



UNIVERSITY OF TORONTO

Lockout/Tagout: General Procedure

1.0 PURPOSE AND SCOPE:

The purpose of this general procedure is to establish minimum requirements for lockout to control potentially hazardous energy associated with machines or equipment in order to prevent injuries during maintenance or repair operations.

If machinery could inadvertently activate, or if the unexpected release of energy could cause injury, then the energy source(s) must be isolated and controlled by using this example general lockout procedure.

This procedure applies to any situation at the University of Toronto which may expose a worker to such a hazard. Departments are expected to develop additional specific procedures in addition to the general procedures for the specific equipment and work they are performing or other specific applications.

2.0 DEFINITIONS:

Affected Individual, persons who are not directly involved in the work requiring the hazardous energy control, but who are (or may be) located in the work area.

Authorized Employee, an employee who is qualified because of knowledge, training, and experience and has been assigned to perform lockout.

Control lock, a Control lock is used to replace a worker's personal lock if he/she must leave the site before the operation is released from lockout. The control lock is usually placed by the supervisor and must be labelled with the appropriate department and telephone number of the person who applied it.

Energy isolating device, a mechanical device (a disconnect switch, line valve, block, blank off plate) that physically prevents the transmission or release of an energy source to machinery or equipment. An example is a manually operated switch (e.g. electrical circuit breaker, a disconnect switch) by which the conductors of the circuit can be disconnected from all ungrounded supply conductors.

Energy source, any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, gravitational, stored or other energy.

Group Lockout Procedure, this is the procedure used where there are several workers involved and several sources of energy to be locked out. This is usually accomplished through the use of a lock box under the direction of a Superior Authorized Employee.

Superior Authorized Employee (group lockout), this is a person (usually the supervisor) who is qualified because of knowledge, training, and experience to coordinate the application and removal of the lockout procedure for multiple groups of authorized employees under the Group Lockout situation.

Principal Authorized Employee (group lockout), this person (usually a supervisor) has responsibility for a particular group of employees under the Group Lockout process and reports to Superior Authorized Employee in Group lockout situations.

Hazardous Energy, any electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, thermal, gravitational, or other energy that can cause harm to personnel.

Individual Lockout procedure, this is the basic procedure that is used where there is only one worker who is required to lockout one source of energy.

Lock box, this is a secure box, usually attached to the machinery or equipment that contains locks, tags and keys for use in a group lockout situation. It is usually under the control of the Superior Trade or Utility.

Lock box locks, these are the locks which are supplied with the lock box and used in a group lockout situation.

Lockout, lockout means to physically neutralize all energy sources in machinery or equipment, usually by applying locks, before beginning any maintenance or repair work. The primary purpose of lockout is to prevent all energy isolation devices (switch, circuit breaker or valve) from accidentally or inadvertently being operated while workers are working on equipment.

Lockout device, this is a device that uses a positive means (such as a lock) to hold an energy-isolation device in a safe position and prevent the energizing of a machine or a piece of equipment. This includes devices such as accessories to go over valves and other isolation devices. Each lockout device must always be accompanied by a tagout device.

All Lockout devices, must

- be unique, distinctive, easily recognizable, and clearly visible
- be the only devices used for controlling potentially hazardous energy
- not be used for any other purpose
- be capable of withstanding the environment to which they are exposed
- be substantial enough to prevent operation of the energy isolating device without the use of excessive force
- application of lockout device shall not itself create a hazard to either authorized or affected individuals

Locks, by themselves, do not de-energize equipment. They are attached only after the machinery has been isolated from its energy sources.

Multiple person lockout procedure, this procedure is used where several workers are involved, but there is a single lockout point. Generally, a multi-lock hasp is attached to the energy isolating device which allows as many personal locks as necessary to be attached.

Multi-lock hasp or scissor device, this is a special device which allows several personal locks to be attached to a single lockout point. It cannot be opened until all of the personal locks have been removed. If more than 6 locks are required for the lockout, then the last hole is left empty so that another multi-lock hasp can be added, thereby allowing more locks to be added.

Personal lock, a personal lock is one that is assigned to a particular worker involved in the operation. Each worker must apply and remove his/her own personal lock and carry his/her own key. Combination locks or locks with master or duplicate keys must not be used. Each personal lock shall be identified by an attached tag with the worker's name, department and contact number.

Tagout device, this is a tag or sign, which must be attached to the lockout device, that is used to communicate vital information about the lockout, including the identity of the Authorized Employee who applied the device, the reason for locking out, and the date and time. It also warns workers not to operate that equipment. The tag must be substantial enough to withstand the environment, be secured to prevent inadvertent or accidental removal, and it must remain legible for the duration of the job. It must be made of non-conducting material and be placed in a conspicuous location.

Tagout, tagout means to attach tags or signs to the locks with written information about the nature of the lockout.

Zero Energy State, an energy level that is not harmful to an individual. Methods for achieving a zero energy state in a system include de-energization of electrical sources and discharging of capacitive and inductive elements (absence of voltage and current), blocking or totally releasing mechanical energy (kinetic or potential), and dissipating chemical or thermal energy.

3.0: GENERAL LOCKOUT/TAGOUT PROCEDURES

Step 1. Preparation for Shutdown

The Supervisor or Authorized Employee shall:

- Identify the types and magnitude of energy to be controlled
- Identify all hazards (including stored energy)
- Identify the method or means of controlling the energy
- Identify the location of switches, energy sources, controls, interlocks or other such devices necessary to isolate the system.
- Assess the consequences of shutdown
- Notify all affected persons that the equipment will be shutdown and locked/tagged out
- Conduct a written job hazard analysis where necessary.

Step 2. Equipment Shutdown

- The equipment will be shutdown following established procedures.
- Ensure that all points of operation are considered, including remote control points.

Step 3. Equipment Isolation

- The equipment shall be isolated by following established isolation procedures which specify the use of disconnect switches, line valves, blocks, blanks, removal of spools, and capping of lines etc., as required.
- Computer shutdown alone does not constitute a proper isolation procedure.

Step 4. Application of Lockout Devices

- Locks shall be applied to each of the isolation devices. Each employee working on the equipment is responsible for attaching his/her personal lock and keeping the key, without exception.
- A multi-lock hasp or scissor device may be used to allow the application of more than one lock to a single energy isolating device.
- Tags must be attached to each lockout device whether it is a personal lock or a control lock. The tag should state the name, department and telephone number of the person who applied the device, the reason for locking out, the date and time.
- In the case of a group lockout, a designated Authorized Employee, usually the Principal Authorized Employee, will apply all control lockout devices.

Step 5. Release of Stored Energy (De-energization)

- Once all necessary Lockout devices have been applied, all potentially hazardous stored or residual energy must be relieved, blocked, bled, restrained, grounded or rendered safe by Authorized Employees. See examples below.
- Additional measures may be necessary to prevent the re-accumulation of energy.
- Each worker must ensure that this has been done.

ENERGY FORM	ENERGY SOURCE	GENERAL LOCKOUT GUIDELINE
Electricity	<ul style="list-style-type: none"> • power transmission lines • machine power cords • motors • solenoids • capacitors (stored electrical energy) • generators • batteries • photovoltaic arrays 	<ul style="list-style-type: none"> • Turn off power at machine first (point of operation switch), and then at main disconnect switch for machine; lock and tag main disconnect switch (or remove fuses from box, and then lock and tag box). • Fully discharge all capacitive systems (e.g. cycle machine to drain power from capacitors) according to manufacturer's instructions. • Install grounds where necessary.
Fluid Pressure	<ul style="list-style-type: none"> • Hydraulic systems <ul style="list-style-type: none"> - hydraulic presses - rams - cylinders - hammers 	<ul style="list-style-type: none"> • Shut off, lock (with chains, built-in lockout devices, or lockout attachments) and tag valves; bleed off and blank lines as necessary. • Block any possible movement of machinery.
Air Pressure	<ul style="list-style-type: none"> • Pneumatic systems: <ul style="list-style-type: none"> - lines - pressure reservoirs - accumulators - air surge tanks - rams - cylinders 	<ul style="list-style-type: none"> • Shut off, lock (with chains, built-in lockout devices, or lockout attachments) and tag valves; bleed off excess air. • If pressure cannot be relieved, block any possible movement of machinery.
Kinetic Energy (energy of a moving object or materials - moving object may be powered or coasting)	<ul style="list-style-type: none"> • blades • flywheels • materials in supply lines of bins or silos 	<ul style="list-style-type: none"> • Stop and block machine parts, and ensure that they do not recycle. Review entire cycle of mechanical motion; ensure that all motions are stopped. • Block material from moving into area of work and blank as required.
Potential Energy (energy stored in an object with the potential for release due to its position)	<ul style="list-style-type: none"> • springs • actuators • counterweights • raised loads • top or movable part of a press or lifting device 	<ul style="list-style-type: none"> • If possible, lower all suspended parts and loads to the lowest (rest) position, block parts that might move due to gravity; release or block stored spring energy.
Pressurized liquids and gases (including steam, chemicals)	<ul style="list-style-type: none"> • supply lines • storage tanks and vessels 	<ul style="list-style-type: none"> • Shut off, lock (with chains, built-in lockout devices, or lockout attachments) and tag valves; bleed off excess liquids or gases; blank lines as necessary.

Adapted from "A Health and Safety Guideline for your Workplace," Industrial Accident Prevention Association, 2008

Step 6. Verification of Isolation

- Prior to starting the work, and after isolation and de-energization, the Authorized Employee should perform a test of all start buttons and other activating controls on the equipment, check potential of the electrical supplies to ensure the equipment has been de-energized.
- Verify the test equipment before and after the test on a known source of energy
- Potential test indicators should not be used beyond the voltage limits for which they are rated.
- Return all of the controls to the off or neutral position after trying to start.
- For work involving several points of isolation, the Authorized Employee must keep record of the devices opened, locked off or otherwise rendered inoperable so that all of these devices can be reactivated once work is complete.
- Each person who has placed a personal lock on the equipment should be assured of his/her right to verify individually that the potentially hazardous energy has been isolated and/or de-energized before the repair or maintenance work begins.

PERFORM THE REPAIR OR MAINTENANCE WORK

- Do not do anything that could re-activate the equipment.
- Do not inadvertently bypass the lockout (e.g. when installing a new pipe or wiring.)

Step 7. Release from Lockout Control

Prior to restoring energy to the equipment, the Authorized Employee will perform an assessment of the work area to determine that:

- the machine or equipment is operationally intact
- all necessary guards have been re-installed
- all tools and materials used during the repair or maintenance activities have been removed
- all temporary de-energization measures and devices have been removed by those who placed them
- all other workers and affected individuals have been informed that the energy is about to be restored
- all other workers and affected individuals are clear of the equipment (perform a head count if necessary)

The last lock to be removed should be that of the person supervising the lockout. This responsibility should not be delegated to another person.

Follow the required steps to re-energize the system.

4.0 ADDITIONAL LOCKOUT SITUATIONS

4.1 Multiple Persons Lockout

If more than one Authorized employee works on the same equipment, each person must attach his/her lock to the multi-lock hasp on the energy-isolating device.

4.2 Group Lockout (lock box procedures)

Where there are several lockout points to be secured and several Authorized Employees involved on the job, a group lockout procedure is followed.

- The Superior Authorized Employee obtains a lock box and secures it to the machine or equipment.
- Lock box locks from the lock box and tags are applied to all the lockout points by Authorized Employees under direction from the Superior Authorized Employee.
- The keys are collected, verified and placed inside the lock box.

- The lock box is then closed and a multi-lock hasp is affixed to it. This will allow additional locks to be added.
- The last available hole should never be used for a lock, but should remain open to add another multiple lockout device if needed to create more spaces. In this way, as many locks as needed can be added to the equipment.
- Verification procedures are to be used to determine the effectiveness of lockout. Each worker can request at the time of lockout, that isolation be verified in their presence.
- Each worker on the job then applies his/her personal lock to the multi-lock hasp such that the box cannot be opened until each personal lock is removed. Each worker's personal lock remains in place as long as he/she is actively working on the locked out equipment.
- As the work progresses, remove all non-essential items from the work site. When it is sure that there is no reason for workers to return, they can then consider their need for isolation to have ended, following which they remove their personal lock and tag from the lock box.
- In all cases, the last lock to be removed should be that of the person supervising the lockout. This responsibility should not be delegated to another person.

4.3 Shift or Personnel Changes

If the work lasts longer than one shift, or when the Authorized Employee who applied the lock must leave the workplace, lockout protection must not be interrupted. There are at least two approaches to ensure continuity of lockout control.

- The replacement worker applies his/her lock before the departing worker removes his/hers. This also provides an opportunity for discussion regarding the status of the job.
- A control lock is applied by the supervisor, along with each personal lock. When an Authorized Employee has completed his/her shift but the work is not completed, he/she removes the personal lock, and communicates to the supervisor any outstanding work required.

The control lock(s) must remain in place until the equipment is safe to return to service or has been rendered incapable of being returned to service, i.e. physically disconnected.

4.4 Lock Removal when Person is Absent

Personal locks

Workers should always apply and remove their own locks. However, in the rare event that the worker who applied a lock is unable to remove it (e.g. due to sudden illness or injury) the lock can be removed only under the direction and in the presence of the worker's supervisor who has assessed the situation and determined that it is safe to remove the lock. A lock removal form (Appendix B) must be completed by the supervisor and kept on file. The person whose lock was removed must be notified verbally and in writing of the removal upon his/her return, and before resuming work (Appendix C). Anyone who removes someone else's lock without following this procedure will be subject to disciplinary action.

Control locks

As above, a control lock can only be removed by another supervisor in the same Trade or Utility after he/she has assessed the situation and determined that it is safe to remove the lock. The person who applied the control lock must be notified of the lock removal before he/she returns to work. A lock removal form must be completed and kept on file. Anyone who removes a control lock without following this procedure will be subject to disciplinary action.

4.5 Energized Testing

Where lockout devices must be temporarily removed for testing, trouble shooting, re-positioning of components etc.:

- The state of the maintenance work must be assessed with a Risk Assessment to ensure that testing can be done safely.
- All provisions of Step 7, Release from Lockout Control, must be followed.
- Energized testing is conducted.
- When energy is no longer needed, lockout is applied again, according to the procedures outlined in Steps 1 to 6.

4.6 Other Considerations

Confined Spaces

Special considerations are required for work in Confined Spaces. Refer to Ontario Regulation 632/05, Confined Spaces, under the OHS Act and the University of Toronto Confined Space Program.

High Voltage

Written procedures must be developed to describe lockout measures necessary when employees are required to work on high-voltage circuits or equipment. Refer to the E&USA Rule Book, Electric Utility Operations (2019)

Mobile Equipment

Maintenance work on mobile equipment can also require lockout procedures. It is important to identify the hazards associated with performing the work and select the correct lockout method or risk assessment process for other control methods (this could include: removing fuel source, chocking wheels, dissipating thermal energy, disabling start circuits, etc.).

Examples of Mobile equipment include (but not limited to): front-end loaders, dozers, backhoes, excavators, skidders, scrapers, compactors, rollers, lift trucks, industrial tractors, transportation vehicles, walkie pallet stackers, self-powered man lifts and hoists, etc.

If you or your department performs tasks (such as inspection of components, diagnostic testing, mechanical repair, maintenance and lubrication, minor component replacement, changing chains, checking for leaks, etc.), ensure that all hazardous energies are appropriately identified, assessed, and documented procedures are available to ensure equipment is placed to zero energy state before work begins.

Other Control Methods: Other control methods must only be used with caution and rigorous risk assessment. Risk reduction methods (i.e. hierarchy of controls) must be evaluated to identify appropriate alternative control methods. Users should exercise care when using alternative methods. Examples of alternative methods are summarized briefly below:

Remote Low Voltage Lockable systems

Remotely located isolation device that controls and monitors electromechanical energy control systems could provide an acceptable alternative to hazardous-energy-isolating devices located in inaccessible or inconvenient locations on machines, equipment or processes. If your department utilizes these systems, ensure that department specific procedures are clearly documented and authorized employees are trained. This procedure is not intended for use without specific and individual assessment.

Inch-Safe-Service Procedure

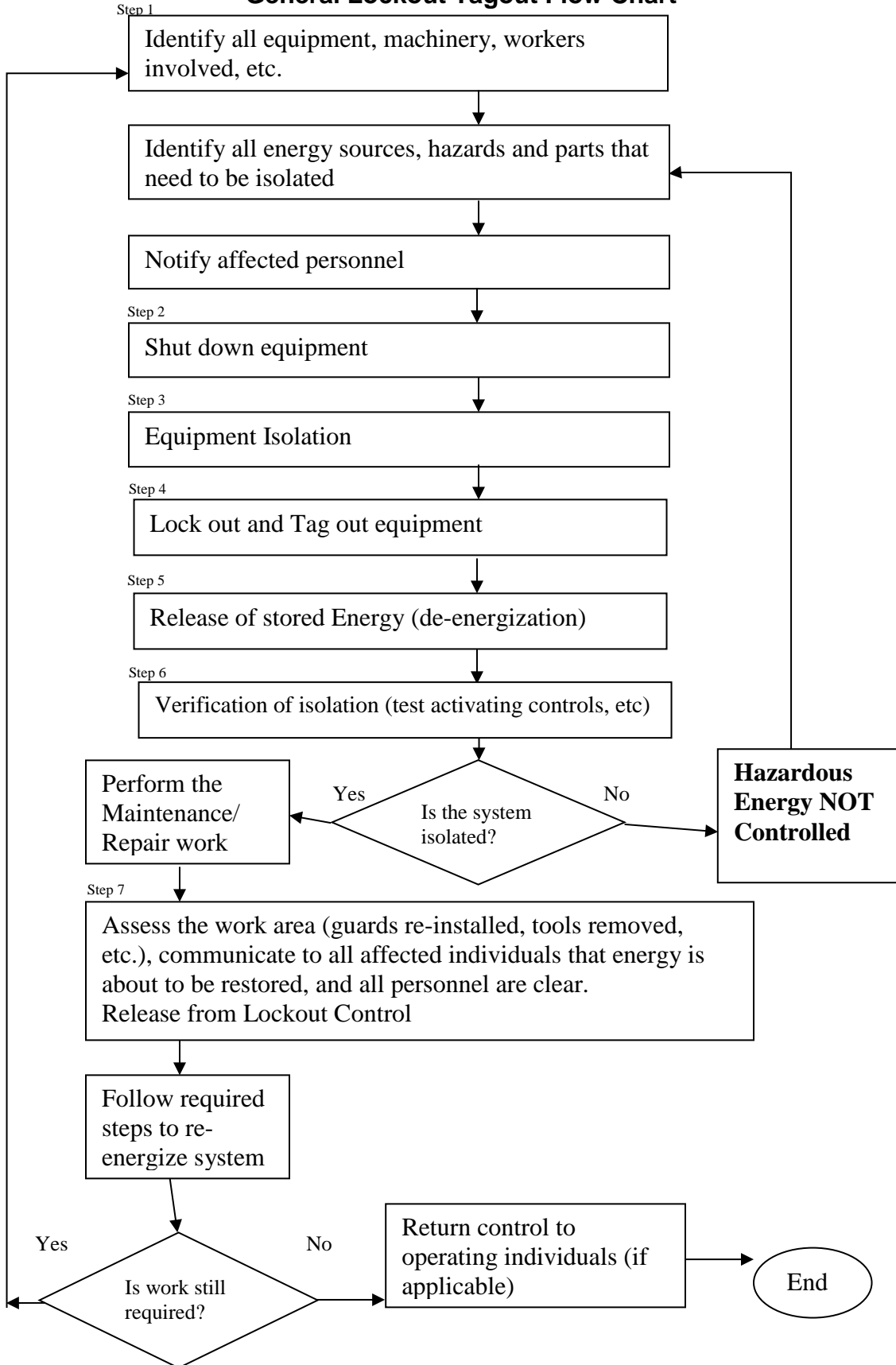
Some large equipment are equipped with control stations containing, at a minimum, a stop/safe or stop/safe/ready push button. Some motion control stations also include an inch button that enables slow machine motion while the button is held down. These control stations are electrically linked to an audible or area light warning system that provides an audible or visual indication of the machine's state and impending motion. The inch-safe procedure is employed by personnel who operate the equipment, and in combination with the stop control, warning system, and guards, provides other control methods. If your department utilizes these procedures, ensure that department specific procedures are clearly documented and authorized employees are trained. This procedure is not intended for use without specific and individual assessment.

Freeze Plug Technology

Freeze plug technology for isolating piping systems. Line freezing does not require permanent modification or welding of the piping system. It can be used as a secondary isolation seal for additional protection. Piping systems that may potentially use the freeze plug isolation technology are systems containing water, hydrocarbons, or any chemical with a suitable freeze point and no flow. When freeze plug technology is applied, department specific procedures with clearly documented and adequately trained authorized employees are required. This procedure is not intended for use without specific and individual assessment.

APPENDIX A: GENERAL PROCEDURE LOCKOUT TAGOUT FLOW CHART

General Lockout Tagout Flow Chart



Adapted from "Electrical Construction and Maintenance Worker's Safety Manual," Construction Safety Association of Ontario, 2008

APPENDIX B: LOCKOUT DEVICE REMOVAL FORM

LOCKOUT DEVICE AND INFORMATION TAG REMOVAL REPORT

Department: _____

Shift: _____

Authorized Employee's Name: _____

Machine, Equipment or Process: _____

Date and Time Lockout Device and Information Tag was discovered to be left on:

Reason(s) for Removal of Lock and Tag:

A. Confirmed that the Authorized Employee has left site or facility? (check one) <input type="checkbox"/> Yes or <input type="checkbox"/> No Supervisors Signature: _____ Time and Date: _____	
B. Attempts made to contact the Authorized Employee? (check one) <input type="checkbox"/> Yes or <input type="checkbox"/> No Supervisors Signature: _____ Time and Date: _____	
<input type="checkbox"/>	Authorized Employee has been contacted and is returning to workplace to remove the lockout device(s) and information tags. (Procedure ends, exit procedure, file form for future reference). Supervisors Signature: _____ Time and Date: _____
<input type="checkbox"/>	Authorized Employee cannot be contacted and or is unable to return to the Site to remove their lock or Information Tag. Proceed with Step C. Supervisors Signature: _____ Time and Date: _____
C. Supervisor may authorize removal of the lock and tag once:	
<input type="checkbox"/>	The status and condition of the machine or equipment is assessed and verified to be in a state that will allow for the safe removal of the Lockout device. Supervisors Signature: _____ Time and Date: _____
<input type="checkbox"/>	Provisions have been made to prevent the Authorized Employee from resuming work at this facility without notification that their lock and tag have been removed. Supervisors Signature: _____ Time and Date: _____
Only upon completion of the above Steps A-C, Supervisor can remove the lock and tag.	
Supervisors Signature: _____ Time and Date: _____	
Witness: _____ Time and Date: _____	

WARNING

Notice to Employee

Name: _____

Department: _____

The Lockout device and information tag that you applied to (machinery or equipment):

located in (room/building): _____

has been removed by (supervisor name and phone number): _____

The reason for the removal was: _____

Please report to your immediate supervisor before starting work.

Date: _____

Supervisor: _____