Northwestern

# Control of Hazardous Energy (Lockout/Tagout)

Environmental Health and Safety

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# I. Purpose

This program provides the framework to prevent injuries resulting from the unexpected startup or release of stored energy (e.g., mechanical, electrical, steam, hydraulic, pneumatic, chemical, thermal, gravity) when servicing or maintaining machinery or equipment.

# II. Scope

A. This program applies to Northwestern staff, faculty, students, and contractors who:
   i. Perform service or maintenance on machinery or equipment, in which the unexpected energization or startup could cause harm, and
   ii. Are affected by service or maintenance on machinery and equipment, in which the unexpected energization or startup could cause harm.

B. This program does not apply to:
   i. Construction or renovation projects under the exclusive control of contractors, except when hazardous energy isolation and re-energization are required on machinery or equipment under the control of Northwestern,
   ii. Controlling hazardous energy in installations for the exclusive purpose of power generation, transmission, and distribution, including related equipment for communication or metering, and
   iii. Specific tasks as follows:
      a. Minor tool changes and adjustments, and other minor servicing activities, which take place during normal production operations, so long as they meet the following requirements:
         1. The work is routine, repetitive, and integral to the use of the equipment or machinery for production, and
         2. The work is performed using alternative measures, such as machine guards, which provide effective protection against hazardous energy sources.
      b. Work on cord- and plug-connected electric equipment for which exposure to the hazards of unexpected energization or start-up of the equipment is controlled by:
         1. The unplugging of the equipment from the energy source, and
         2. By the plug being under the exclusive control of the person performing the servicing or maintenance.
   iv. Hot tap operations involving transmission and distribution systems for substances such as gas, steam, water, or petroleum products when they are performed on pressurized pipelines, provided that:
      a. Continuity of service is essential,
      b. Shutdown of the system is impractical, and
      c. Documented procedures are followed, and special equipment is used, which will provide proven effective protection for workers.

# III. Definitions

A. **Affected employee:** A person whose role requires them to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose role requires them to work in an area in which such servicing or maintenance is being performed.

B. **Authorized employee:** A person who locks out or tags out machinery or equipment to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when their duties include performing servicing or maintenance covered by this program.
C. **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.
D. **Hot tap:** A procedure used in the repair, maintenance, and services activities that involves welding on a piece of equipment (e.g., pipelines, vessels, or tanks) under pressure, to install connections or appurtenances. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam, and petrochemical distribution systems.
E. **Lockout device:** A device that utilizes a positive means, such as a lock, either key or combination type, to hold an energy isolating device in a safe position and prevent the energizing of a machine or equipment. Included are blank flanges and bolted slip blinds.
F. **Tagout 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 device is removed.

## IV. Responsibilities

A. **Environmental Health and Safety (EHS)**
   i. Adhere to the requirements of this program.
   ii. Review and update this program, as necessary.
   iii. Assist schools and units in the development and review of energy control procedures.
   iv. Coordinate and/or administer training (see **Section XII – Training**), when necessary.
   v. Provide consultation and guidance, as necessary and upon request, to identify, evaluate, and control potential hazards associated with hazardous energy.
B. **Schools and Units**
   i. Adhere to the requirements of this program.
   ii. Ensure employees complete all required training (see **Section XII – Training**).
   iii. In partnership with EHS, develop and review energy control procedures.
   iv. Designate the appropriate number of qualified and authorized people (see **Section III.B.**) to lock or tag out machinery or equipment to perform servicing or maintenance on that machine or equipment.
   v. Provide resources necessary to ensure adequate lockout and/or tagout equipment (e.g., locks, tags, cables).
   vi. Inform contractors about applicable lockout or tagout procedures, and ensure contractors adhere to this program.

vii. Hazardous energy isolations involving multiple parties (e.g., contractors, Northwestern employees) must adhere to the requirements of **Section VIII – Group Lockout or Tagout**.
viii. When contractor energy control programs are in effect, such as when energy isolation is necessary on machines or equipment under contractor control and not under the control of Northwestern (e.g., new installations), ensure employees understand and comply with the restrictions and prohibitions of the contractor's energy control program.
ix. Contact EHS for guidance and technical assistance, as necessary, to ensure compliance with this program.

C. **Authorized Employees**
i. Adhere to the requirements of this program.
ii. Complete all required training (see **Section XII – Training**).
iii. Adhere to energy control procedures and identify and lock or tag out hazardous energy sources on machinery or equipment to perform servicing or maintenance.
iv. Notify affected persons and others, as necessary, before the application of lockout or tagout devices and after removal.
v. Report all maintenance issues, malfunctions, accidents, or observed unsafe practices to supervisors.
vi. Wear appropriate and assigned personal protective equipment (PPE) correctly, as required.

D. **Affected Employees**
i. Adhere to the requirements of this program.
ii. Complete all required training (see **Section XII – Training**).
iii. Not permitted to operate, perform servicing or maintenance on, tamper with, or remove lockout or tagout devices on machinery or equipment that have been locked or tagged out.
iv. Wear appropriate and assigned PPE correctly, as required.

E. **Contractors**
i. Adhere to the requirements of this program.
ii. Ensure subcontractors adhere to the requirements of this program.
iii. Ensure employees complete all applicable training, as required (see **Section XII – Training**).
iv. Not authorized, except in extenuating circumstances with authorization from Northwestern, to shut down, apply initial lockout or tagout devices, or start up machinery or equipment under the control of Northwestern.
v. Responsible for the procedures (i.e., shutdown, lockout or tagout, and startup) of machinery or equipment under their control and not under the control of Northwestern (e.g., new installations).
vi. Hazardous energy isolations involving multiple parties (e.g., contractors, Northwestern employees) must adhere to the requirements of **Section VIII – Group Lockout or Tagout**.
vii. Responsible for supplying their own lockout or tagout equipment (e.g., locks, tags) in accordance with **Section VII – Protective Materials and Hardware**.
viii. Inform Northwestern about applicable lockout or tagout procedures.

## V. Requirements

A. All machinery and equipment that have the potential to unexpectedly start or release hazardous energy must be isolated, de-energized, rendered inoperative, and locked or tagged out at each energy source prior to performing maintenance or repair activities, including but not limited to adjusting, inspecting, repairing, modifying, retooling, constructing, clearing jams, lubricating, cleaning, working on energized valves (e.g., valves that are being used to isolate hazardous energy), electrical work, removing or bypassing a safety device, and placing any part of the body in harm's way.

B. Lockout
   i. If an energy isolating device is capable of being locked out, a lockout system must be utilized, unless the utilization of a tagout system will provide a level of safety equivalent to that obtained by using a lockout program.
   ii. Whenever replacement or major repair, renovation, or modification of a machine or equipment is performed, and whenever new machines or equipment are installed, energy isolating devices for such machine or equipment must be designed to accept a lockout device.

C. Tagout
   i. If an energy isolating device is not capable of being locked out, a tagout system must be utilized.
   ii. When a tagout device is used on an energy isolating device that is capable of being locked out, the tagout device must be attached at the same location that the lockout device would have been attached and must provide a level of safety equivalent to that obtained by using a lockout program.
   iii. In demonstrating that a level of safety is achieved in the tagout program that is equivalent to the level of safety obtained by using a lockout program, additional elements must be implemented as necessary to provide the equivalent safety available from the use of a lockout device. Examples include but are not limited to the removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or the removal of a valve handle to reduce the likelihood of inadvertent energization.

D. When hazardous energy must be isolated to enter a confined space, the Northwestern Confined Spaces Program must be followed.

## VI. Energy Control Procedures

A. Machinery and equipment must have documented energy control procedures that clearly and specifically outline 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:
   i. A statement of the intended use of the procedure,
   ii. Specific procedural steps for shutting down, isolating, blocking, and securing to control hazardous energy (see **Section VI.C.**),
   iii. Specific procedural steps for the placement, removal, and transfer of lockout devices or tagout devices and the responsibility for them,
   iv. Specific requirements for testing to determine and verify the effectiveness of lockout devices, tagout devices, and other energy control measures,

v. Procedures to restore machines or equipment to service (see **Section VI.E.**), and

B. Documented energy control procedures for machinery and equipment are not required when all the following elements exist:
   i. There is no potential for stored or residual energy or re-accumulation of stored energy after shutdown, which could endanger people,
   ii. There is a single energy source that can be readily identified and isolated,
   iii. The isolation and locking out of that energy source will completely deenergize and deactivate the machinery or equipment,
   iv. The machinery, equipment, or system is isolated from that energy source and locked out during servicing or maintenance,
   v. A single lockout device will achieve a locked-out condition,
   vi. The lockout device is under the exclusive control of the authorized person performing the servicing or maintenance,
   vii. The servicing or maintenance does not create hazards for others, and
   viii. In utilizing this exception, there have been no accidents involving the unexpected activation or reenergization of the machinery or equipment during servicing or maintenance.

C. Energy control procedure sequence
   i. Notify all affected employees that servicing or maintenance is required on a machine or equipment and that the machine or equipment must be shut down and locked or tagged out to perform the servicing or maintenance.
   ii. The authorized employee must identify the type and magnitude of the energy that the machine or equipment utilizes, understand the hazards of the energy, and know the methods to control the energy.
   iii. If the machine or equipment is operating, shut it down by the normal stopping procedure (e.g., depress the stop button, open the switch, close the valve, etc.).
   iv. De-activate the energy isolating device(s) so that the machine or equipment is isolated from the energy source(s).
   v. Lock out the energy isolating device(s) with assigned individual lock(s). If a lockout is infeasible, tagout may be used in compliance with **Section V.C.**
   vi. Stored or residual energy (such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure, etc.) must be dissipated or restrained by methods such as grounding, repositioning, blocking, bleeding down, etc.
   vii. Ensure that the machine or equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, then verify the isolation of the equipment by operating the push button or other normal operating control(s) or by testing to make certain the equipment will not operate.
   **Note:** Return operating control(s) to neutral or "off" position after verifying the isolation of the machine or equipment.
   viii. The machine or equipment is now locked or tagged out.

D. In situations in which lockout or tagout devices must be temporarily removed from the energy isolating device and the machine or equipment energized to test or position the machine, equipment, or component thereof, the following sequence of actions must be followed:

i. Clear the machine or equipment of tools and materials,
ii. Remove personnel from the machine or equipment area,
iii. Remove the lockout or tagout device,
iv. Energize and proceed with testing or positioning, and
v. Deenergize all systems and apply energy control measures to continue the servicing and/or maintenance.

E. Restoring machinery or equipment to service when the servicing or maintenance is completed and the machine or equipment is ready to return to normal operating condition.
   i. Check the machine or equipment and the immediate area to ensure that nonessential items have been removed and that the machine or equipment components are operationally intact.
   ii. Check the work area to ensure that all personnel have been safely positioned or removed from the area.
   iii. Verify that the controls are in neutral.
   iv. Remove the lockout or tagout devices and reenergize the machine or equipment. Note: The removal of some forms of blocking may require reenergization of the machine before safe removal.
   v. Notify affected employees that the servicing or maintenance is completed and the machine or equipment is ready for use.

F. When documented energy control procedures are required, the Equipment-Specific Energy Control Procedure Template or any other effective means may be utilized.

G. Work involving electrical hazards conducted by trained and qualified electrical workers (i.e., electricians) who install, maintain, repair, and/or replace premise electrical wiring systems must have energy control procedures as follows:
   i. Documented energy control procedures in the form of a copy of paragraph 29 CFR 1910.333(b), which must be made available to all trained and qualified electrical workers, or
   ii. Documented energy control procedures pursuant to **Section VI.A.,** unless not required by **Section VI.B.**

## VII. Protective Materials and Hardware

A. Protective materials and hardware include, but are not limited to, locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware for isolating, securing, or blocking of machines or equipment from energy sources.

B. Lockout devices and tagout devices must be singularly identified, the only devices(s) used for controlling energy, not used for other purposes, and must meet the following requirements:
   i. **Durable**: Capable of withstanding the environment to which they are exposed for as long as the exposure is expected without deteriorating or the text becoming illegible.
   ii. **Standardized**: Devices must be standardized in at least one of the following criteria: color, shape, or size. Additionally, tags must have a standardized print and format.
   iii. **Substantial**: Lockout devices must be substantial enough to prevent removal without the use of excessive force or unusual techniques (e.g., bolt cutters).

Tagout devices, including their means of attachment, must be substantial enough to prevent inadvertent or accidental removal.

iv. **Identifiable**: Lockout device(s) must indicate the identity of the employee applying the device(s).

v. Tagout devices must warn against hazardous conditions if the machine or equipment is energized and must include a legend such as the following: *Do Not Start, Do Not Open, Do Not Close, Do Not Energize, Do Not Operate*.

## VIII. Group Lockout or Tagout

A. If maintenance or servicing of machinery or equipment is performed by a crew, craft, department, or other group (e.g., contractors and employees), they must utilize a procedure that affords the employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device.

B. Group lockout or tagout devices must meet the requirements of **Section VII - Protective Materials and Hardware**.

C. Primary responsibility is vested in a designated authorized employee ("primary authorized employee") for a set number of employees working under the protection of a group lockout or tagout device (e.g., operations lock).

i. For machinery or equipment under the control of Northwestern, this will be a Northwestern employee.

ii. For machinery or equipment not under the control of Northwestern (e.g., new installations), this will be an employee of the contractor or company responsible (e.g., utility company).

D. Primary authorized employee:

i. Authorizes the lockout or tagout of the machinery or equipment,

ii. Is designated to coordinate all affected workforces and assume overall responsibility for lockout or tagout control to ensure continuous protection.

iii. Initiates and completes the energy control procedure, including notifications to affected employees and start-up procedures, and is the first person to apply their lockout or tagout device,

iv. Must be able to determine the exposure status of each group member during the lockout or tagout of the machinery or equipment.

E. Each authorized employee must affix a personal lockout or tagout device to the group lockout device, group lockbox, or comparable mechanism (e.g., hasp) when they begin work, and must remove those devices when they stop working on the machinery or equipment being serviced or maintained.

## IX. Shift or Personnel Changes

A. The primary authorized employee is responsible for ensuring that the continuity in the protection provided for those involved in the energy control procedures is maintained for the orderly transfer of lockout and tagout devices during shift or personnel changes.

B. When a machine or equipment is to be left locked or tagged out during a shift or personnel change:

i. The outgoing shift must inform the incoming shift about the status of the machine or equipment and work in progress.

ii. When lockout or tagout devices (personal and/or continuity devices) remain on energy isolation devices from a previous shift, incoming authorized employees

must verify that the machine or equipment has been effectively de-energized and isolated. Incoming employees may not depend on the actions of other employees or supervisors, particularly those who have left the workplace for the day, for assurance that it is safe to work on the machinery, equipment, or system.

iii. The incoming shift must accept control of the machine or equipment involved prior to the release of control over the system by the outgoing employees.

iv. The orderly transfer of personal lockout or tagout devices between outgoing and incoming employees must ensure that there is no gap in coverage between the outgoing employee's removal of their devices and the incoming employee's attachment of their devices.

v. The incoming authorized employee's lockout or tagout device must be applied before the outgoing authorized employee's lockout or tagout device is removed.

C. Reference the Occupational Safety and Health Administration (OSHA) Directive: CPL 02-00-147, Section XV – Shift or Personnel Changes, for alternative strategies such as the use of shift or personnel transfer devices or all authorized employees leaving their personal lockout or tagout devices in place until the work is completed.

## X. Lockout or Tagout Device Removal

A. Each lockout or tagout device must be removed from each energy isolating device by the authorized employee who applied the device.

B. When the authorized employee who applied the lockout or tagout device is not available to remove it, that device may be removed under the direction of an authorized school or unit supervisor in accordance with the following steps:

i. Verify that the authorized employee who applied the device is not at the facility,

ii. Make all reasonable efforts to contact the authorized employee to inform them that the lockout or tagout device has been removed, and

iii. Ensure that the authorized employee has this knowledge before they resume work at that facility.

iv. Obtain and review all available information to determine the reason the equipment is locked or tagged out, and thoroughly inspect the machine or equipment to determine if it is safe to remove the lockout or tagout device and re-energize the machine or equipment.

C. Removal of a personal lockout or tagout device by another person may not be based on convenience and may not be done simply because the employee is not available at the energy isolation device location, but is still at the workplace.

## XI. Periodic Inspections

A. Periodic inspections of the energy control procedure are required at least annually to ensure the procedures and this program are being followed.

B. Periodic inspections must be performed by an authorized employee other than the one utilizing the energy control procedure being inspected.

C. Periodic inspections must be conducted to correct any deviations or inadequacies identified.

D. Where lockout is used for energy control, the periodic inspection must include a review, between the inspector and authorized employees, of the employees' responsibilities under the energy control procedure being inspected.

E. Where tagout is used for energy control, the periodic inspection must include a review, between the inspector and authorized and affected employees, of the employees' responsibilities under the energy control procedure being inspected, and the limitations of tagout systems.
F. Energy control procedures that are not required to be documented pursuant to **Section VI.B.**, still need to be inspected and reviewed to ensure that they are adequate and being properly utilized.
G. The Energy Control Procedure Periodic Inspection Form or any other effective means may be utilized to document and certify that the periodic inspections were performed, so long as the following information is recorded:
    i. The identity of the machine, equipment, or system on which the energy control procedure was being utilized,
    ii. The date of the inspection,
    iii. The employees included in the inspection, and
    iv. The person performing the inspection.
H. Energy control procedures used less frequently than once a year need to be inspected only when used.
I. Reference the Occupational Safety and Health Administration (OSHA) Directive: CPL 02-00-147, Section XVII – Periodic Inspection, for strategies to conduct periodic inspections (e.g., grouping distinct procedures associated with similar machinery or equipment to be considered a single procedure for purposes of conducting a periodic inspection, and inspecting a representative number of such employees implementing one procedure within each group).

## XII. Training

A. Northwestern employees must complete training as follows:
    i. Authorized Employees
        a. Biennial Online Control of Hazardous Energy training, and
        b. Authorized Lockout/Tagout training, upon hire.
        c. Must be trained in the following:
            1. Recognition of applicable hazardous energy sources,
            2. Type and magnitude of the energy available,
            3. Purpose and use of the energy control procedure,
            4. Methods and means necessary for energy isolation and control, and
            5. Nature and limitations of tagout systems.
    ii. Affected Employees
        a. Biennial Online Control of Hazardous Energy training
        b. Must be instructed in the purpose and use of the energy control procedure.
    iii. All other employees whose work operations are or may be in an area where energy control procedures may be utilized must be instructed about the procedure and about the prohibition relating to attempts to restart or reenergize machines or equipment that are locked or tagged out.
B. Retraining must be provided to all authorized or affected employees whenever:
    i. There is a change in:
        a. Job assignment,

b. Energy control procedures,
c. Machinery, equipment, systems, or processes that present a new hazard.

ii. A periodic inspection reveals, or whenever there is reason to believe, that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedures.

iii. Retraining must reestablish employee proficiency and introduce new or revised control methods and procedures, as necessary.

C. Contractors (including subcontractors) must ensure employees are appropriately trained in accordance with OSHA 29 CFR 1910.147(c)(7) – Training and Communication.

## XIII. Recordkeeping

A. Training records will be maintained by EHS in myHR Learn and kept for the duration of employment, plus 1 year.

B. Most recent (i.e., current) documented energy control procedures and periodic inspections, where required, must be maintained by the school or unit responsible for the servicing or maintenance of the machine or equipment, for as long as the machine or equipment is in operation.

## XIV. Regulatory Authority

Northwestern and contractors will comply with the Occupational Safety and Health Administration (OSHA) standards and any other applicable codes and standards, including:

Northwestern Confined Spaces Program
Northwestern Contractor Safety Program
Northwestern Personal Protective Equipment Program
OSHA 29 CFR 1910.147 – Control of Hazardous Energy (Lockout/Tagout)
OSHA 29 CFR 1910.331 – Electrical – Selection and Use of Work Practices
OSHA Directive CPL 02-00-147 – The Control of Hazardous Energy – Enforcement Policy and Inspection Procedures

## XV. Contact

For questions, contact Environmental Health and Safety at ehs@northwestern.edu.