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**WELL AT HOME.
SAFE AT WORK.**

Session 411
Lock Out/Tag Out:
Alternate Means of Protection

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8 to 9 a.m. Thursday, March 29

Ohio Bureau of Workers' Compensation

Learning Objectives

- Summarize the OSHA 1910.147 Standard The Control of Hazardous Energy (Lock Out Tag Out)
- Define service and maintenance, and setting up per OSHA 1910.147(b)
- Explore the exception to paragraph (a)(2)(ii)- minor tool changes and adjustments, and other minor servicing activities
- Review 1910.147(f)(1) - testing or positioning of machines, equipment or components thereof...

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Agenda

- Scope and application
- Definitions
- Energy isolation devices
- Normal production operations (application)
- Energy-control procedures
- Alternate procedures - CPL 02-00-147
- Alternate procedure examples – time permitting
- Summary

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Scope

- Covers servicing and maintenance of machines when **unexpected** start-up or release of stored energy could cause injury

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1910.147(a)(1)(i)

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Exclusions

- Normal production operations (See Subpart O) and alternate procedures
- Work on cord and plug connected equipment provided that:
 - The hazards must be controlled solely by unplugging the equipment from its energy source;
 - The plug must be under the exclusive control of the employee performing the maintenance.
- Hot tap operations, under special conditions

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1910.147(a)(2)(ii) & (iii)

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Application

- Standard applies to control of energy during servicing and/or maintenance of machines and equipment.

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1910.147(a)(2)(i)

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Purpose

- Requires employers to:
 - Establish a program and procedures for affixing lockout hardware or tagout materials to energy isolating devices;
 - To otherwise disable machines and equipment to prevent unexpected energization, start-up or release of stored energy in order to prevent injury to employees.



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1910.147(a)(3)(i)

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Lockout/Tagout (LO/TO)

- The employer must use LO/TO to protect the employee from potentially dangerous effects of hazardous energy including:
 - Accidental start-ups;
 - Electric shock;
 - Disabling injuries and death.

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LOTO

- OSHA's statistics show that failure to control hazardous energy has resulted in:
 - 10% of serious industrial accidents;
 - 28,000 lost work days/year;
 - Loss of 120 lives/year.
- Remember: These accidents are a result of someone taking a short cut, or when the employee doesn't understand the hazards of the equipment or the job at hand, or from poor/improper procedures.

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Controlling Energy Sources

- Sources that require LO/TO:
 - Electrical;
 - Mechanical;
 - Pneumatic(air);
 - Hydraulic;
 - Fluids/gases;
 - Thermal;
 - Water under pressure;
 - Springs;
 - Gravity;
 - Others.

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Definitions

Servicing and/or maintenance

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

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1910.147(b)

Normal Production Operations

- If a servicing activity such as lubricating, cleaning or unjamming the equipment takes place during production, employees performing the servicing are covered by LO/TO when any of the following conditions occur:
 - The employee must either remove or bypass machine guards or other safety devices;
 - The employee places any part of his or her body into the point of operation or other pinch point;
 - The employee must place any part of his or her body into a danger zone associated with a machine or operating cycle.
- In the above situations, the equipment must be locked out.

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Normal Production Operations

- o Alternate procedures may also be used if the operation qualifies (discussed later).

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Definitions

Authorized employee

- o A person who locks or tags machines/equipment to perform servicing

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Definitions

Affected employee

- o One who is required to use machines/equipment on which servicing is performed under LO/TO or who must work in such an area
- o Does NOT perform servicing or maintenance on machines

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Definitions

Other employee

- o All employees who are or may be in an area where energy control procedures may be used

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Definitions

- o Lockout - the placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring the device and the equipment being controlled cannot be operated until the lockout device is removed

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Definitions

- o Lockout device - a device that uses a positive means such as a lock, to hold an energy isolating device in a safe position and prevent energization

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Definitions

- 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 to indicate the energy isolating device and equipment being controlled may not be operated until the tagout device is removed

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Definitions

- Energy isolating device - a mechanical device that physically prevents the transmission or release of energy
- This includes:
 - Disconnect switches;
 - Line valves;
 - Blocks;
 - Circuit breakers;
 - Must be designed as an EID.

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Definitions

- Equipment **not** considered isolating devices include:
 - Interlocks;
 - Light curtains;
 - Presence sensing mats;
 - Photo eyes;
 - E-stops;
 - Control circuit devices.

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Energy Isolation Devices

- Two types of isolating devices
 - Those capable of being locked out
 - Those **not** capable of being locked out
 - Must attach a danger tag to the equipment near the isolation device
- Whenever major replacement, repair, renovation or modification of machines is performed, and whenever new machines are installed, the energy isolating devices **must** be lockable.
- Any new machine or equipment purchased after Jan. 2, 1990 must be capable of being locked out.

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Why You Can't Just Lock Out the Push Button

- Another employee enters the motor controller (motor starter) enclosure and manually closes the relay.
- The push button malfunctions.
- There is a failure of a relay or motor controller (e.g., defective spring; welded contacts).

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Why You Can't Just Lock Out the Push Button (continued)

- For example, a machine jam occurs causing higher current in the motor circuit, resulting in the freeze-up of the controller relay contact parts because the current creates arcing, which in turn welds shut the relay's plunger-coil mechanism. This could be particularly hazardous if an employee is relying on control circuits to clear jams as the energized machine could start up and injure the employee.

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Why You Can't Just Lock Out the Push Button (continued)

- A loose wire contacts the conduit or enclosure.
- Two wires short out inside a damaged conduit (e.g., vibration causes wires to rub and wear through the wire's insulation resulting in an electric short and bridging of the control circuit).
- Water, dirt, metal particles or other conductive foreign debris enters the control circuit enclosure causing the switch to operate because the material sufficiently bridges and closes the circuit, allowing current flow.

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Why You Can't Just Lock Out the Push Button(continued)

- Ice, grease, dirt, wood, metal particles or other debris causes a push type control mechanism to stick in the closed position, allowing current to flow.
- Thus, OSHA has determined locking (and/or tagging) the push button for a control circuit is not as safe as the LO/TO of a power circuit energy isolating (disconnect) device.

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Commonly Cited Hazards

- Not locking equipment out
- Lack of employee training
- No or insufficient LO/TO procedures
 - Machine specific procedures
- No periodic inspections

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Requirements for LO/TO Devices

Whichever devices are used, they must be singularly identified (recognized as a LO/TO lock compared to others), must be the **ONLY** devices used for LO/TO and must meet the following requirements:

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Requirements for LO/TO Devices (continued)

- Standardized – Both LO/TO devices must be standardized according to either color, shape, or size;
- Tagout devices must also be standardized according to print and format;

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Requirements for LO/TO Devices (continued)

- Identifiable – Locks and tags must clearly identify the employee who applies them;
 - Tags must also warn against hazardous conditions if the machine is energized and must include a legend such as the following;
 - DO NOT START, DO NOT OPEN, DO NOT OPERATE, etc.

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Energy-Control Program (ECP)

- Consists of the following:
 - Documented energy control procedures;
 - Employee training program;
 - Periodic inspections of the procedures.

- Employers have the flexibility to develop a program that meets the needs of their particular workplace.

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ECP (continued)

- At a minimum, the ECP includes, but is not limited to the following:
 - A statement on how the procedure will be used;
 - The procedural steps needed to shut down, isolate, block, and secure machines or equipment;
 - ✓ The magnitude of each energy source (voltage, psi, etc.);
 - The steps designating safe placement, removal and transfer of LO/TO devices and who has responsibility for them;
 - The specific requirements for testing machines or equipment to determine and verify the effectiveness of locks, tags, and other energy control measures.

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ECP (continued)

- LO/TO procedures must include the following steps:
 - Preparation for shutdown – Notify affected employees;
 - Shut down the machine;
 - Isolate the energy sources;
 - ✓ Must physically locate and isolate them;
 - Attach locks/tags to the devices.

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ECP (continued)

- Eliminate stored energy hazards
 - All potentially hazards stored energy must be relieved, disconnected, restrained or otherwise rendered safe.
- Verify the isolation
 - The authorized person must verify that the isolation and de-energization has been accomplished.
 - Do this by clearing the equipment area.
 - Attempt to start the equipment.
 - Check for residual voltage in electrical components.
 - Verification steps **must** be spelled out exactly as they can differ greatly from machine to machine!

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ECP (continued)

- Release from LO/TO
 - Follow these steps when you release machinery from LO/TO after completing service.
 - Inspect the work area to ensure that all non-essential items have been removed and that the equipment components are operationally intact.
 - Ensure that all employees are safely positioned and that affected employees are notified that the LOTO devices have been removed.
 - Re-energize equipment.

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Testing of Machines

- When LO/TO devices must temporarily be removed for testing/positioning:
 - Clear machine of tools;
 - Remove employees, notify affected employees;
 - Remove LO/TO device;
 - Energize and test;
 - Notify affected employees, de-energize and re-apply energy control measures.

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1910.147(f)(1)

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Something Most Employers Do Not Think of Addressing

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Employers Must Assess Hazards of Electrical Workers

- Specifically as per Subpart S
- Generally as per PPE standards

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Group LO/TO

- When servicing and/or maintenance is performed by a crew, craft, department or other group, they shall use a procedure that affords the employees a level of protection equivalent to that provided by the implementation of a personal LO/TO device.

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Shift/Personnel Changes

- Specific procedures are needed to ensure continuity of lockout/tagout protection, including provision for the orderly transfer of lockout/tagout devices between off-going and oncoming employees.
- Other procedures may be followed as long as the employer can ensure the equipment cannot be started or re-energized between shifts.
 - i.e. Supervisory locks

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1910.147(f)(4) 40

Outside Personnel (Contractors)

- On-site employer and outside employer shall inform each other of their respective procedures.
- On-site employer shall ensure that his/her employees understand and comply with contractor's procedures.
- Employer must ensure that contractor's program is compliant if allowing them to use his/her program.
- Determine who will notify your affected employees.

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1910.147(f)(2)

Employee Training

- The employer **must** provide effective initial training and retraining as necessary, and **must** certify all employees covered by the standard have received such training.
- This certification must contain each employee's name and dates of training.
 - Include who gave the training and how long it lasted.
 - Also, develop an outline that portrays the details of the training program (agenda, lecture, video, handouts, etc.).

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Employee Training Authorized Employees

- The employer's training program for authorized employees must cover, at a minimum, the following areas:
 - Recognition of applicable hazardous energy sources;
 - Details about the type and magnitude of the hazardous energy sources present in their workplace;
 - The methods and means necessary to isolate and control those energy sources;
 - i.e. the elements of your ECP.

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Employee Training Affected/Other

- We group these two types together for training as the training is limited to awareness.
 - Ability to recognize when the LO/TO is being implemented
 - Understand the purpose of the procedure and the importance of NOT attempting to start up or use locked out equipment
 - Limitations of tagout only (if applicable).

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Periodic Inspections (PIs)

- PIs are performed to ensure the energy-control procedures are implemented properly and to show that **each** authorized employee is familiar with their responsibilities under those procedures.
- An authorized employee other than the one using the ECP being inspected shall perform the PI.

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PIs

- Must certify the PIs have been performed and must include the following:
 - Name of employee(s) being inspected;
 - Name of employee performing inspection;
 - Date of inspection;
 - Name of equipment which the inspection was performed on;
 - Other employees included in the inspection (overseeing);
 - When an employee is inspecting a tagout procedure, a review on the limitations of tags, in addition to the above, must also be included.

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Procedure Audit

- The employer must also audit the energy control procedures annually to determine compliance and to address any changes that did not surface throughout the year.
 - i.e. new equipment, modified equipment, new process, etc.

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Machine Specific Procedures (MSPs)

- Required for each piece of equipment that has **more than one** energy source
- Must detail all steps of LO/TO

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Sample MSP

- Open Mechanical Power Press Form

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Must You LO/TO to Zero Energy State?

- It depends.
- You only lockout the energy that the employee is exposed to during the servicing.

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Exception to LO/TO

- Servicing and maintenance activities are permitted without machine or equipment LO/TO pursuant to the *minor servicing exception*.
- §1910.147(a)(2)(ii) note: Minor servicing activities that take place during normal production operations and which are **routine, repetitive and integral** to the use of machine/equipment for production, are not covered by the LO/TO standard if alternative methods provide effective employee protection from hazards associated with the control of hazardous energy (e.g., unexpected start-up).

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What Is Considered Minor?

- This is not specifically defined in the standard nor the CPL, but examples are:
- Lubricating;
- Draining sumps;
- Servicing filters;
- Making simple adjustments;
- Inspecting for leaks and/or malfunction.

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What Is Minor?

- Does not include major disassembly
- Must be part of the production process
- Could likely be in an SOP
- Operation is likely included in the cycle

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Exception to LOTO

- The exception does not cover work performed **before** normal production operations.
- Adjustments made during set-up are not part of normal production as producing has not yet begun.
- The replacement of machine or equipment components such as belts, valves, gauges, etc. normally is not considered a routine maintenance function that can be safely accomplished when a machine or piece of equipment is operating.

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Task Creeping

- This occurs where an employee begins servicing one thing but then realizes other issues are present and begins to check them as well.
 - It is these other issues that may fall out of the minor servicing exception.

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Trap Key Systems

- Where a key is removed from a control station and used to unlock a guard/gate or other device

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Options In Lieu of LOTO

1. Guard the equipment to prevent employee exposure.
 - See Subpart O – machine guarding
 - Example
 - In going nip point exposure – guard the nip point to prevent exposure
2. Implement alternate procedures that are equally effective as locking out.
 - See compliance directive, case law and possibly interpretations for additional guidance.
3. Implement provisions in (f)(1) – testing/repositioning.

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Alternate Procedures

- Because these situations are addressed on a case-by-case basis due to numerous variables, there are no exact or black and white solutions to apply across the board.
- The employer must, at a minimum, perform a JHA/risk assessment on the process to determine hazards present, employee exposure and possible exposure, and means to control the hazards or prevent exposure.
 - Use ANSI B11.19 – 1990 protocol.

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Alternate Procedures (continued)

- To use alternate procedures, the employer must determine if the operation qualifies for use of alternate procedures.
- The activity must take place during, and is inherent to, normal production operations.
- These servicing activities must be necessary to allow production to proceed without interruption.
- Additionally...

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**Employer must
justify
applying the
exception!**

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The Activity Must be:

- A. Routine:** The activity must be performed as part of a regular and prescribed course of procedure and be performed in accordance with established practices;
- B. Repetitive:** The activity must be repeated regularly as part of the production process or cycle;
- C. Integral:** The activity must be inherent to the production process;
Must allow production to continue.

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Alternate Procedures

- The employer must also demonstrate the alternative measures provide effective protection from the hazardous energy.
- Most importantly, this exception applies only if each and every element of the exception is met.

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Alternate Procedures (continued)

- For the control measure to be considered an effective and properly applied technique, the selection and use of alternative method(s) must be based on **generally accepted good engineering practices** (e.g., applicable manufacturers' design, maintenance, inspection, testing and operation recommendations; prior operating experience; reliability data).

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Alternate Procedures (continued)

- To better illustrate effective alternative protection based on recognized good engineering practices, a circuit that meets the **control reliability and control-component-failure protection requirements ANSI B11.19-1990** would provide alternative safeguarding measures with respect to the minor servicing exception if these devices are under the **exclusive control** of the employee performing the minor servicing.

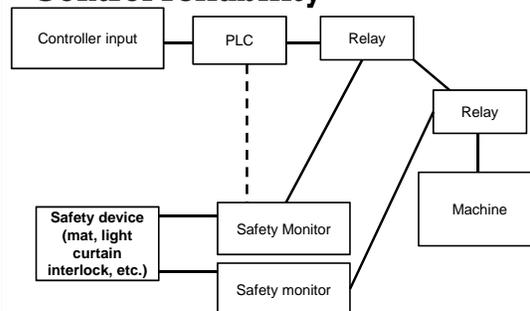
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Control reliability

- Redundancy, default to a safe state, self-monitoring
 - Safety related controls must be separate from the PLC system so as to not rely on the PLC to stop machine in case of in case of PLC failure or malfunction.
 - Monitors activities regardless of what the PLC is doing.
 - Cuts power or action outside of the PLC program.

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Control reliability



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Control reliability

- o It is important to apply this safeguard through a hazard-analysis process on a case-by-case basis to ensure that it provides equivalent and effective employee protection.

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Exclusive Control

- o Exclusive control of the employee means:
 - The authorized employee has the authority to and is **continuously** in a position to prevent (exclude) other individuals from re-energizing the machine or equipment during the servicing or maintenance activity.

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Injury History

- o If an employer has an injury associated with machine movement during the minor servicing, then the protocol developed for the servicing would not be considered effective, and therefore citable.

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Burden of proof

- o The employer has the burden of proving his/her procedure is effective.
- o However, if a CSHO, with investigation, can show that a possibility of injury exists with the current protocol, then the procedure would be considered unacceptable.
 - For this to occur, the energy present has to be demonstrated as **hazardous**.

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Examples of exceptions

- o Tool changes and adjustments such as changing a mixing blade on a vertical mixer or a drill bit on a single-spindle drill press are permitted to be performed without LO/TO if the machine's electrical disconnects or control (e.g., on/off buttons or emergency stops) switches.
 1. Properly designed and applied in accordance with recognized and good engineering practice
 2. Control all the hazardous energy and are placed in an off position
 3. Under the exclusive control of the employee performing the task

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- o A simple task on an automatic chucking machine, for example, may involve adjusting coolant flow or the resetting the tool holder to a position that would result in a dimensionally accurate finished work piece.
- o In these and other similar cases where the employee must negate the effectiveness of the safeguards or otherwise expose himself to the hazardous energy, the machine operator would need to shut off the switch and have **exclusive control** of the on/off switch or local disconnect switch.

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Blow mold

- Blow mold machine operators perform minor un-jamming tasks, during normal production operations, at the machine's trimmer unit on a routine and repetitive basis to remove stuck plastic containers.

This operator shuts the machines off with the control circuit switch (stop button) and she opens an interlocked plexi-glass barrier guard to gain access to the trimmer's point-of-operation area.

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Blow mold (continued)

- The employer uses a guard system, designed by the manufacturer **in accordance with recognized and generally accepted good engineering practices**, that causes the mechanical interlock switch to break the electric circuit when the guard is moved for employee access purposes and shuts down the machine.

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Blow mold (continued)

Within the context of the minor servicing exception, the described and properly applied interlocked plexi-glass guard system, together with the **operator's exclusive control** of the control circuit devices, constitute alternative measures, which constitute effective protection.

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Plastic Injection Molding

- The removal of a part that is stuck (jammed) in a plastic injection molding machine may not require de-energization and LO/TO of the entire machine. Once the machine has completed a cycle and is shut-off (using the stop push button), opening the interlocked sliding operator gate guard prevents the machine from cycling until the operator repositions the guard and intentionally starts up the machine. Similarly, when an operator stops a machine by using the stop/start controller, the use of interlocked movable guards, which prevent activation of the machine while the guard is not in place, provides effective alternative protection as long as:

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Plastic Injection Molding (continued)

- 1. The employee is positioned such that the interlock operator-gate and rear-gate guards provide the employee(s) with sufficient protection (e.g., an interlock gate guard is not adequate protection if the employee's entire body is inside the guard area);

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Plastic Injection Molding (continued)

- 2. Injection molding machine safety systems are designed, inspected, tested, maintained, and operated in accordance with recognized and generally accepted good engineering practices (e.g., per the manufacturer's instruction);

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Plastic Injection Molding (continued)

- o 3. Means of control of the machine remain in the exclusive control of the person afforded the protection.
- o These precautions are necessary to ensure that the gate guards do not accidentally close causing the machine to start-up while the employee is inside the machine and to ensure that no other person can restart the machine without the knowledge and consent of the person performing the minor servicing.

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Plastic Injection Molding (continued)

- o Alternatively, LO/TO would be required if the stuck part or other condition creates a situation where each and every element of the minor servicing exception cannot be met.

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Plastic Injection Molding (continued)

- o For example, a mold may open too soon or a stuck plastic part may melt or the part may become stuck such that LO/TO is required because other-than minor cleaning (e.g., prying, pulling, scrapping, and/or chipping) or even machine component (e.g., die) disassembly, must be performed. These types of activities are not minor in nature.

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LO/TO Summary

- o Survey the workplace for all equipment which may be subjected to LOTO.
- o Develop an ECP for each piece of equipment.
- o Develop a training program for authorized, affected, and other employees.
- o Re-train as required.
- o Document the ECP and all related training.
- o JHAs on alternate protection situations.

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Questions?

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