RECOGNIZING HAZARDOUS ENERGY AND CONTROLS

Petrochemical Manufacturing
WCB Industry Code 37801

Bulk Petroleum Dealers
WCB Industry Code 60800

AASP
Alberta Association for Safety Partnerships

ABOUT THIS MANUAL

This course was developed based on the needs of Alberta employers, W.C.B. Codes 37801 and 60800, in the business of petrochemical manufacturing and the bulk petroleum dealers. Recognizing hazardous energy and then implementing appropriate and effective controls is a critical part of business.

This training was developed by Alberta Association for Safety Partnerships as a result of a funds being directed by court order due to serious incidents that had occurred. The project was headed by AASP, SafetyVantage and Agrium Inc. with the intent to provide an an effective eLearning course for employees in the petrochemical industry codes. As well, the intent is to as share with all organizations who encounter any form of hazardous energy to improve understanding and better recognition of all types of hazardous energy and the importance of appropriate and adequate controls.

The outcome we hope to achieve is making this training easily accessible, ensuring employers have reasonable and accessible options to train employees in how to recognize, implement procedures and apply necessary Lock Out/Tag Out procedures or other methods of controls to eliminate hazardous energy releases. Also provided are a couple of helpful tools in the resources section of the eLearning course - a self-evaluation form and a competency testing form.

ACKNOWLEGEMENTS TO:

Adele Tait - OHS
Melissa Garland - OHS
Joel Hanson - Supervisor, Carseland Nitrogen Operations
Rob Jost - Meglobal
Brian Hooey - Dow Chemical
TJ Snyman - SafetyVantage
Lisa Snyman - SafetyVantage
Ray Gaetz - Alberta Association for Safety Partnerships
Carol Ross - Alberta Association for Safety Partnerships

CHAPTER 1

RECOGNIZING HAZARDOUS ENERGY AND CONTROLS

COURSE LEARNING OBJECTIVES

At the end of this course, you will be able to:

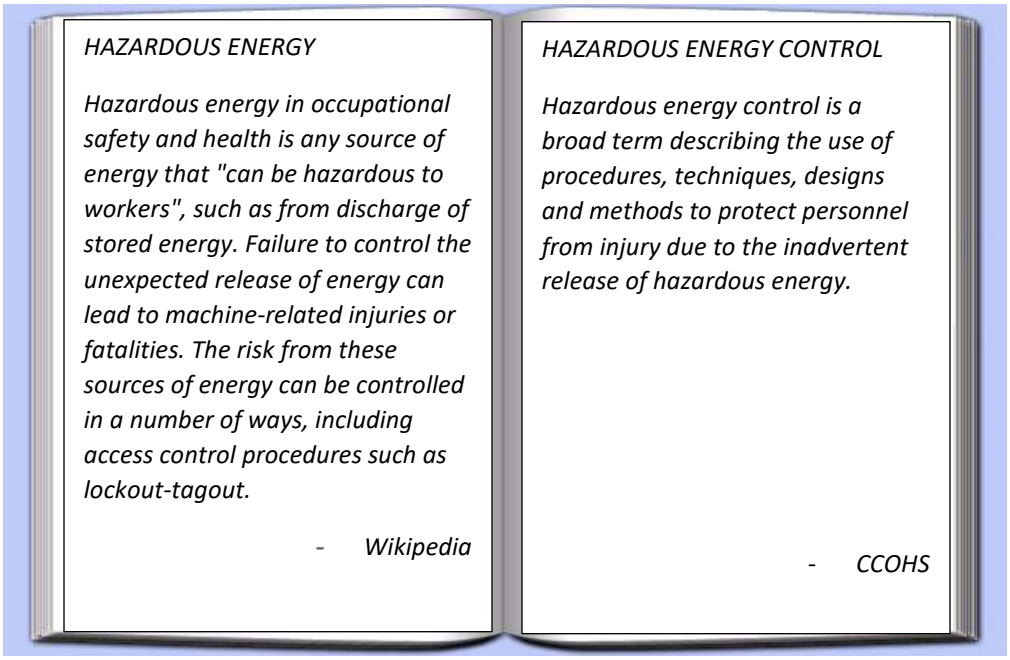
- describe a Hazardous Energy Control Program
- explain the terms lockout and tagout, and the lockout/tagout procedures
- locate hazardous energy control legislation
- discuss hazardous energy control roles and responsibilities
- identify, assess, and control hazardous energy hazards
- maintain and update the Hazardous Energy Control Program and documentation
- explain the six steps of the lockout procedure
- secure isolation in different ways; individual, group, and complex group
- explain emergency response procedures

CHAPTER 2

DEVELOPING A HAZARDOUS ENERGY CONTROL PROGRAM

After this chapter, you will be able to:

- List the sources of hazardous energy
- Describe a Hazardous Energy Control Program
- Explain how lockout fits into the Hazardous Energy Control Program
- Define lockout and tagout
- Locate federal and provincial laws governing the control of hazardous energy and where to access them
- Understand hazardous energy control roles and responsibilities

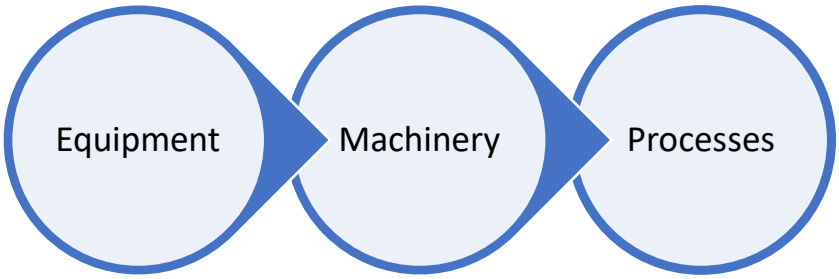


Understanding Energy

Source		Examples	Possible Injuries
Electrical Energy	The movement of electrons to form electricity	• Motors • Power transmission Lines • Generators	• Electrical Shock • Electrocution • Burns • Falls and Injuries
Mechanical Energy	Kinetic – energy in motion.	*Kinetic Energy*: (in Motion) • Fan blades • Conveyor belts • Mixers • Agitators • Flywheels	• Struck by • Crushed • Pinched
	Potential energy - enegey that is stored	*Potential Energy: (Stored)* • Coiled objects • Elevated or suspended objects like springs, batteries and motors	
Pneumatic Energy (potential)	The transmission of power through pressurized air or gas	• Compressed air engines • Handheld jackhammers	• Struck by • Crushed
Hydraulic Energy (potential)	Energy stored in pressurized liquid	• Hydraulic presses • Braking systems	• Struck by • crushed
Gravitational Energy (potential)	Energy an object possesses because of its position in a gravitational field	• Objects falling from heights	• Struck by falling objects
Thermal (Heat) Energy	Energy of moving or vibrating molecules	• Pressurized steam used to power a turbine	• Burns
Chemical Energy	Power created by the reaction between substances	• Reactions of combustible, flammable, or corrosive substances	• Fires • Explosions
Radiation Energy	Energy produced from electromagnetic sources.	• Lasers • Ultraviolet (UV) rays • Infrared (IR) waves • X-rays	• Radiation burns • Damage to eyes and skin

Developing a Hazardous Energy Control Program

The first step in controlling hazardous energy is to develop a Hazardous Energy Control Program. A Hazardous Energy Control Program is an overarching process for controlling hazardous energy in the workplace. You will need one when doing nonconventional or non-routine work on:



Non-conventional or non-routine work includes:

- Installations
- Inspections
- Plant turnarounds or shutdowns
- Repairs
- Lubrication
- Cleaning
- Adjustments

Developing a Hazardous Energy Control Program

Step 1	Gather information about each system or procedure that requires non-routine work	a. System maintenance procedures b. Part installation or removal procedures c. Planned and unplanned interruption and stoppage procedures (e.g.: jams or malfunctions) d. Energy isolation device access and use procedures
Step 2	Conduct a task analysis for each system	a. Consider the manufacturer specifications and list all the steps required to work on a system b. Consider all aspects of the working system such as: i. Set up ii. Modes of operation iii. Planned and unplanned maintenance and repair iv. Regular and emergency stoppages and restarts v. Unintentional start up vi. System failures vii. Cleaning and troubleshooting c. Identify and assess all hazards, including sources of hazardous energy
Step 3	Assess the risk involved	Assess risk associated with: a. Removing a guard or barrier b. Accidentally releasing residual energy in hydraulic or pneumatic systems c. Accidentally releasing energy from springs in mechanical systems d. Accidentally releasing chemical energy from lines in a system e. Accidentally starting-up motors or capacitors
Step 4	Implement Controls	a. Identify the controls needed to eliminate or manage the risks b. Identify the energy-isolating devices needed for controlling hazardous energy
Step 5	Provide Training	a. Train all affected employees about their responsibilities in the Hazardous Energy Control Program

Developing a Hazardous Energy Control Policy

Your Hazardous Energy Control policy should:

- Identify all company systems that require hazardous energy control
- Describe stakeholder responsibilities
- Include short descriptions of the hazardous energy control procedures
- List training and competency requirements
- Describe policy review and update terms

Maintaining Hazardous Energy Control Documentation

- Training records and competency assessments for each worker (including the type and level of training)
- Hazard identification, assessment, and control procedures
- Safe work procedures for each system (including securing remote-controlled systems and complex group control)
- Permits, inspections, and incident reports specific to the program

Developing a Hazardous Energy Control Procedures

The policy is designed to uphold worker safety by ensuring that safeguards are in place to prevent the unintentional release of stored energy, the unintended start-up of systems, and to prevent contact with hazards when safety devices are removed or by-passed. Develop Hazardous Energy Control Procedures for working on each system which include:

- Preparing for shutdown
- Notifications
- Isolation and applying locks
- Controlling stored energy
- Verifying isolation and performing the work
- Removing the lock when safe to do so
- Resuming regular work functions

Defining and Application of Lockout/Tagout

It is important to understand although Lockout/Tagout is important, it is just one component of a Hazardous Energy Control Program.

LOCKOUT – is the placement of a lock or tag on an energy-isolating device in accordance with an established procedure, indicating that the energy-isolating device is NOW to be operated until the removal of the lock or tag, in accordance with an established procedure.

TAGOUT – is the attachment of a tag, label, or warning sign on a system to identify:

- The reason for the lockout
- The name of the authorized person who applied the tag
- The time the tag or lock was applied

Using a tagout device only does not create the same physical barrier as a lockout device does to prevent the potential release of hazardous energy

Legislation and Regulations

In Canada there are both federal and provincial regulations and guidelines that relate to lockout.

Refer to table below for some key information.

Federal 	Canada Occupational Health and Safety Regulations SOR/86-304: 8.12-8.23	http://laws.justice.gc.ca/eng/regulations/SOR-86-304/FullText.html
British Columbia 	WorkSafe BC OHS Regulation, Part 10: De-energization and Lockout	https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-10-de-energization-and-lockout
Alberta 	Occupational Health and Safety Code Part 15, Managing the Control of Hazardous Energy	http://employment.alberta.ca/documents/whs/whs-leg_ohsc_2009.pdf
Saskatchewan 	Saskatchewan Occupational Health and Safety Regulations, 1996, Part X: Machine Safety, Section 139: Locking Out, Part XVIII: Confined Space Entry, Entry; Part XXX: Additional Protection for Electrical Workers, Section 464: Grounding of Equipment Before Work Begins.	http://www.qp.gov.sk.ca/documents/English/Regulations/Regulations/O1-1R1.pdf
Manitoba 	Manitoba Workplace Safety and Health Regulation, Part 16: Machines, Tools and Robots, Sections 16.14-16.18: Lockout Part 15: Confined Spaces, Sections 15.7(1)(c): Requirements Before Confined Space is Entered	http://umanitoba.ca/admin/human_resources/ehso/media/WSHRegs2007ConsolidatedVersion.pdf
Ontario 	Occupational Health and Safety Act (OHSA), R.S.O. 1990 O. Reg.851, R.R.O. 1990, Industrial Establishments, Sections 42,43,75,76	https://www.ontario.ca/laws/regulation/900851
Quebec	Regulation Respecting Occupational Health and Safety S-2.1, r13 XXI 172-193: Machines	http://www.canlii.org/en/qc/laws/regu/rrq-c-s-2.1-r-13/latest/rrq-c-s-2.1-r-13.html

		
Nova Scotia 	Occupational Safety General Regulations: Part 6: Lock-out	http://www.novascotia.ca/just/regulations/regs/ohsgensf.htm#TOC1_6
PEI 	Occupational Health and Safety Act: General Regulations: Part 30.6-30.7: Mechanical Safety	https://www.princeedwardisland.ca/sites/default/files/legislation/o1-01g.pdf
New Brunswick 	General Regulation 91-191, Sections 239-240	http://laws.gnb.ca/en/showfulldoc/cr/91-191/#anchorga:s_239
Newfoundland 	General Health and Safety Regulations, Part IX, De-energization and Lockout	http://www.assembly.nl.ca/Legislation/sr/Regulations/rc120005.htm#127_
Yukon 	Occupational Health and Safety Act and Regulations, Part 3 – Lockout	http://yukonregs.ca/RegsPublic/Home/Details/743
NWT and Nunavut 	Safety Act: Consolidation of General Safety Regulations: Maintenance of Machinery and Equipment, 141-149	http://www.canlii.org/en/nu/laws/regu/rrnwt-nu-1990-c-s-1/latest/part-1/rrnwt-nu-1990-c-s-1-part-1.pdf

Roles and Responsibilities

Employer –

Employer must ensure:

- ✓ A Hazardous Energy Control program is developed and implemented
- ✓ All systems and processes requiring non-routine work are identified
- ✓ Lockout equipment and tools are available
- ✓ All required personal protective equipment (PPE) is available
- ✓ Employees receive Hazardous Energy Control program, policy, and procedure training

Supervisor –

In addition to their general responsibilities, supervisors must oversee the lockout process.

In certain jurisdictions, an authorized or competent person (someone that has the qualifications, training, and experience in controlling energy sources) may also take on these responsibilities. They include:

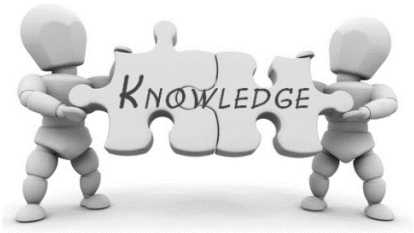
- ✓ Ensuring that workers involved in the Hazardous Energy Control Program are trained and competent
- ✓ Approving the appropriate equipment-specific procedures for each system
- ✓ Ensuring safe work procedures are followed by supervising the work being done
- ✓ Notifying workers in adjacent areas of the work being done
- ✓ Inspecting all systems, tools, and equipment prior to work being done
- ✓ Developing and supervise group lockout procedures
- ✓ Making sure systems have been isolated prior to work commencing

- ✓ Making sure workers know when locks have been removed and systems have been restored to normal function
- ✓ Ensuring the appropriate hardware and PPE are distributed and used

Worker –

Workers and affected persons (anyone working in an area where hazardous energy control work is being done) are expected work within the Hazardous Energy Control Program guidelines. They must:

- ✓ Train and achieve competency before beginning the work
- ✓ Assist in developing system=specific lockout procedures for their work areas
- ✓ Comply with all the safe work procedures and PPE requirements
- ✓ Report any hazards and issues associated with the program throughout the work process



Quiz 1

1. **You DO NOT need a Hazardous Energy Control Program if you are working on:**
   A) Equipment
   B) Machinery
   C) Processes
   D) Lap-tops

2. **Which of these is NOT a source of hazardous energy?**
   A) Pneumatic
   B) Radiation
   C) Electrical
   D) Psionic

3. *The placement of a lock on an energy-isolating device in accordance with an established procedure, indicating that the energy-isolating device is NOT to be operated until the removal of the lock, in accordance with an established procedure.* **This is a description of:**
   A) Lockout
   B) Tagout

CHAPTER 3

IDENTIFYING, ASSESSING AND CONTROLLING HAZARDOUS ENERGY

After this chapter, you will be able to:

- Describe the process of hazard identification, assessment, and control
- Apply the hierarchy of controls to job hazards
- Discuss engineering, administrative, and PPE hazardous energy controls

Hazard Identification, Assessment and Control

IDENTIFY:

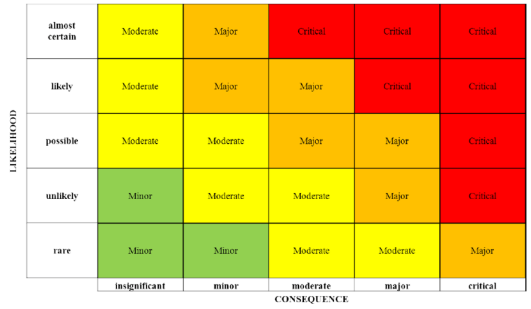
Survey your work area and surrounding environment. In addition to the sources of hazardous energy you already know, look at the scope of work required to complete system tasks, such as hot work or confined space entry.

Ask yourself – is there the potential for:

- Poor air quality (fumes, dust, and smoke)?
- Flammable and explosive environments?
- Hazardous atmospheres (oxygen deficiency, oxygen enrichment, or chemical exposures)
- Heat, noise, biological hazards, and visibility?
- Engulfment hazards where a worker could be overcome by a solid substance (sawdust, seed, soil, sand, and gravel) or become submerged in a liquid (water, liquid chemical)?
- Entrapment hazards where a worker could become trapped because of the spatial configuration of the area where the work is being done?

ANALYZE:

Once you have collected your hazard information, you can begin assessing the likelihood and severity of injury, damage, or loss that each hazard presents. Usually, this is done using a risk matrix, which helps you prioritize each hazard in three categories – low, medium, or high risk. High risk hazards are high priority hazards. They need to be controlled first, while low risk, low priority hazards are controlled last.

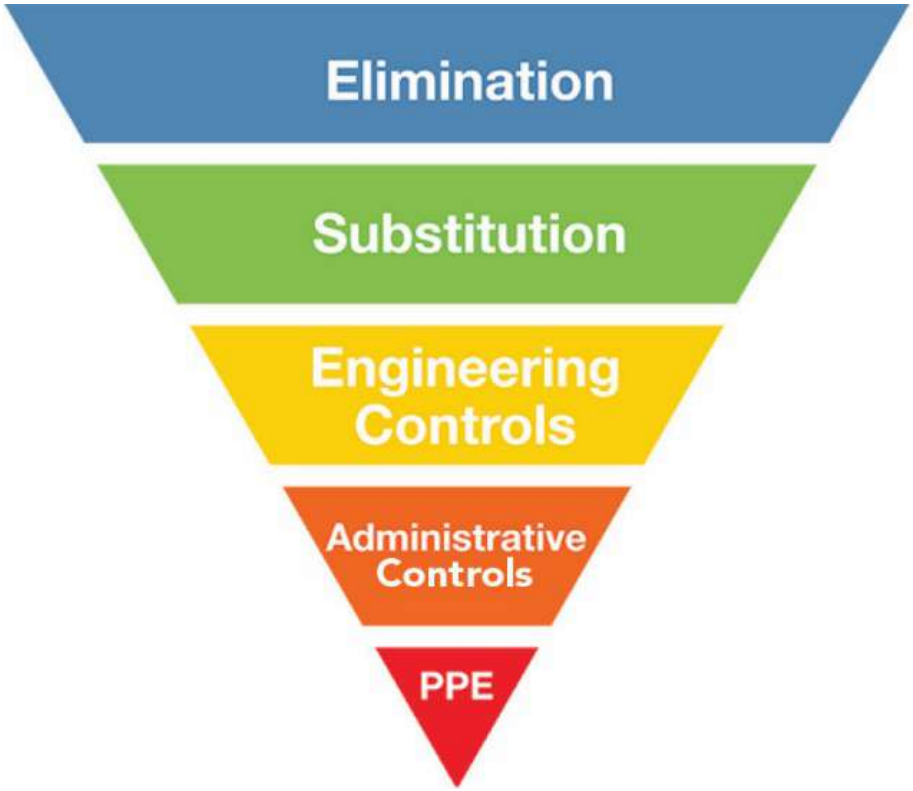


CONTROL:

Hazards need to be identified, assessed, prioritized according to their risk, and then controlled in order of their priority level.

Hazard controls reduce or remove the possible risk of injury, damage, or loss that a hazard presents. In a perfect world, hazards would be eliminated completely from the workplace, or would be substituted with less hazardous things. Because elimination and substitution controls are not always reasonable or available, you may have to use the hierarchy of controls instead.

The hierarchy of controls is a system designed to minimize hazard exposure. You should always apply the hierarchy in this order to maximize the effects of your controls.



TRAINING AND COMPETENCY:

For the Hazard Energy Control Program to be successful, training to staff is imperative. The company needs to apply application-based training onsite to teach employees how the program applies to their workplace and their work. This training should include hands-on, site-specific training with a demonstration of competency.

Being competent means having the necessary abilities, skills, and knowledge to perform job tasks in a capable and proficient manner. This may be accomplished through written exams, on-the-job skills training, and observation.

Training requirements may include:

- The hazardous energy control program
- Legislative requirements
- System-specific work procedures
- Hazard identification, assessment, and control
- Complex systems and lockout errors
- PPE use
- Inspecting work areas
- Responding to emergencies

Refresher training should be conducted:

- When your certificate expires
- If new hazards are presented
- When the hazardous energy control program is updated.

SAFE WORK PROCEDURES:

Safe work procedures should be developed for every system and process within the workplace, and where applicable, identify whether a lockout is required.

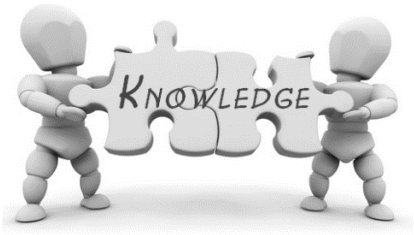
However, if a safe work procedure ***has not*** been developed, or if a lockout ***is not*** identified in the procedure, then the company should:

- Identify and assess the system or process (machines, equipment) being worked on to see if any non-routine work is required. This can be accomplished through hazard assessments and inspections, or incident investigations.
- Assess all systems that are included in the work. Include any in the work area that could become hazardous to workers during the procedure.
- Keep a list of all systems that require a lockout, including all the hazardous energy sources employees need to be aware of.

During this process ask yourself - Could anything within the system inadvertently fall, roll, or move?

- What sources of hazardous energy are present?
- If hazardous energy was accidentally released, is there a risk of injury to workers from moving machinery, equipment, or parts?
- Are there other hazards that could injure workers? Burns, chemical exposures, entrapment?

If hazards are present, the company will need to develop a safe work procedure for lockout.



Quiz 2

1. **Even though you are focusing on hazardous energy, it is important to consider all hazards during the hazard identification process. Surveying the work area and the surrounding environment.**

   TRUE

   FALSE

2. **Mechanical guards are an administrative control for hazardous energy.**

   TRUE

   FALSE

3. **Not every system, requiring non-routine work, needs safe work procedures.**

   TRUE

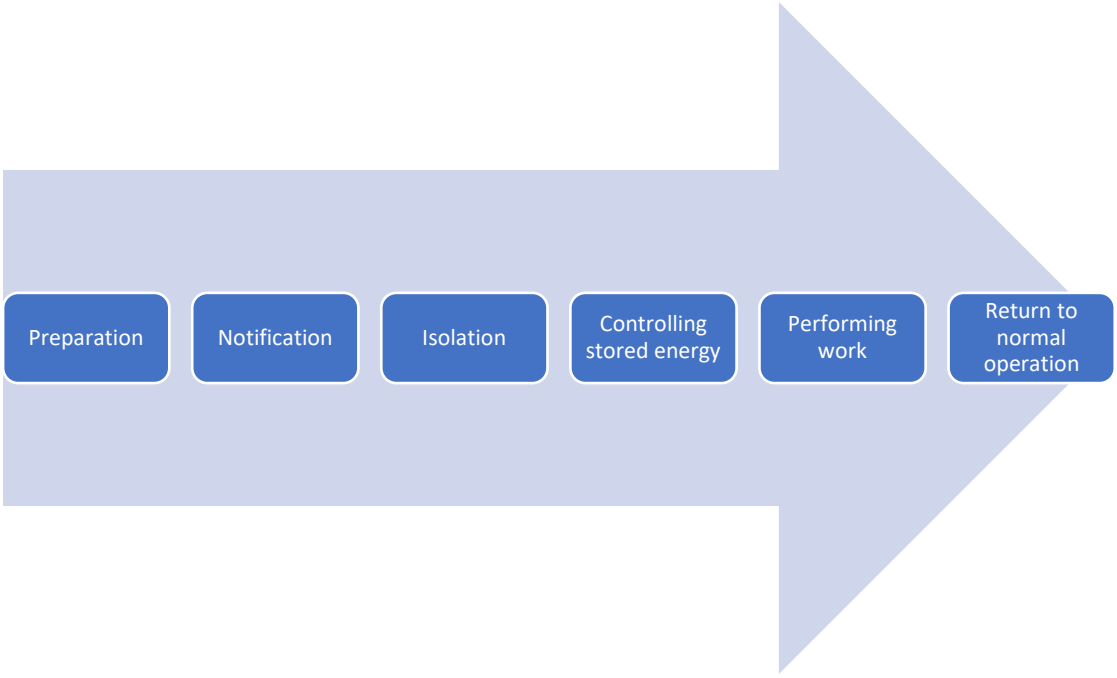
   FALSE

CHAPTER 4

THE LOCKOUT PROCEDURE

After this chapter, you will be able to:

- List the steps in a safe work procedure requiring a lockout
- Describe the tasks associated with each step
- Compare lockout devices
- Discuss the different lockout methods
- Describe different ways to store energy



STEP 1 – PREPARATION:

Before any work is done on a system, you will need to complete a pre-job hazard assessment, and hold a pre-job meeting. Consider:

- All hazardous energy sources
- The control methods to be implemented
- The safe work procedures (including lockout/tagout procedures)

STEP 2 - NOTIFICATION:

Supervisors need to notify all employees potentially affected by a lockout whenever non-routine work is required on a system. Employees need to know:

- The reason for the lockout/tagout
- The system being locked or tagged out
- The timeframe of the lockout/tagout
- Who is responsible for locking or tagging out the system
- The name and contact details of the employee in charge of the lockout/tagout

STEP 3 - SHUTDOWN AND ISOLATION:

There are 2 key elements to a successful isolation.

1. **Means of isolation** - *These are the isolation points or devices used to turn the system 'off' and provide a physical barrier between the worker and the potentially harmful energy*.

2. **Means of securement** - *These are the devices used to ensure the isolation points remain in the required position.*

MEANS OF ISOLATION

Before working on a system, it needs to be shutdown, made inoperable, and put into the 'off' position. All moving parts need to be at a complete stop, creating a 'zero-energy' state. Always use the manufacturer's specifications and your company's safe work procedures for system shutdowns.

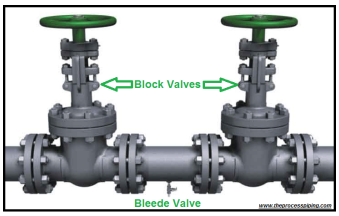
Next, you will need to locate the energy-isolating devices that control the system energy sources – keep in mind, push buttons and selector switches are not considered energy-isolating devices. Real energy-isolating devices include:

- Circuit Breakers
- Main disconnect switches
- Line valves or plugs
- Vehicle immobilization

Isolate piping, or a pipeline containing harmful substances, under pressure using either a system of blanking or blinding, or a double block and bleed isolation system. For piping systems, if it is not

reasonably practicable to provide blanking, blinding, or double block and bleed isolation, an employer must ensure that an alternate means of isolation that provides adequate protection to workers, certified as appropriate and safe by a professional engineer, is implemented.

To isolate piping or a pipeline containing harmful substances under pressure use either a system of blanking, or a double block and bleed isolation system.



A double block and bleed isolation system consists of two blocking seals on either side of the isolation point with an operable bleed-off between the two seals.

WHAT IF IT CANNOT BE ISOLATED?

There may be times when, due to design, an employer may not be able to isolate a system following normal acceptable isolation procedures. In cases such as this the employer must determine they have done everything reasonably practicable to provide an isolation solution but have not been successful. The employer must then develop and implement procedures for an alternate means of isolation that is certified by a professional engineer as safe and appropriate for the protection of workers.

Reference OHS Code Part 15, s. 215.5(5)

MEANS OF SECUREMENT

Energy-isolating devices must be locked out in the 'off' position to ensure there is no accidental release of energy to systems. Once the energy-isolating device is in place, you will need to secure a lock to it. Make sure it is well secured, so it cannot fall off or be removed.

If tags are used, they should be attached directly to the energy-isolating device or as close as possible to the device. Tags should be obvious to workers and should indicate that the system is not be operational until the tag is removed.

If work is done on a cord-connected piece of equipment, such as a saw, an isolating device can be attached to the plug end. Another, more practical, option is to remove the plug from the electrical source. That makes it inoperative while the plug is in sight and while it is in your immediate control as you are working on it. Never leave it unattended.

3. Lockout/tagout devices

Lock with keys	Every lock you use must be a personal lock. That means it is assigned to you, and only you can use it. Each lock needs a different key. You cannot have multiple locks that use the same key. Similarly, you cannot use combination locks. Locks must also be a standardized shape, size, and colour. You should always ensure they are durable so they cannot be removed by metal-cutting tools. Every lock you use for lockouts can only be used for that purpose
Tags	Tags must be durable enough to withstand extreme temperatures, chemicals, and other environmental factors. When a worker attaches a tag, they are the only ones allowed to remove it. Tags must: o Be standard shapes, sizes, and colours o Have legible, clear warnings o Be made of non-conductive materials o Identify the department and the worker who attached it to the energy isolating device o State reasons for the lockout o State the date and time of its attachment
Scissor Clamps	Scissor clamps allow multiple workers to attach their personal locks to an energy-isolating device.
Lockboxes	Lockboxes are generally used during group lockout procedures. They are designed so that multiple workers can place their individual locks on a box that holds the keys for all the locks placed on energy-isolating devices.
Cable, bar, or chain	In some cases, several energy-isolating devices are locked near one another and secured at the same time. After the system is in the 'off' position, employees use personal locks to secure each energy-isolating device. Then, a cable, bar, or chain is run through the lock-points of the

	energy-isolating devices and secured with a personal lock to prevent removal. If you use this kind of lockout device, the cable, bar, or chain must be strong enough and wide enough in diameter to ensure the energy-isolating device stays in the 'off' position. It cannot be made of materials that can be removed by tools.

When securing valves, the devices used must:

- Provide a positive mechanical means of keeping the valves in the required position
- Be strong enough and designed to withstand inadvertent opening without the use of excessive force, unusual measures, or destructive techniques

4. Locking out energy-isolating devices

a. ***Individual lockout*** *– used when an employee secures their own personal lock to the energy-isolating device.*

- When conducting an individual lockout, always ensure the energy source is isolated before you attach your lock to the energy-isolating device.
- If two or more employees are working in an area where energy is being isolated, each one needs to secure their own personal lock. If you are attaching your lock first, you are also responsible for ensuring that the energy source is isolated. If work on the system extends over two or more shifts, or employees are reassigned before completing it, your supervisor needs to maintain the hazardous energy control procedure. That means your supervisor must secure their lock in place prior to the first employee removing their lock. That ensures the effective transfer of the lockout's control to another person.
- Locks need to be traced back to their owners. This can be done through engraved names, identification codes, symbols, color codes, or secure

identification tags. When you are ready to remove the locks, the final lock is most important. Removing the final lock means that energy is **no longer isolated**, and that the system is ready to be returned to service. The final lock should **not** be removed until shift changes or employee reassignments are completed, to maintain the control of hazardous energy throughout.

b. ***Group Lockout*** *– used when there are multiple energy isolating devices and multiple workers involved in the work*

Whenever group lockouts are applied, they need to follow the written procedure developed by the supervisor. This procedure needs to:

- Designate a person, such as a supervisor or authorized person, to be responsible for placing the energy-isolating devices
- Designate a person (supervisor or worker) to:
    - Place a lock on each energy-isolating device
    - Place the key to each lock in a lockbox or keyring and apply a personal lock
    - Complete, sign, and post a list identifying all machinery or equipment included in the procedure
    - Confirm and document the steps that resulted in all hazardous energy sources being effectively isolated

Once you have verified the isolation, but before beginning work, each worker secures their own lock to the lockbox or keyring. This ensures the master-key inside is not removed until after each worker's lock is removed.

When you are finished, each worker removes their own personal lock from the lockbox or keyring. When the last lock is removed, the designated person or

supervisor removes their lock from the energy-isolating device and verifies that no workers are in danger due to lock removal.

c. ***Complex Group Lockout –*** *used when an individual or group lockout is not a practical option*

Group lockout procedures may need to be modified or adapted through written procedures, like a work permit or a master tag system, to create a complex group lockout. You might use it because:

- The physical size of machinery, equipment, pipeline, piping, or process may occupy multiple areas and buildings, or one large area
- The energy-isolating devices are inaccessible and could expose workers to hazards (e.g., confined spaces or high noise levels)
- The number of workers involved in conducting the work may make group lockout impractical or difficult (e.g., plant shutdowns)
- The number of energy-isolating devices makes group lockout difficult or impractical
- Extended isolation timelines prevent locks from being used for other work
- Interdependent systems may present a complex situation where group lockout is impractical or difficult (e.g., piping, pipelines, or computer controls at remote or different physical locations)

To complete a complex group lockout procedure:

1) A designated person, such as a supervisor, secures all the energy-isolating devices
2) A second designated person verifies isolation and confirms that all the energy sources are controlled. The second designated person ensures that

all hazardous energy sources are isolated prior to system work; NOT to ensure lock placement.

3) All workers individually sign on and off the job, according to the work permit or master tag system. Supervisors can sign on and off on behalf of their workers.
4) Workers have the option to place personal locks on the lock-securing device and then verify isolation.
5) Once the work is complete, all involved workers are accounted for before any locks are removed.
6) The designated person ensures that no workers are in danger due to lock removal when the machinery or equipment returns to normal operation.

In some provinces, the procedures may need to be approved to ensure a certain level of protection for workers. In Alberta, approval must be granted by the Director of Inspection.

5. <u>Locking out remotely controlled systems</u>

Remotely controlled systems, such as computer controls for systems for pipelines or machinery, must also be located. A control system isolating device, written authorizations, and safe work procedures are used in this type of situation. The control system isolating device must physically prevent the activation of remotely controlled equipment. The best practice is to ensure the equipment is rendered inoperative. However, if this is not possible, you can isolate the control system by:

- Locking out computer ports, such as the mouse and keyboard
- Locking out the room where the operation-controlling computer is located

STEP 4 - CONTROLLING STORED ENERGY:

After applying lockout devices, you must release the potential energy from the system. Doing so ensures that there is no remaining stored energy. Stored energy could remain in:

- Rotating flywheels
- Springs
- Steam pressure in lines
- Elevated equipment
- Compressed air
- Hydraulic lines that remain pressurized

Stored energy can be restrained, released, or neutralized in many ways. Some examples include:

Electrical energy:

- Installing ground wires to ensure zero voltage
- Discharging capacitors in motors or switch gears to protect workers from electrical shock

Gravitational energy:

- Blocking elevated equipment that may fall

Hydraulic or pneumatic energy:

- Bleeding the lines using relief valves or safely removing liquid or gas from a closed system (e.g., bleeding off residual pressure from steam or compressed air)

Mechanical energy:

- Blocking wheels and applying and locking off the brakes of moving equipment
- Releasing compressed springs or using blocks to secure the parts if energy is unintentionally released
- Applying chains to conveyors or other moving parts

Chemical energy:

- Bleeding the lines or capping ends to remove chemicals from a system

Pressurized piping:

- Blanking or inserting a physical barrier through a cross-section of pipe so that materials cannot flow past that point
- Blinding or disconnecting a pipe and attaching a physical barrier to the end so materials cannot flow out
- Double blanking and bleeding a pipe using a three-valve system, where a pipe has two closed valves and one open drain valve positioned in between the two, so material cannot flow and is re-directed if there is a valve leak

If energy has the potential to re-accumulate in systems, you will need to continue to verify or safely release it throughout the work process.

STEP 5 - VERIFYING ISOLATION AND PERFORMING WORK:

Once you have dissipated or removed all potential energy, you will need to verify the lockout. This needs to be done before starting any system work.

There are two main ways of verifying isolation.

Visual inspection of the system

Take a close look at the system to ensure it is at a 'zero' energy state. You should:

- Make sure suspended parts are blocked, or are in a resting position to stop movement
- Look at the position of valves in pipes and ducts that have double block and bleed systems: make sure two valves are closed
- Make sure there is a blank (solid plate) in place to close a line in a pipe
- Ensure that no switches, push buttons, or process controls are 'on' or activated

Testing the system

You will have to test the system to make sure it is inoperative. This is commonly called a bump test. You will need to try to activate the system to verify that it is actually locked out. In a group lockout situation, an authorized person, such as a supervisor, may perform the bump test for the workers. If workers feel that systems are not properly locked out or that energy isolating devices are defective, they have the right to refuse to conduct the work until each device is repaired or replaced. Ensure the system is inoperative by:

- Testing circuitry-make sure energy is drained in equipment with capacitors
- Attempting to cycle the system
- Activating control switches

Once the isolation has been verified the work may be completed according to the safe work procedures for that system.

It may be necessary to work on systems that are operational and energized in certain situations. Such as when you are:

- Troubleshooting a problem
- Making minor adjustments
- Testing machinery and equipment

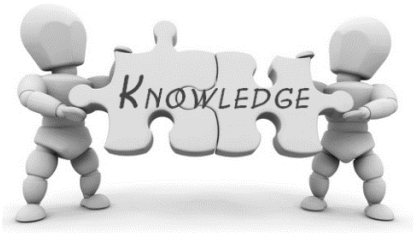
You should only work on energized systems if you can do so safely, and according to the manufacturers' specifications. If there are no specifications, employers need to implement safe work procedures for it.

STEP 6 - RETURN TO NORMAL OPERATIONS:

Once work's done, you can return the system to normal operation. At this point, locks and tags can be removed. However, do not remove them until you've:

- Ensured each worker involved is accounted for
- Ensured guards have been reinstalled on equipment
- Removed all tools from the work area
- Verified that controls are in a neutral position
- Ensured blocks, blanks, and other energy isolating devices have been removed
- Removed the locks and tags
- Cleared all workers from the area
- Restored systems back to their normal operations
- Ensured systems are in good working order
- Notified all workers that the work is complete and lockout/tagout devices have been removed

If an emergency occurs and the person who installed a lockout device is not available, a supervisor or other competent person can remove the lock, but only after they verify that no worker will be put in danger because of the lock's removal.



Quiz 3

1. Arrange the steps below into the correct lockout procedure.

Notification	Step 1:
Performing work	Step 2:
Return to normal operations	Step 3:
Isolation	Step 4:
Preparation	Step 5:
Controlling stored energy	Step 6:

2. If an emergency occurs, and the person who installed the lockout device isn't available, who can remove the lock?
    A) Anyone with a set of bolt cutters
    B) The custodian
    C) A supervisor
    D) No one

3. Which type of lockout should be used when there are multiple energy isolating devices and multiple workers involved in the work?
    A) Individual lockout
    B) Group lockout
    C) Complex group lockout

4. During a visual inspection, you should ensure that:
    A) The system is in a 'zero' energy state
    B) The system is in a 50/50 energy state
    C) The system is in a 75% energy state
    D) The system is in a 100% energy state

CHAPTER 5

RESPONDING TO INCIDENTS

After this chapter, you will be able to:

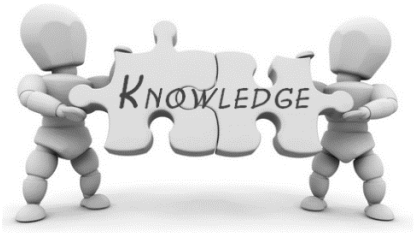
- Explain the term: Emergency response plan
- Describe the contents of a typical ERP

In the event of an emergency onsite, it is important to have a site-specific Emergency Response Plan (ERP) to ensure workers have the training and the practice they need to respond appropriately to emergencies.

An ERP needs to:

- Identify potential site-specific emergencies
- Identify communication procedures (e.g., call trees and methods of communication)
- Identify who is to be contacted (e.g., internal, and external notifications including emergency services, supervisors, and the fire department)
- Include contact information for all parties (e.g., emergency services and employee emergency contacts)
- Detail evacuation procedures and identify muster points
- Identify the location and operation of emergency response equipment
- Provide for emergency response training requirements
- Provide the first aid requirements and applicable training requirements
- Test the emergency response plan by conducting and documenting drills to make certain workers respond effectively
- Describe rescue procedures where required

All parties share the responsibility to be safe on a worksite. It is important that everyone is made aware of emergency response procedures, so they respond appropriately if challenged with an unplanned event.



Quiz 4

1. What needs to be included in an Emergency response Plan (ERP)?

   A) Evacuation procedures and identified muster points

   B) Emergency response equipment location

   C) Emergency response training requirements

   D) All of the above

CHAPTER 6

COURSE CONCLUSION

Review Course Objectives

After completing the course you can:

- describe a Hazardous Energy Control Program
- explain the terms lockout and tagout, and the lockout/tagout procedures
- locate hazardous energy control legislation
- discuss hazardous energy control roles and responsibilities
- identify, assess, and control hazardous energy hazards
- maintain and update the Hazardous Energy Control Program and documentation
- explain the six steps of the lockout procedure
- secure isolation in different ways; individual, group, and complex group
- explain emergency response procedures