other individuals to carry out these responsibilities.

(3) Performing LOTO in accordance with their training and the requirements of this suborder.

10. AUTHORITIES

There are no authorities specific to this suborder alone.

11. DIRECTIVE OWNER

Chief Safety Officer

12. APPENDICES

A. Revision History

Appendix A. Revision History

Version No.	Approval Date	Deployment Start Date	Effective Date	Brief Description of Change; Rationale
1	03/20/14	06/25/14	04/01/15	None – Initial document
2	11/05/15	11/05/15	11/05/15	• Made suborder applicable to "associates". • Added new Section 3c(1) to clarify the relationship between this suborder and NIST N 7101.64, Electrical Safety; added "to which employees could be exposed" to Section 3c(2)(b).
3	03/14/18	07/30/19	04/01/20	• Changed "Associates" and "Contractors" to "Covered Associates" and "Non-R&D Contractors" to align the suborder with NIST O 7101.00. • Indicated that LOTO locks and tags are not to be used for equipment taken out of service when that equipment presents no hazards to personnel. • Added requirements for tracking of locks and tags. • Added additional requirements for group LOTO. • Revised the LOTO procedure for shift changes. • Added additional requirements for LOTO conducted by non-R&D contractors.
4	06/17/19	07/30/19	04/01/20	• The term "employee" replaces "worker" to represent federal employees and covered NIST associates to be consistent with terminology used in 29 CFR 1910.147. • The terms "Primary Authorized Employee" and "Principal Authorized Employee" have been added and defined. • The term "job lock" replaces "supervisor lock".
5	01/07/21	NA	04/01/20	• Updated suborder links.

Appendix A. Revision History (continued)

Version No.	Approval Date	Effective Date	Brief Description of Change; Rationale
6	07/09/24	10/01/24	• Section 1 – Updated to be consistent with other suborders. • Section 2.b – Content moved to Section 3.d. • Section 5 – NIST S 7101.23 and S 7101.73 added. • Section 6.a(2) – Added note regarding NIST S 7101.73. • Section 6.a(3)(c) – Added. • Section 6.b(2) – Removed reference to NIST IT application for developing LOTO procedures. • Section 6.c(1) – Content removed as OSHA does not require a procedure for tracking LOTO locks and tags. • Section 6.c(1)(d)i – Content added regarding the use of electrical disconnects and breakers. • Section 6.c(1)(g)i – Content added for verification of de-energization. • Section 6.e(1)(b) – Modified from "electrical power disconnect" to "electrical isolation device". • Section 6.j(1) – Content added regarding compliance with NIST S 7101.23. • Section 6.l – Added requirements for records retention. • Section 9 – Responsibilities updated for OU Directors and CSO, added for Division Chiefs, line management, and NIST staff.