Lockout and Tagout Awareness

Control of hazardous energy

References

- CAN / CSA - Z460-13: Control of hazardous energy – Lockout and other methods
  - A National Standard of Canada
- Bill C – 45: Westray Bill
  - Canadian Criminal Code

Overview

Performing tasks (maintenance, inspections or related activities) on a machine, equipment, or a process may expose a worker to risk if there were to be an unexpected release of:

- Hazardous energy
- Mechanical movement, or
- Material flow to equipment or a process

Identifying and controlling such potential inadvertent release(s) is imperative to protect personnel from exposure to risk and / or injury

Overview

The most common, and recognized, form of energy used in workplaces is electrical energy

- It can be available through live power lines, or
- It can also be stored, for example, in batteries or capacitors

Overview

Electrical energy can harm people in one of three ways:

1. By electrical shock
2. By secondary injury, or
3. By exposure to an electrical arc (arc flash)

However, often, other forms of hazardous energy is overlooked or not recognized all together

Can you name a few?

Statistics

The release of uncontrolled hazardous energy causes thousands of injuries each year

In the food manufacturing industry alone workers experienced injury or illness at rate of 5.4% compared to 3.4% in the private sector

According to OHSA, the number of Lockout and Tagout (LOTO) fatalities each year range between 150 and 200

The number of Lockout and Tagout (LOTO) accidents per year average 60,000

Statistics

Each year, approximately 3,000 workers suffer lost-time injuries from being:

- Caught in dangerous parts of equipment or machinery
- During maintenance, or
- Even during cleaning

Further, each year there are approximately 60 fatalities

OSHA states that Lockout and Tagout is the most frequently cited violation with penalties totaling over $894000

Statistics

In addition to caught-in exposure, workers:

- Face struck-by
- Crushing
- Electric shock
- Burns, and
- Other hazards when work is done without properly controlling the release of hazardous energy

Statistics

These ‘Fatal 5’ are the causes of Lockout and Tagout preventable injuries

1. Failure to stop equipment
2. Failure to disconnect from the power source
3. Failure to drain residual energy
4. Accidental restart of machinery
5. Failure to clear work areas before restarting

Statistics

Some ways to avoid any incident and / or accident is to:

- Act in compliance with OHSA regulations
  - Only qualified and certified electricians to perform electrical work
- Adopt, implement and follow a Hazardous energy control program, and
- Train all individuals on basic hazardous energy control concepts

Statistics

OSHA has estimated that its Lockout and Tagout standard prevents 85% of the total number of injuries or fatalities from exposure to hazardous energy in the workplace

It is estimate that approximately

- 31,900 minor (non-lost time) injuries
- 28,400 lost time injuries, and
- 122 fatalities per year are prevented by the standard

Disclaimer

This ***Awareness*** training shall not replace, or constitute, workplace specific training in managing hazardous energy

This module is only a component in the recognition, management and control of hazardous energy

If you are required to participate in a hazardous control program you may need additional, employer (user), site specific training

Important note:

This module does not provide any awareness regarding the legislated requirements for the control of hazardous energy with respect to Confined Spaces

(Ontario Regulation 632 / 05)

Learner Objectives

- Understand and explain what hazardous energy is
- Describe types of hazardous energy
- Assess the risk involved in working on a machine, equipment and / or process
  - Task and hazard identification

Learner Objectives

- Understand what:
  - A Hazardous Energy Control Program is
  - The required training, and
  - The need to reduce injuries related to the unexpected release of stored energy
- Identify some types of Lockout devices and their uses

Is Lockout and Hazardous Energy Control the same thing?

The terms lockout and hazardous energy control are sometimes used interchangeably, but they are **NOT** the same thing

Hazardous energy control is a broad term describing the use of:

- Procedures
- Techniques, and
- Designs and methods, to
- Protect personnel from injury due to the inadvertent release of hazardous energy

Is Lockout and Hazardous Energy Control the same thing?

Lockout is the placement of a lock or tag on an energy-isolating device in accordance with an established procedure

- It indicates that the energy-isolating device is not to be operated until removal of the lock or tag, and
- Therefore, lockout is **one** way in which hazardous energy control can be achieved.

It’s more than just Lockout and Tagout

Employers must identify all machines, equipment and / or process(es) that have:

- The potential for hazardous energy release
- Implement mitigating controls, and execute a
- Hazardous Energy Control Program
  - Lockout and Tagout

Also, employers must re-evaluate new machines, equipment and / or process(es) that are introduced in the workplace

It’s more than just Lockout and Tagout

The Hazardous Energy Control Program should be:

- Comprehensive, and
- Diligently planned which includes, but not limited to:
  - Definitions
  - User responsibilities
  - Design of machines, equipment and processes
  - Task and Hazard identification
  - Hazardous energy control program (itself)
  - Training
  - Periodic review (Documentation)
    - Management of Change* (MOC)

Definitions

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 Individual (Qualified)

- A person who is qualified to engage in hazardous energy control because of knowledge, training, and experience (competent) and has been assigned to engage in such control

De-energized

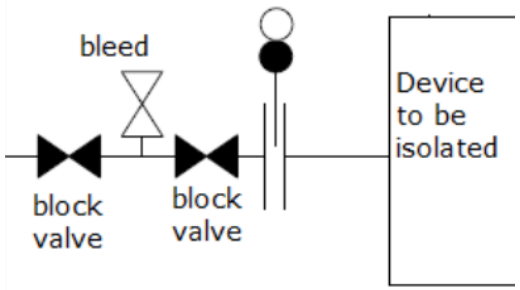
- Disconnected from all energy sources and not containing residual or stored energy

Definitions

Energy Isolation Device

- A mechanical device that physically prevents the transmission or release of energy, example:
  - Manually operated electrical circuit breaker, or disconnect switch
  - Master switch (equipment)
    - Push button selector switches and other control type devices are not energy isolating devices
  - Blank, or double block and bleed

Note: Consult O. Reg 632 for Confined Space isolation requirements



Definitions

Equipment

Any machine driven by electricity or any other prime mover and / or combination of machines that operate as a system / process

Guard

- A physical barrier that prevents access to areas of a machine, equipment, or a process where a hazard exists

Hazard

- A potential source of harm to personnel

Definitions

Information tag (Tagout and Lockout)

- A warning means and a means of attachment used in conjunction with the application of a Lockout device to an energy isolating device
- Usually indicates the nature, purpose, and time of the application of the Lockout, as well as the identify of the authorized individual who performed the Lockout

Isolate

- To introduce any number of approved physical barriers between the equipment and all sources of forms of hazardous energy

Lockout

- The placement of a lockout device, or other energy isolation device, to prevent the operation of the machine, equipment or process, in accordance with an established procedure, until the device is removed, or deemed inoperable

Definitions

Lockout Device

- A mechanical means of locking that uses an individually keyed lock to secure an energy isolation device in a position that prevents the energizing of the machine, equipment or process

Risk

- The chance that a person could be harmed by a hazard
  - Risk = Likelihood x Severity

Risk Assessment

- A comprehensive evaluation of the probability and degree of possible injury or damage to health in a hazardous situation, undertaken to select appropriate safeguards

Definitions

Servicing and / or maintenance

- Workplace activities, work, or task(s) where an individual may be exposed to the unexpected energization, startup, release of hazardous energy of such machine, equipment or process

User

- An individual, company, or organization that purchases, leases, or uses machines and equipment is responsible for the personnel associated with hazardous energy control.

Zero Energy State

- An energy level that is not harmful to any individual. A state where all hazardous energy has been isolated and de-energized, or otherwise controlled to manage risk

Hazardous Energy

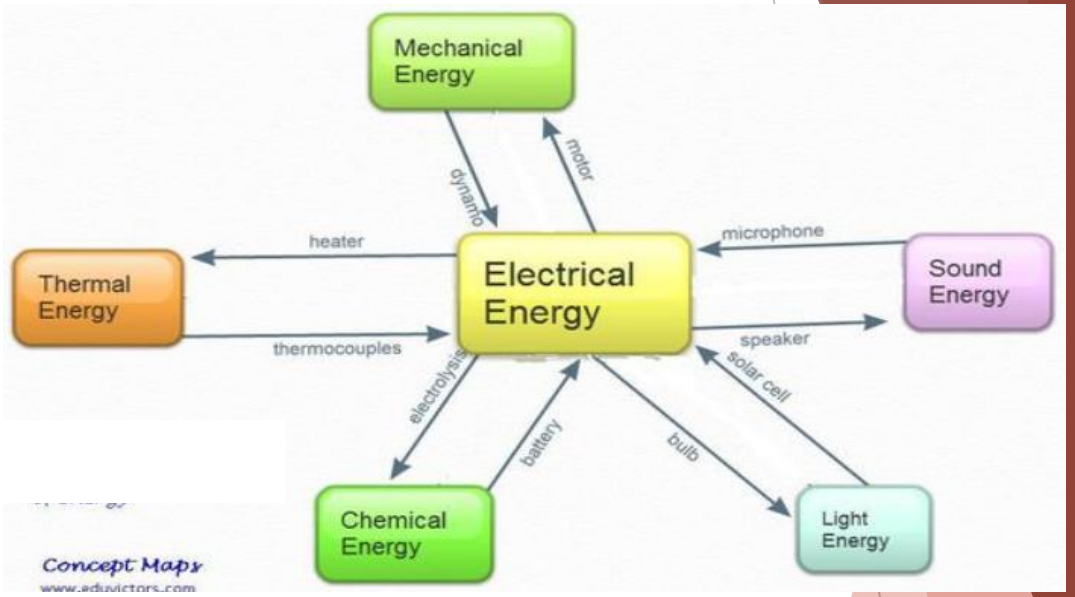
Hazardous Energy

Some energy sources are obvious:

- Such as electricity,
- Heat in a furnace,
- Or something that might fall

Others may be hidden hazards such as:

- Air pressure in a system, or
- A tightly wound spring



Law of conservation of energy

The term energy refers to anything that can provide power to a system to allow it to perform work

The term system refers to machinery, equipment, and/or processes

Hazardous Energy

What is '**Hazardous Energy***'?

- Is defined as not only as an **Electrical** source; but can also include, and not limited too:
  - Mechanical
  - Hydraulic or water
  - Pneumatic (Air or gas under pressure)
  - Chemical
  - Radioactive or Nuclear energy
  - Thermal (Steam vapor, convection, conduction)
  - Gravitational potential (Stored), or
  - Other energy that can harm personnel (Residual, back pressure)

Some energy sources are obvious, others may be hidden hazards (spring) that can harm personnel

*As defined by CSA Z460 – 13 Control of hazardous energy – Lockout and other materials

Date of Incident: November 2017
Location: Northern Region
Posted: January 4, 2018

A worker was electrocuted while changing a bulb, resulting in fatal injuries.

Resources:

- Electrical Hazards (Ministry of Labour)
- Electrical Hazards (Workplace Safety & Prevention Services)
- Electrical Hazards (Infrastructure Health & Safety Association)

Hazardous Energy

Electrical Energy:

- Current Electricity
  - Is the most common (accumulation or motion of numbers of elec
  - Can be available through live power lines
  - Occupational Health and Safety – Encroachment
    - Construction (O. Reg 213)
    - Mining (O. Reg 854)
    - Industrial (O. Reg 851)

Examples:

- Hydro and Solar
- Static Electricity (Friction between objects)
- Electrostatics (Magnetic fields)
- Electrical Potential* Energy (Circuit boards, defibrillators, capacitors)

Item	Column 1 Nominal phase-to-phase voltage rating	Column 2 Minimum distance
1.	750 or more volts, but no more than 150,000 volts	3 m – 10 ft
2.	more than 150,000 volts, but no more than 250,000 volts	4.5 m – 15 ft
3.	more than 250,000 volts	6 m – 20 ft

Date of Incident: March 2018
Location: Central East
Posted: July 6, 2018

A worker was clearing material from a machine when part of the machine moved resulting in fatal injuries.

Resources:

- Machine Guarding / Safeguarding / Lockout
- Machine Guarding

*When the term potential is associated in conjunction with a type of hazardous energy it should be with the understanding this is equivalent to residual and / or stored energy

Hazardous Energy

Mechanical Energy:

Is the energy transferred by means of a force on an object through a distance, or an object in motion.

Is contained in:

- An item under tension, or compression
- Can be either Potential energy (stored energy), or
- Kinetic energy (energy of motion), or
- Sum of kinetic energy to a system to perform work

Examples:

- Elasticity of a material
- A spring that is compressed, or coiled will have stored energy which will be released in the form of movement when the spring expands
- Windmills, watermills

Date of Incident: July 2017
Location: Central East Region
Posted: August 25, 2017

A worker was fatally injured after being caught in a manufacturing machine.

Resources:

- Heavy Equipment
- Construction Health and Safety Manual
- Machine Guarding/Safeguarding/Lock Out

Hazardous Energy

Hydraulic Energy:

- Is energy stored within a pressurized fluid

When under pressure, the fluid can be used to move:

- Heavy objects,
- Machinery, or equipment

When Hydraulic energy is released in an uncontrolled manner, individuals may be:

- Crushed or struck by moving machinery, equipment or other items.

Date of Incident: February 2017
Location: Central East Region
Posted: May 12, 2017

A worker was fatally injured when their clothing became entangled while working on a machine.

Resources:

- Machine Guarding/Safe Guarding/Lockout
- Machine Guarding

Hazardous Energy

Hydraulic Energy:

Examples:

- Automotive car lifts (Lift cylinders)
- Hydraulic lines, pumps, and accumulators on mobile equipment
    - Never look for hydraulic leaks using your hands or body, use cardboard
- Power presses, and
- The braking system in cars

Date of Incident: March 2016
Location: Western Region
Posted: March 24, 2016

Individual was performing mechanical work under a vehicle. Vehicle fell off of supporting blocks. Individual later succumbed to injuries.

Resources:

- Safety Around Heavy Equipment

Hazardous Energy

Pneumatic Energy:

- Is the energy produced from compressing air, or gas, within a closed system
- Pressure is a result of compression
  - Can be relatively static (surge tanks, accumulators), or
  - In motion through tubing or hoses
- Compressors create much higher pressure the blowers and fans
  - Can range from 1 to 1000 psi(g)

Date of Incident: January 2017
Location: Central East Region
Posted: February 2, 2017

A worker was fatally injured while cleaning a concrete mixing machine.

Resources:

- Machine Guarding/Safeguarding/Lockout
- Concrete Finishers Health & Safety Manual (PDF)

Hazardous Energy

Date of Incident: August 2016
Location: Eastern Region
Posted: October 15, 2016

A worker sustained injuries while using a compressed air nail gun. The worker later succumbed to injuries.

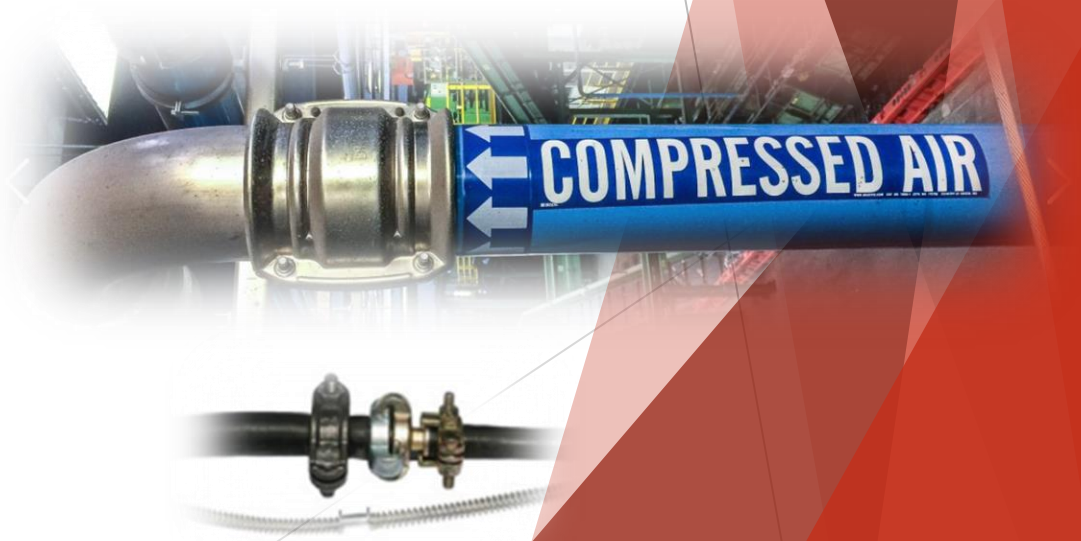
Resources:

- Nail Gun Safety: How to tame this deadly hazard
- Nail Gun Safety
- Struck-by Hazards

Pneumatic Energy:

Examples:

- Air or gases under pressure* (Nail gun, spraying devices)
- Compressors, pipes, tanks, cylinders and vessels
- Vacuum pumps
- Power washers, or
- Machinery



*Pressurized lines can pose many hazards, example, Air Embolism

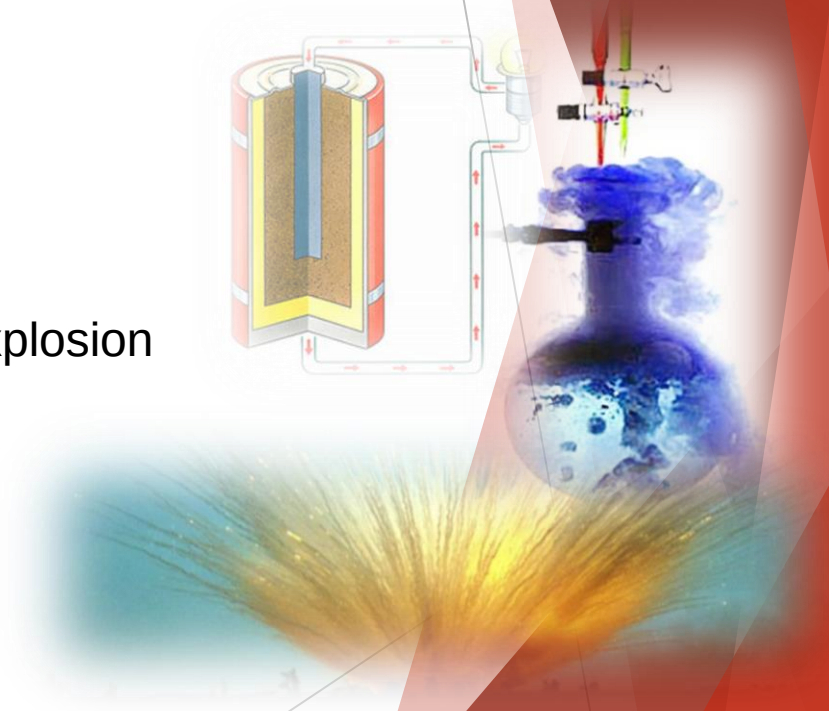
Hazardous Energy

Chemical Energy:

- Is a form of potential energy
- Is the energy released when a substance undergoes a chemical reaction

Energy is normally released as:

- Heat, but
- Could be released in other forms, such as:
  - Pressure (vapor pressure)
- A common result of a hazardous chemical reaction is fire or explosion

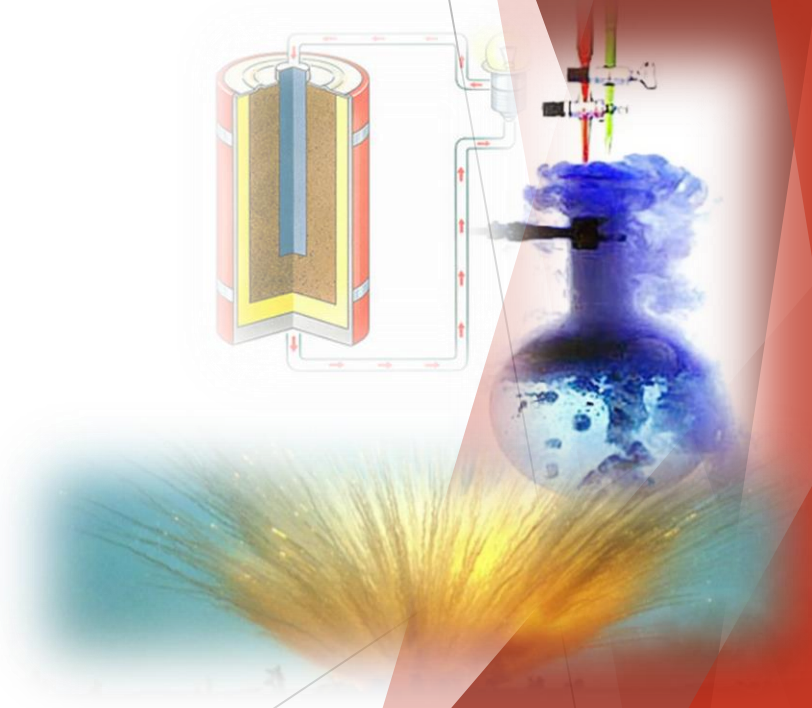


Hazardous Energy

Chemical Energy:

Examples:

- Wood
- Chemical batteries
- Air bags
- Baking soda and vinegar
- Ammonia and bleach (Toxic vapors)



Hazardous Energy

Radioactive or Nuclear energy:

Is energy related to:

- Ionizing (X-rays)
- Low-frequency electromagnetics
- Optical, or
- Radio-frequency electromagnetic radiation

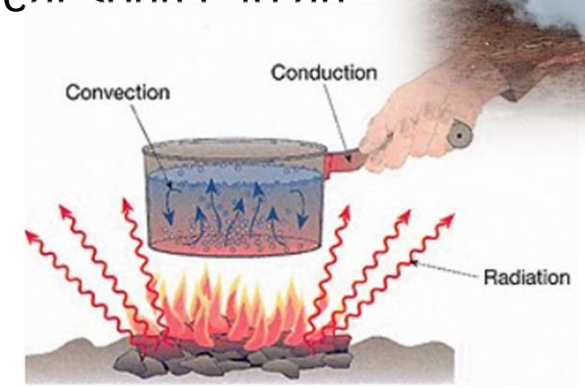
Examples:

- Sun exposure (Nuclear fusion)
- Burns
- Medical imaging
- Magnetic motor generators (magnets)
- Density measurements

Hazardous Energy

Thermal Energy:

- Is energy from an explosion
- Flame
  - Result of wood releasing stored energy into thermal
- Objects with high or low temperatures, or
- Radiation from heat sources
- Occurs when energy is transferred from a heat source to an object or body
  - Principles of Thermodynamics

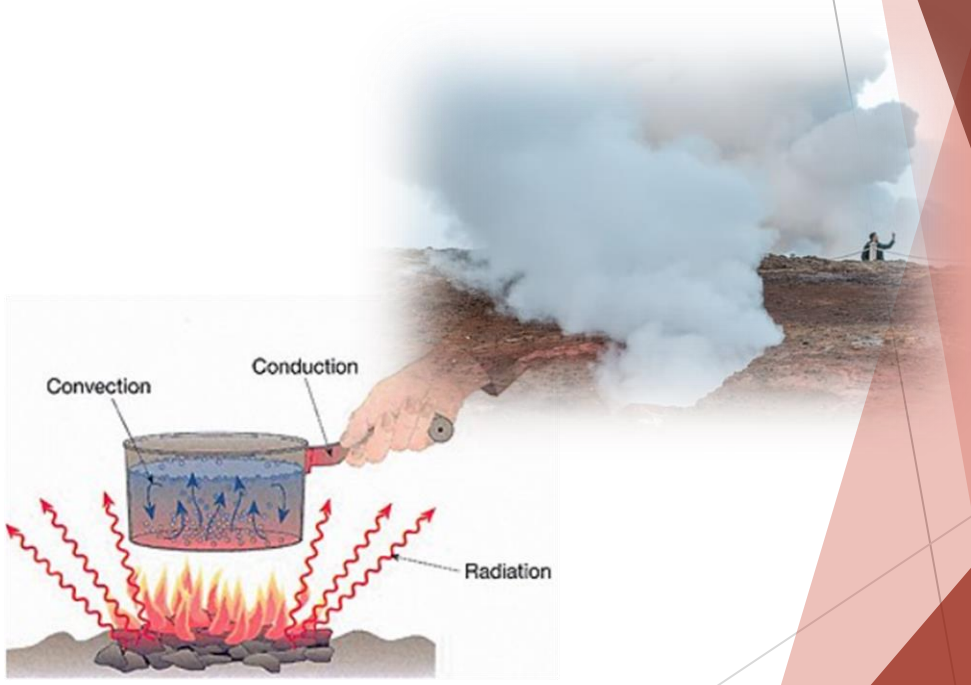


Hazardous Energy

Thermal Energy:

Examples:

- Boiling liquids or other matter
  - Steam (Vapor Pressure)
  - Radiator coolant
  - Exhaust systems
- Sun exposure



Hazardous Energy

Date of Incident: May 2017
Location: Northern Region
Posted: August 25, 2017

While cutting trees, an individual was fatally injured when a tree fell.

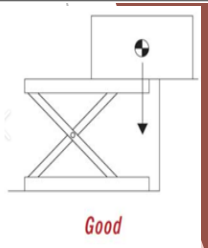
Resources:

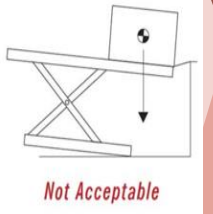
- Struck By Hazards
- Arborist Industry: Safe Work Practices (PDF)

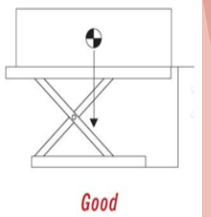
Gravitational Potential Energy:

Is the potential energy related:

- To the mass of an object and its distance from the earth (or ground)
- Is the potential energy associated with the gravitational field (stored or residual energy), which is released (converted into kinetic energy) when the object falls
  - When stored or residual energy is determined to be a hazard, a means for non-hazardous dissipation or safe restraint of the energy shall be incorporated into the machine, equipment or process
  - Devices used for dissipating stored energy shall be designed with a means or method of verifying their position and state
- The heavier an object is, and the further it is from the ground, the greater its gravitational potential energy







Examples:

- Object raised to a height
- Water behind a dam
- Vehicle parked on a grade

Hazardous Energy

It is important to understand that all these energy types can be considered as either:

- The primary source
  - That is used to perform work, or
- The stored / residual energy
  - Energy within the system that is not being used

When present, this energy could cause a circuit to energize, or a machine, machine part to move inadvertently or fall, causing injury to a worker

Understand, at times, traditional Lockout and Tagout of hazardous energy is not always practical in all situations, or attainable; other hazardous energy control methods shall be used

Hazardous Energy

Other hazardous energy control options are, but not limited to:

- Engineered safeguards (Guards, pressure mats or safety rated switches)
- Warning and alerting techniques (Attendant, barricades, signs or placards)
- Safe work procedures (Illumination, preparation for work)
- Administrative controls (Training)
- Personal protective equipment

Task and Hazard Identification

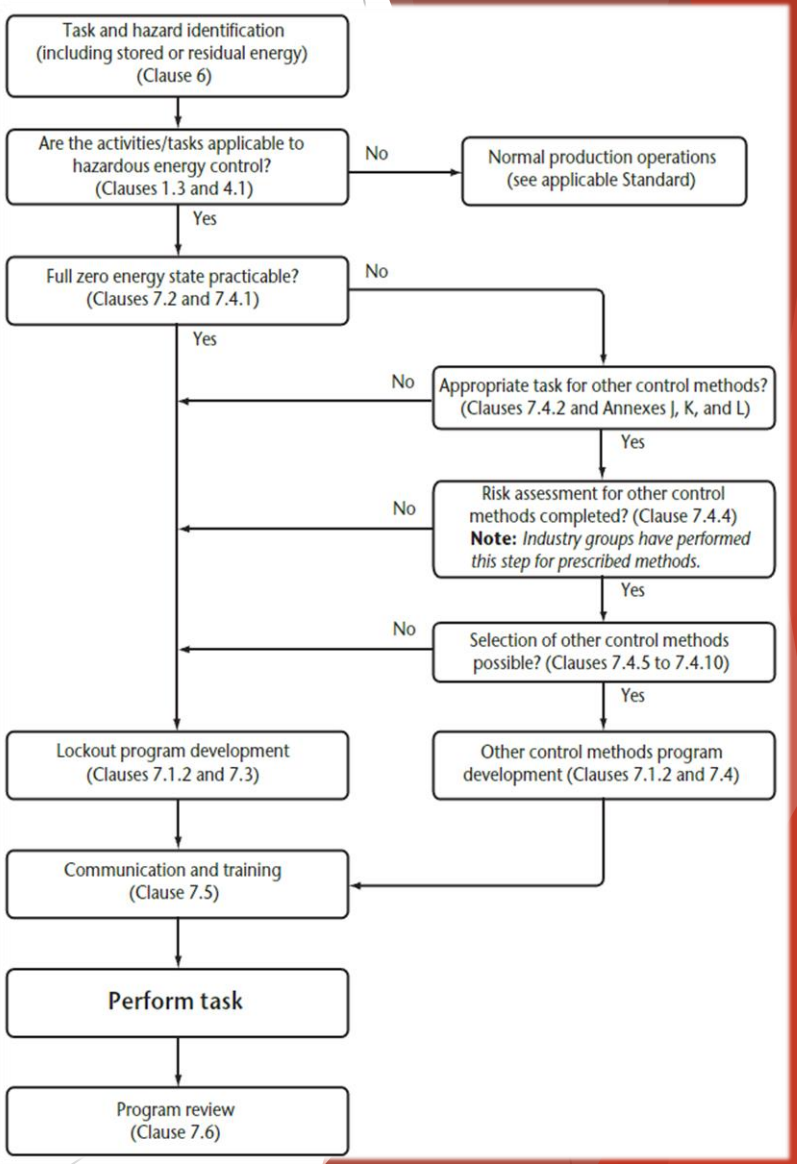
Task and Hazard (Identification)

Other parts of hazardous energy control that causes confusion is:

- Untrained, or lack of training, for workers associated to task performance, and
- Not recognizing all sources of energy

So how can sources of hazardous energy be identified?

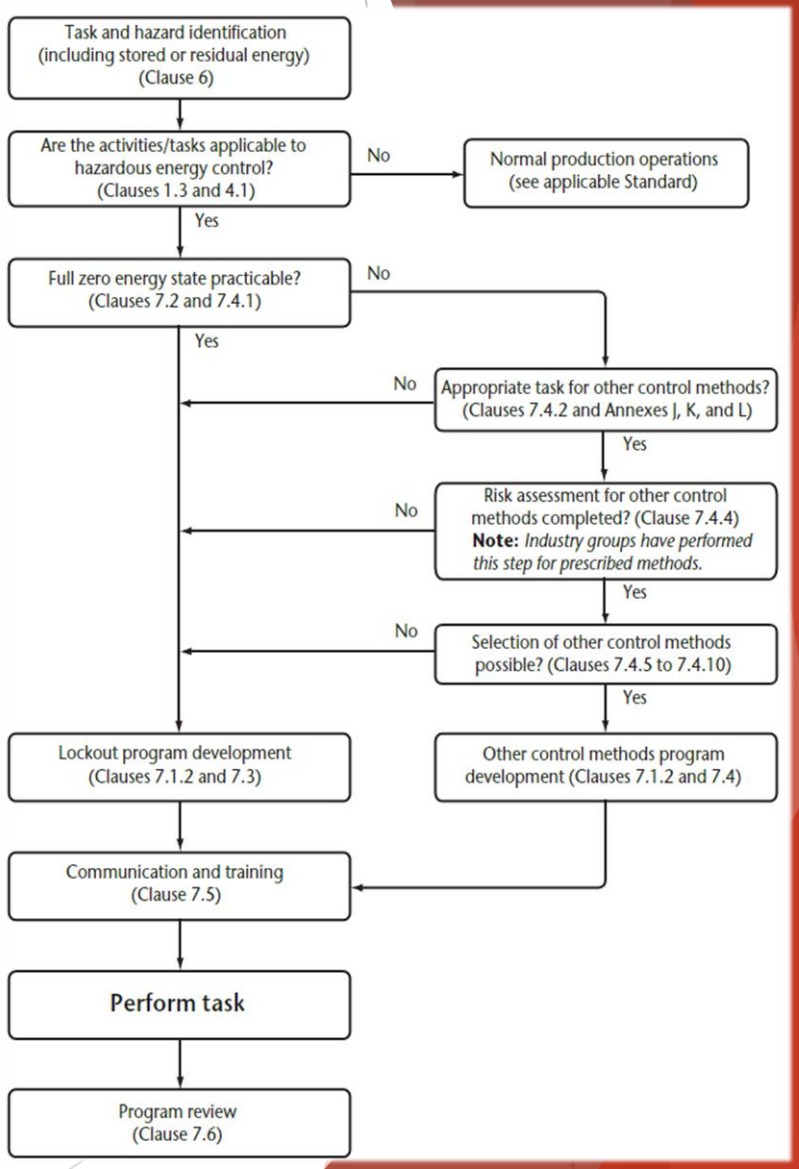
- Perform a Task and Hazard Assessment



Task and Hazard (Identification)

What is a Task and Hazard Assessment?

- The essential first step in developing a hazardous control program for:
  - Machines,
  - Equipment, and
  - Processes
- Is a systematic approach in identifying all possible hazardous situations involving:
  - The task(s) to be performed
  - Hazards associated with the task(s), and
  - How they can lead to harm



Task and Hazard (Identification)

What is a Task and Hazard Assessment

- The process assumes that:
  - An existing hazard will sooner or later lead to harm, if
  - Measures are not taken to eliminate or protect against it
- Only when hazards are identified:
  - Can steps be developed to eliminate or reduce the risk(s) associated to them

Task and Hazard (Identification)

What is a Task and Hazard Assessment

- Is as approach for hazard identification and risk assessment involving a team consisting of, but not limited to:
  - Operators
  - Maintenance
  - Engineering
  - Supervisors (Managers), and
  - Safety

Task and Hazard (Identification)

Task and Hazard Identification steps include:

- Task identification
- Hazard identification
- Risk assessment, and
- Documentation

Task and Hazard (Identification)

First step: Task Identification Should take into account the following (but not limited to):

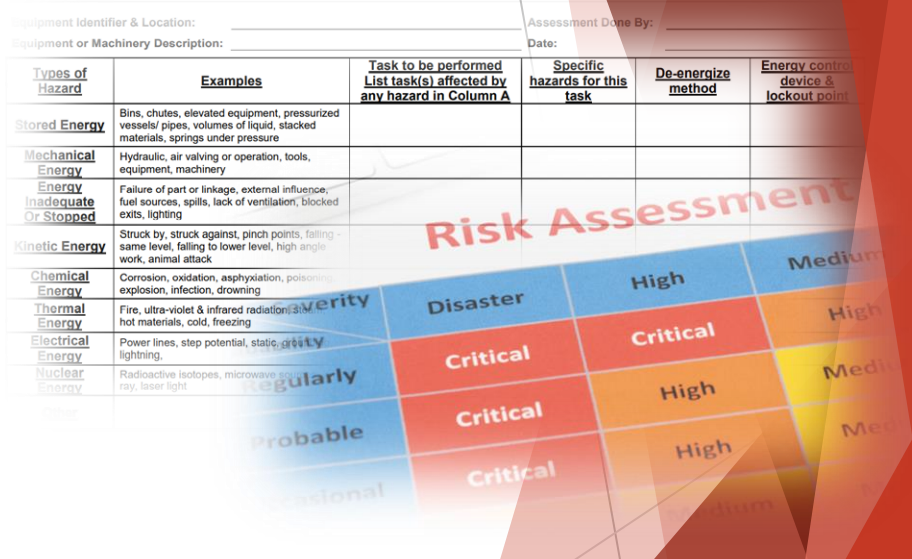
- The machine, equipment and process
- Training (Teaching and programming)
- Modes of operation
- Product input and output
- Normal and abnormal operation
- Emergencies
- Troubleshooting
- Cleaning and housekeeping
- Maintenance and repair

Task and Hazard (Identification)

Second step: Hazard Identification

Following the task Identification step all:

- Hazards
- Hazardous situations, and
- Possible Hazardous events associated with the task shall be identified; example,
  - Mechanical (Sharp edges, high pressure, stability)
  - Electrical Arc (Encroachments, live parts, short circuit)
  - Noise (Scraping of surfaces, exhausting system)
  - Materials and substances (Aerosols, dust, flammable material)
- In addition, reasonably foreseeable hazards, hazardous situations, or hazardous events not directly related to the task(s) shall be identified, example,
  - Lightning
  - Environmental conditions, snow, temperature, humidity



Task and Hazard (Identification)

Second step: Hazard Identification

Note:

Where a risk assessment exists and identifies the need for hazardous energy control procedures, this assessment can be used as the basis for the hazardous energy control procedure

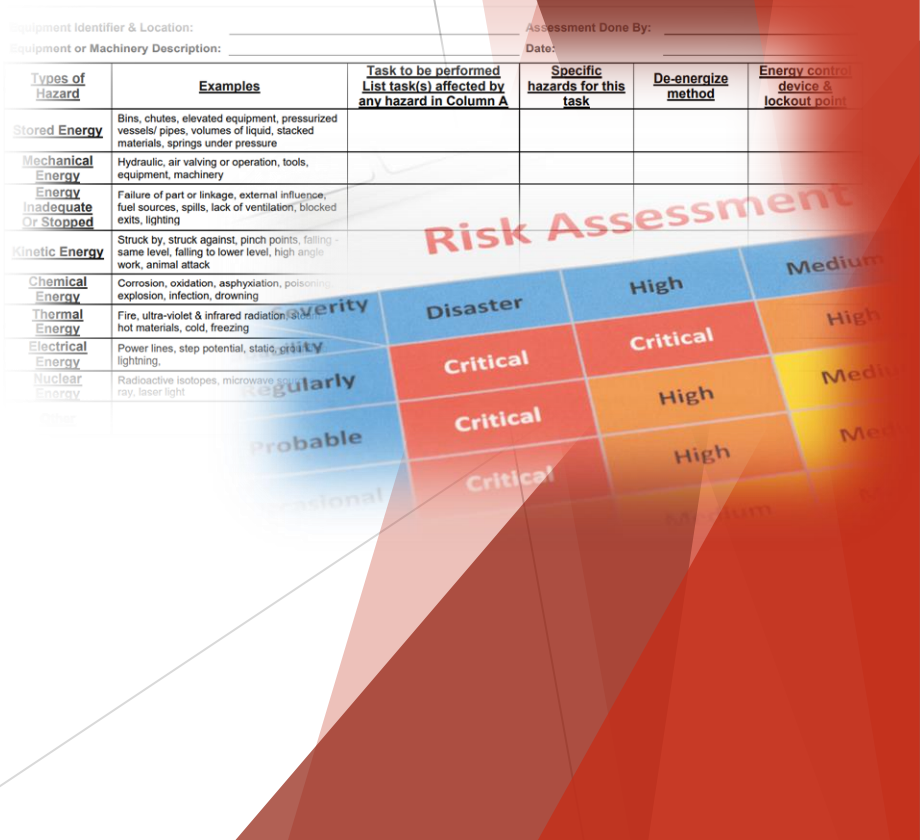
If no risk assessment exists and other hazardous energy control measures are employed, than a complete risk assessment shall be conducted

Risk assessment consists of:

- Risk estimation and evaluation
  - The severity of harm that can result from considered hazard, and
  - The likelihood of occurrence of that harm, were likelihood depends on

Were the likelihood depends on:

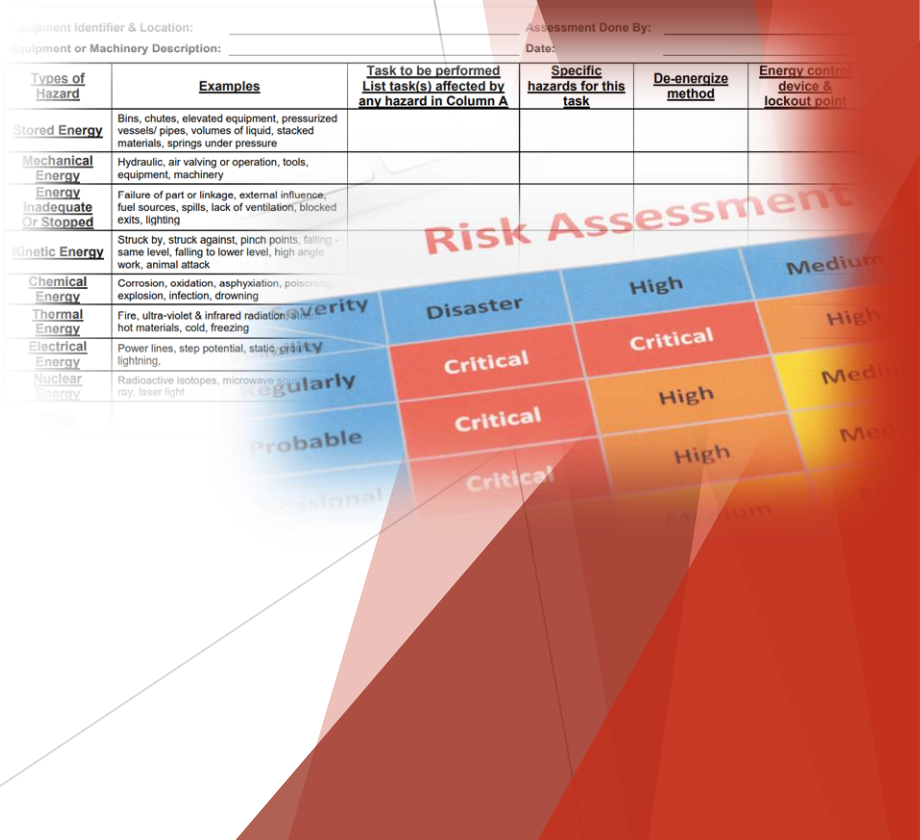
- The frequency and duration
- Possibility of avoiding or limiting the harm, and
- Risk evaluation
  - Determine whether risk reduction is required, or
  - Effective risk reduction has been effectively reduced or achieved



Task and Hazard (Identification)

Final step: Documentation

- A record of each task and its associated hazards should be kept and made available, with
  - The objective of making the record a useful tool (Resource)
  - Providing both a management record, and a source of information for managers and workers



Control Program

Control Program (Purpose)

What is the purpose of a hazardous energy control program?

In most cases, a machine, equipment or process will have safety devices built in

These safety devices include, but not limited to are:

- Programable logic (Interlocks, sensors)
- Railing or guard rails
- Barrier guards, and
- Safeguarding devices to help protect workers during normal operations

Control Program (Purpose)

What is the purpose of a hazardous energy control program?

However, during maintenance or repairs, these devices may have to be removed or by-passed

- In these situations, a hazardous energy control program is needed

A hazardous energy control program is used to maintain worker safety by preventing

- Unintended release of stored energy
- Unintended start-up
- Unintended motion, and
- Contact with a hazard when guards are removed or safety devices have been by-passed or removed.
    - Often referred to as a “Running Repair”

Control Program (Purpose)

What is the purpose of a hazardous energy control program?

The purpose

Is to ensure that:

- Workers have a safe work environment and are able to follow applicable safety procedures without faltering
- Risk of exposure to hazards will be eliminated or minimized before any authorized individual performs any activity specified on a:
  - Machine
  - Equipment,
  - or process
- Where the unexpected:
  - Energizing
  - Start up, or
  - Release of stored energy could occur and cause injury
- Shall include:
  - Documented task and hazard identification prior to specification of Lockout procedures, and
  - A risk assessment prior to specification of other control methods

Control Program (Purpose)

Each party in the workplace has a responsibility in the Lockout and Tagout program, in general:

Management:

Is responsible for:

- Drafting, periodically reviewing, and updating the documented program
- Identifying the individuals, machines, equipment and processes included in the program
- Providing the necessary protective equipment, hardware and appliances, and
- Monitoring and measuring conformance with the program

Supervision:

Is responsible for:

- Distributing protective equipment, hardware, any appliances and ensuring its proper use by individuals
- Making sure that equipment specific procedures are established for the machines, equipment and processes
- Making sure that only properly trained individuals perform work / tasks that require Lockout, and
- Making sure that individuals under their supervision follow the established Lockout procedures

Control Program (Purpose)

Each party in the workplace has a responsibility in the Lockout and Tagout program, in general:

Authorized individuals:

Are responsible for:

- Following the established procedures, and
- Reporting any problems associated with:
  - Those procedures
  - The equipment, or
  - The process of locking and tagging out.

Control Program (Purpose)

Lockout Program:

Purpose is to:

- Ensure that risk of exposure to hazards will be eliminated or minimized before any authorized individual performs any activity or work

The user shall establish a documented program for hazardous energy control that incorporates, and not limited to:

- Lockable and securable energy isolating devices (capable of being locked), or
- When energy isolating devices are not capable of being locked out, they shall be secured in an effective isolating position using a means that prevents the inadvertent operation of the device and tagged using and information tag
- Whenever an energy isolating device is used that is not capable of being locked out, the means of securing that device shall be specified in the Lockout program

Control Program (Purpose)

Lockout Program:

Lockout is a systematic program and is the primary method of hazardous energy control and shall consist of, but not limited to:

- List of required energy isolating devices
- Documented Lockout procedures, including
  - Identification of a machine, equipment or process
  - Steps for shut down, isolating, blocking, securing, and relieving stored or residual energy, and start up
  - Validation (Accuracy, completeness and effectiveness)
  - Management of Change* (MOC)
  - Approval of procedures
  - Lockout device application and location
  - Verification (isolated and de-energized)
  - Individual, group, complex group (Lock Box), remote Lockout, and
  - Shall be readily available

*MOC: is a systematic approach to organizational changes with the aim of ensuring the continued safety of the workforce and workplace throughout the process.

- These systematic processes ensures that the change is dealt with in a proactive fashion

Control Program (Purpose)

Lockout Program:

- Hazardous energy control procedures and training (continued)
  - Training, and
  - Auditing of program elements

- Lockout devices and hardware
  - Be capable of withstanding the environment to which they are exposed
  - Be standardized within the workplace in at least one of the following:
    - Colour
    - Shape
    - Size, or
    - Specific markings,
    - Substantial enough to prevent inadvertent, movement, and
    - Have a tag attached

Control Program (Purpose)

Communication and Training:

The user shall provide initial communication and training that will assist:

- All authorized and affected individuals to understand the purpose and function of the Control Program, and
    - To the extent appropriate for the level of hazard exposure they will possibly encounter

The training program shall comply with the following requirements, but not limited to:

- Individual training prior to performing tasks or being potentially exposed to hazardous energy
- Specific to the user's documented program
- Shall be developed using:
    - Manufacturer's documentation
    - Industry best practices, regulatory requirements and input from authorized individuals
- Include samples of specific procedures and enable personnel to interpret and implement such procedures
- Training methods (Instructor led, CBT*, interactive, simulation, demonstration and / or blended

*CBT: Computer Based Training

Control Program (Purpose)

Communication and Training:

Provide periodic refresher training

- At intervals not to exceed three years
- Be based on known hazards and risk assessment for work activities and conditions, and shall
- Receive additional training if
  - Individual is not complying with a hazardous energy control program
  - Changed or new technology, equipment, job assignment, or procedures necessitate (MOC)
  - The individual needs to employ a hazardous energy control program that is not normally used
- Assessment of training
  - Assess effectiveness that ensures
  - Knowledge of the program
  - Recognition and understanding of hazardous energy types, and
  - Use of appropriate energy control procedures

Control Program (Purpose)

Program monitoring and measurement:

The user shall determine the frequency for monitoring and measuring each element of the hazardous control program

- Frequency shall be at regular intervals of three years or less
- Provide qualitative and quantitative feedback, and
- Emphasis placed on operation and maintenance personnel who are directly involved
- Should include:
  - Trends
  - Variances
  - Rates of compliance
  - Key findings, and
  - observations

Energy Isolating Devices

Energy Isolation (Devices)

Devices:

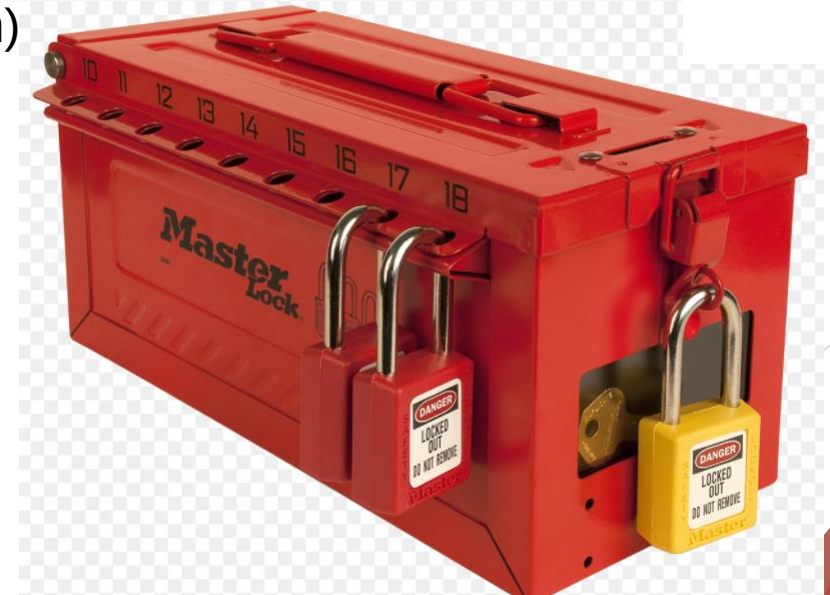
Machines, equipment and processes shall be designed, manufactured, supplied and installed with energy isolating devices to enable such machine, equipment or process

- The need to reduce injuries related to the hazard of unexpected release of stored energy is imperative
  - Is the “placement of a Lockout device on an energy isolating device”

Energy Isolation (Devices)

Devices:

- A Lockout device is a “mechanical means of locking that uses an individually keyed lock to secure an energy isolating device in a position that prevents energization of a machine, equipment or a process”
  - Locks (single keyed)
- Ball valve (valves with aligning lock tabs, locking covers, wheels with locking tabs, physical blocks with locking aligning tabs)
- Stem valves (Rising and non-rising stem)
- Lock Box
- Lock extenders (Christmas tree)
- Master switch, disconnect (MCC)



Lockout and Tagout steps

Disclaimer

This ***Awareness*** training shall not replace, or constitute, workplace specific training in managing hazardous energy

This module is only a component in the recognition, management and control of hazardous energy

If you are required to participate in a hazardous control program you may need additional, employer (user), site specific training

Important note:

This module does not provide any awareness regarding the legislated requirements for the control of hazardous energy with respect to Confined Spaces

(Ontario Regulation 632 / 05)

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Lockout and Tagout involves more than putting a lock on an energy isolating device

The process involves:

- Communication
- Coordination, and
- Training

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Steps of a Lockout and Tagout program include:

<u>Step 1</u> - Prepare for shutdown

- The authorized person will identify which sources of energy are present and must be controlled; and more importantly
- Identify what method of control will be used

This step involves:

- Completing sets of specific work instructions that outline what controls and practices are needed to lock and Tagout a system before performing any activity (Procedures)

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Steps of a Lockout and Tagout program include:

<u>Step 2</u> – Notify all affected individuals

The authorized person will communicate the following information to affected individuals:

- What is going to be locked and tagged out
- Why it is going to be locked and tagged out
- For approximately how long will the machine, equipment or process be unavailable
- Who is responsible for the Lockout and Tagout, and
- Who to contact for more information

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Steps of a Lockout and Tagout program include:

<u>Step 3</u> – Machine, equipment or process shutdown

If the system is operating:

- It should be shutdown in its normal manner
  - Use manufacturer instructions or facilities work procedures

Equipment shutdown involves:

- Ensuring controls are in the off position, and
- Verifying that all moving parts such as flywheels, gears, and spindles have come to a complete stop

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Steps of a Lockout and Tagout program include:

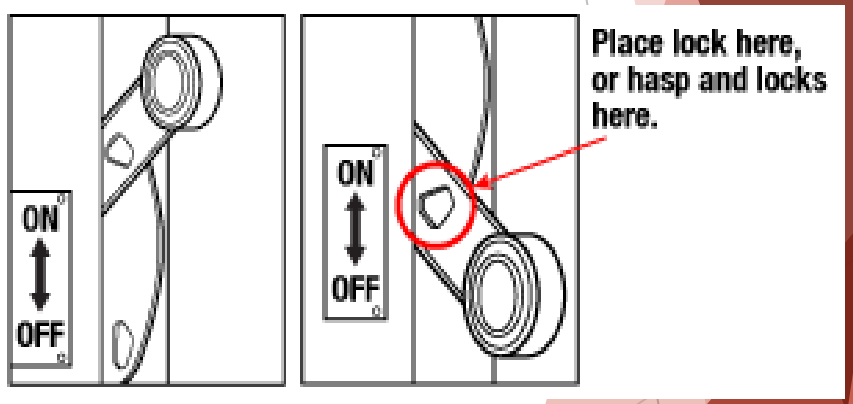
<u>Step 4</u> – Isolation of machine, equipment or process from hazardous energy

- The exact written procedures will be specific to that system in the workplace

In general, the following procedures are used:

Electrical energy

- Switch electrical disconnects to the off (open) position
  - If applicable, visually verify breaker knives are separated
- Switch breaker connections to the off position
- Lock the disconnects into the off position
- Isolate electrical supply to capacitor(s)
  - Lockout supply
  - Have appropriate authority discharge electrical potential energy from the capacitor (s)



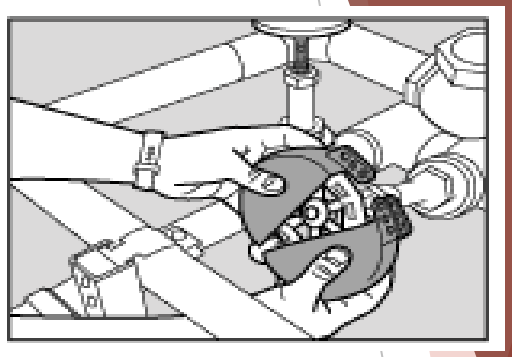
Disconnect Lockout

Lockout and Tagout (Steps)

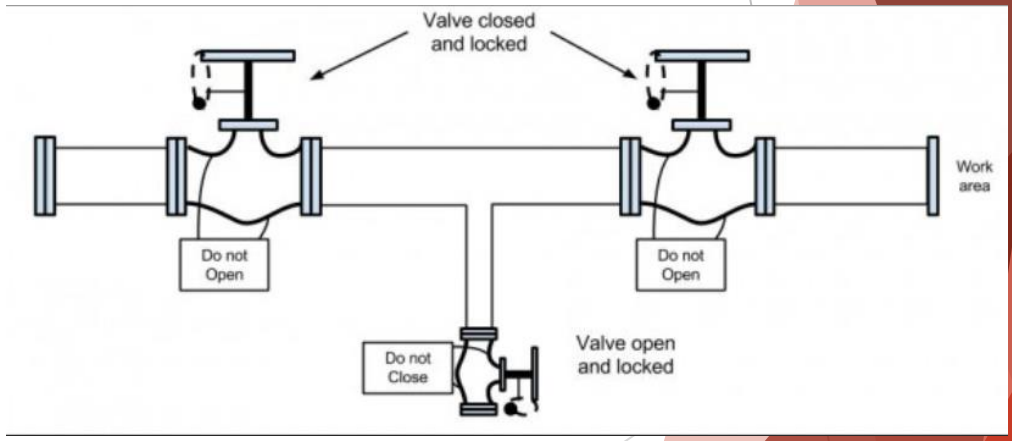
What are the basic steps of locking and tagging out a system?

Hydraulic and Pneumatic potential energy

- Set the supply line valve(s) in the closed position
- Open the bleed, drain or pressure relief valve(s) to bleed the system of potential energy (reference step 5)
- Lock the supply line valve(s) and the bleed, drain or pressure relief valve(s)
    - Refer to as “Double Block and Bleed”



Valve Lockout device



Note:

- Lock the supply lines in the closed position
- Lock the bleed, drain or pressure relief valve(s) in the open position

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Mechanical potential energy

- Carefully release energy from springs that may still be compressed
    - If not feasible, block the parts that may move if there is a possibility energy transfer

Gravitational potential energy

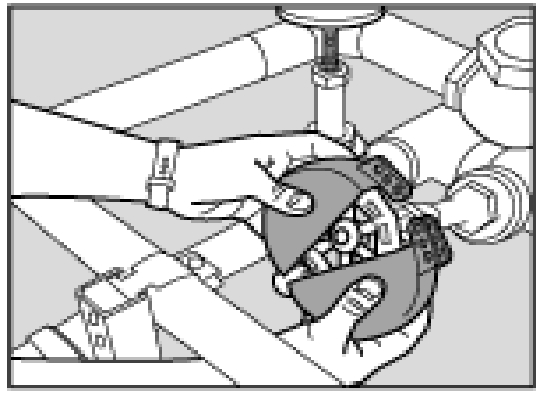
- Use a safety block or pin to prevent the part of the system that may fall or move

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Chemical potential energy

- Locate chemical supply lines to the system
- Close supply valve(s)
- Open the bleed, drain or cap ends to bleed the system of chemicals (reference step 5)
- Lock the supply line valve(s) and the bleed, drain or cap ends
    - Refer to as “Double Block and Bleed”



Valve Lockout device

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Steps of a Lockout and Tagout program include:

<u>Step 5</u> – Dissipation (removal) of residual or stored energy

In general, examples include:

Electrical

In order to discharge a capacitor(s) in a machine, equipment or process specific authorities may be required:

- Contact the manufacturer or workplace for guidance
    - Only qualified and authorized persons (Electrician or other electrical authority)
- In some cases, capacitors hold a charge and may release energy very rapidly
    - The flash of a camera
- In other cases, capacitors are used to remove spikes and surges in order to protect other electrical components
- Capacitors must be discharged in the Lockout process in order to protect workers from electrical shock.

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Steps of a Lockout and Tagout program include:

<u>Step 5</u> – Dissipation (removal) of residual or stored energy

In general, examples include:

Hydraulic and Pneumatic potential energy

- Setting valves in the closed position and locking them into place only isolates the lines from more energy entering the system

In most cases, there will still be residual energy left in the lines as pressurized fluid and can be removed by:

- Bleeding the lines through pressure relief valves
- Verify depressurization or use flange-breaking techniques
- Contact the manufacturer for more specific details, or if no pressure relief valves are available, what other methods are available
    - workplace specific isolation procedures

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Steps of a Lockout and Tagout program include:

<u>Step 5</u> – Dissipation (removal) of residual or stored energy

In general, examples include:

Mechanical potential energy

- Carefully release energy from springs that may still be compressed
- If this is not possible, use blocks to hold the parts that may move if the energy is released
- As in the water wheel
    - Isolate and lock the supply of running water
    - Install and lock blocking, pin or other device to prevent wheel rotation

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Steps of a Lockout and Tagout program include:

<u>Step 5</u> – Dissipation (removal) of residual or stored energy

In general, examples include:

Gravitational potential energy

If feasible

- Lower the part to a height where falling is impossible
- Install blocking or other device(s) to prevent gravitational movement

Chemical potential energy

- Bleed lines and/or cap ends to remove chemicals from the system

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

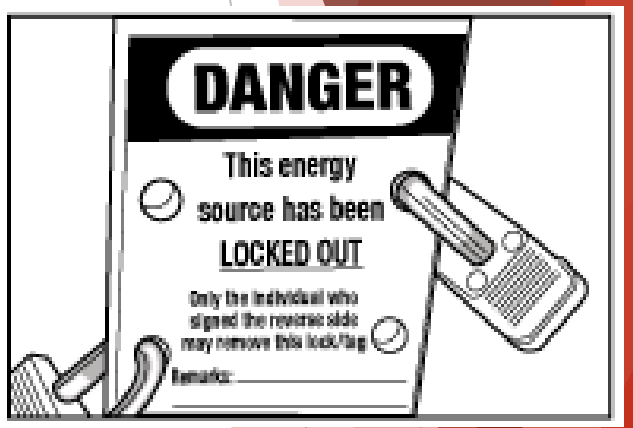
Steps of a Lockout and Tagout program include:

<u>Step 6</u> – Lockout and Tagout

When the machine, equipment or process energy sources are locked out, there are specific guidelines that must be followed to make sure that the lock cannot be removed, and the system cannot be inadvertently operated

These guidelines include:

- Each lock should only have one key (no master keys are allowed)
- There should be as many locks on the system as there are people working on it
  - For example, if a maintenance job requires 3 workers, then 3 locks should be present
  - Each of the individuals should place their OWN lock on the system
  - Locks can only be removed by those who installed them, and
  - Should only be removed using a specific process (Step 9)*



*In the event the worker is absent – Control Program shall specify the procedure, or protocol, to remove the lock without the presence of the worker

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Steps of a Lockout and Tagout program include:

<u>Step 7</u> – Verify Isolation (Test)

Choose the method that will best make sure that the energy to the system has been isolated without creating other hazards during the verification

Verify that the system is properly locked out before beginning any work. Verification can take place in several ways

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Steps of a Lockout and Tagout program include:

Step 7 – Verify Isolation (Test)

Visual inspection:

- Electrical connections to make sure they are the open (Square disconnect)
- Suspended parts are lowered to a resting position or blocked to prevent movement (Gravitational Potential Energy)
- Other devices that restrain machine or process movement Valve positioning for double block and bleed (for pipes or ducts)
    - Closing two valves of a section of a line, and then bleeding (or venting) the section of the line between the two closed valves (Double Block and Bleed)
- Presence of solid plate used to absolutely close a line
    - Called line blanking or spading (for pipes or ducts)
- Any other acceptable method of energy isolation

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Steps of a Lockout and Tagout program include:

<u>Step 7</u> – Verify Isolation (Test)

Testing of the equipment:

- Test circuitry (should be done by a certified electrician)
    - Equipment with capacitors need to be cycled until all energy is drained, or by other means (Grounding by certified persons)*
- Check pressure gauges to make sure hydraulic and pneumatic potential energy has been removed
- Check temperature gauges to make sure thermal energy has been discharged.

The machine, equipment, or process controls (push buttons, switches, etc.) are engaged or activated and the result is observed

- No response means isolation is verified. Return controls to the safe position (off)

Ensure you test the equipment, machine or process prior to performing any task or work

* Do not rely on Interlocks or jumpers for positive isolation

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Steps of a Lockout and Tagout program include:

<u>Step 8</u> – Perform maintenance or service activity

Complete the activity that required the Lockout process to be started

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Steps of a Lockout and Tagout program include:

<u>Step 9</u> – Remove Lockout and Tagout devices

To remove locks and tags from a system that is now ready to be put back into service, the following general procedure can be used:

- Inspect the work area to make sure all tools and items have been removed
- Confirm that all individuals and persons are safely located away from hazardous areas
- Verify that controls are in a neutral position
- Remove devices and re-energize machine
- Notify affected individuals that servicing is completed

Lockout and Tagout (Steps)

What are the basic steps of locking and tagging out a system?

Steps of a Lockout and Tagout program include:

<u>Step 9</u> – Remove Lockout and Tagout devices

Note - it is good practice to make sure all individual who placed a lock on the equipment, machine or process be present when the equipment, machine or process is re-started

This practice helps ensure all working on the equipment, machine or process are not in a hazardous area when restarted

Review

Review (Inspection)

The Hazardous Energy Control Program shall be reviewed periodically and should include:

- An inspection of the written procedures
- A review that the procedures are being followed
- Procedures will be updated as necessary, and
  - Communication to the workforce
- individuals re-trained as necessary

Summary (General)

- Only authorized individual may perform Lockout and Tagout using only the employers' prescribed procedures
- Identify ALL energy sources and establish zero energy prior to servicing equipment
- Take your time and do it RIGHT!!! (Lockout, Tagout, Tryout)
- IF YOU DO NOT KNOW, ASK!!!