Lockout:
de-energizing hazards

Version 2.0

Sixteen-year-old student Ivan Golyashov worked part-time to help supplement his family's income. He was described by co-workers as hard working, but in the end as one commented, "He was just a school boy." Golyashov was crushed to death when a co-worker mistakenly switched on the dough-making machine he was cleaning. One of the police investigators on the scene reportedly concluded, "If anything it was a lack of training."

What makes Ivan's death all the more tragic — just seven months before 18-year-old David Ellis was killed in a similar incident. He too worked part-time in a small bakery. Ellis, who was on his second day on the job, became entangled in a commercial dough mixer. The company was fined $62,500 under the *Occupational Health and Safety Act (the Act)* for failing to ensure that the exposed moving parts of the mixer were guarded. Under a similar provision of *the Act*, two supervisors who are co-owners and directors of the company, were also charged. One was fined $7,500 the other received a 20 day jail sentence.

Unfortunately Ivan's and David's deaths are not isolated incidents. According to the Workplace Safety and Insurance Board, thousands of workers file lost-time injury claims relating to machine guarding and lockout every year. Some are killed. Many more go unreported.

In 2013, 17 per cent or 2,737 of all orders issued by The Ministry of Labour, Immigration, Training and Skills Development inspectors under the Regulations for Industrial Establishments were for machine guarding and lockout violations. Workers in many other sectors face similar machine guarding and lockout-related risks.

What is lockout?

The term lockout refers to methods, devices and procedures for preventing the sudden and uncontrolled release of energy from a system, machine or piece of equipment. Workers can be injured when machinery starts up while performing repairs, or when power is restored after a power outage. Today, computer-operated equipment means that some systems can start and stop in even more unpredictable ways.

Since energy is what a lockout system attempts to eliminate or control, it is important to identify all active or potential sources of energy in the workplace.

Main energy sources provide power to a system such as electricity, pneumatics or hydraulics. **Stored or secondary energy** stays in the system after the main source is turned off. Stored energy includes electricity in batteries and capacitors, volatile chemicals in piping systems, or pistons that move back and forth after the equipment's power supply is turned off.

- **Electrical Energy:** Generated electricity, which can be stored in batteries or capacitors, transmits energy used to operate machinery and equipment. Contact with electrical energy can cause shock, burns and even death. Static electricity is a type of potential energy produced by friction between different materials. When not controlled through proper grounding, static electricity can be a fire and explosion hazard.
- **Hydraulic Energy:** A hydraulic system uses liquids under pressure to operate equipment. Examples of such equipment are lifting devices, such as a forklift truck, or electric pumps that move liquid under pressure along pipes or hoses. The energy generated by this form of pressure can exert great force. Risk to health can occur through direct contact or fire/explosion when the liquid escapes from the containment system.
- **Pneumatic Energy:** A pneumatic system uses pressurized air to move objects or operate equipment or machinery. Nail guns and power washers are examples of equipment powered by pneumatic systems. The energy is stored within pressurized air. Unexpected or uncontrolled release of pneumatic energy can cause a worker to be struck by an object or come into direct contact with pressurized air.
- **Mechanical energy:** This type of energy produces movement (rotational, reciprocating or transverse motion) used to activate equipment. It is often stored in the equipment allowing active parts like flywheels or blades to continue moving. Without proper lockout procedures workers could become caught in, punched or crushed by these moving parts.
- **Gravitational Energy:** Machine parts kept aloft by other sources of energy will naturally drop if lockout procedures are not put in place for that energy source. Lockout procedures must involve safeguarding from every potential energy source. In situations where risk is presented by gravity, the machinery must be blocked to prevent gravitational movement.
- **Thermal Energy:** Thermal energy is the heat generated by the movement of tiny particles within an object or system. Thermal energy can be created by chemical, electrical, mechanical or radiation sources. Welding equipment and steam are two obvious sources of exposure for workers. Air conditioners and condenser units can also be sources.
- **Chemical Energy:** This type of energy is stored in chemical compounds and released, often as heat, during a chemical reaction. Exposed workers can be injured from the heat or, in some instances, as a result of fire or explosion.
- **Radiant Energy:** There are two types of radiation—ionizing and non-ionizing. Ionizing radiation, like x-rays and gamma rays can damage human cells and cause mutations, cancer and birth defects. Non-ionizing radiation is electromagnetic which can cause electric shocks, burns, eye damage and fires from sources such as arc-welding and laser beams.
- **Multiple Energy:** Multiple energy is when these different sources of energy are combined to create a more complex and hazardous environment. The two types include:

  1) a system with one type of energy with more than one point of control

  2) a system with more than one type of energy.

It is crucial to identify all points and types of energy.

What is the law in Ontario?

Specific lockout requirements can be found in the sectoral regulations under the *Occupational Health and Safety Act (the Act)*.

For instance, Ontario employers governed by the Regulation for Industrial Establishments have significant legal obligations when it comes to protecting workers from the starting of a machine, transmission

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machinery, device or other thing (s. 76, O. Reg. 851/90—Industrial Regulations). They must ensure control switches or other control mechanisms are locked out and other precautions needed to prevent start up are in place. They must also provide information, instruction and supervision to a worker to protect the health or safety of the worker from lockout-related hazards (s. 25(2)(a), *Occupational Health and Safety Act).*

The Ontario The Ministry of Labour, Immigration, Training and Skills Development has also published specific guidelines for farming operations assisting them to comply with specific requirements under the *the Act* and regulations.

What are the elements of a good lockout program?

In assessing energy hazards it's important to consider all paths of energy from each piece of equipment, machinery, or other device and all components which comprise them. Effective control of energy hazards means achieving a zero energy state. This means that all forms of energy in a machine or system have been isolated or controlled thereby ensuring no worker is exposed to any active or moving part. When equipment or machinery is in operation, this is achieved through a variety of guards and engineering controls. These controls however are often disabled or removed during installation, service, maintenance or repair operations.

It is during these operations especially that lockout methods, devices and procedures must be used.

Lockout methods

Isolation ensures the main energy supply to equipment is physically cut off. Most effectively this means disconnecting the main energy source and making it impossible for equipment to be accidentally re-energized.

Other controls must also be used to neutralize all stored energy that remains in the system. Some neutralization methods include using a chock or wedge to prevent unexpected movements of parked vehicles; waiting for hot equipment to cool or rotating parts to stop; and bleeding-off valves or lines of residual liquid or pressurized materials (although, never vent toxic, flammable, or explosive substances directly into the atmosphere).

Lockout devices

Depending on the type of equipment and the energy it contains, there are a variety of lockout devices that can be used. Personal locks are commonly assigned to an individual worker for his or her use only — the essential principle being one worker, one lock, one key. Other devices include multiple lock adapters, master padlocks, chains, slings and cables, insulated fuse pullers, blanks or caps, blocks and pin, along with the use of tags, stickers and record logs.

Lockout procedures

The best lockout devices alone will not prevent serious injury. For a lockout system to be effective a detailed written policy and accompanying set of lockout procedures should be communicated in writing and reinforced through specific training. The policy should also clearly identify when lockout procedures should be used, who is qualified and who has the authority to perform lockouts.

It is especially important to be vigilant about lockout procedures when situations arise that are out of the ordinary. For instance when shift work or a changeover requires lockout knowledge to be transmitted from one person to another; when there are new or inexperienced workers; or when there are contractors or visitors on site to perform work on systems or equipment; or in cases when an employee has inadvertently failed to remove a lock at the end of the day.

Some workplaces employ the use of safe work permits. These are used to verify that lockout has been applied and the system is safe to work on. These precautions are routinely used for locking out systems involving high voltage confined spaces, robots and systems that contain hazardous chemicals.

Like any set of safe work procedures lockout procedures must be adapted to fit the needs of each workplace, system and piece of equipment that poses a hazard. The joint health and safety committee can play an important role in inspecting the workplace for energy hazards and developing an appropriate lockout program. Here are some key questions to keep in mind when designing your lockout program.

- Who is authorized to lockout?
- Have you identified all relevant energy sources?
- Where are all relevant energy components, disconnect points, blocking, discharging and bleeding points?
- Should associated and/or adjoining equipment be locked out?
- What special hazards or considerations exist (eg. High-speed rotary blades contain stored energy and must take time to spin down.)?
- Do you have a step-by-step lockout procedure? Has it been customized to address the unique hazards of each piece of equipment or machinery?
- Is there a procedure for testing and verifying the lockout?
- Have you developed a step-by-step lock and tag removal procedure?
- Do you have a comprehensive training program in place?
- When purchasing machines and systems is priority given to those which workers can most easily control for hazardous energy?

Similarly each and every lockout procedure must be designed to anticipate the hazards specific to each system or piece of equipment. Any effective lockout procedure will involve these minimum steps.

1. Shutdown the system or equipment.
2. Verify that all moving parts have stopped.
3. Lock and tag each energy-isolating device in the proper sequence and with appropriate lockout devices. (Be sure to use durable tags and your own personal locks with only one existing key for each lock, which you hold.)
4. Verify that each lockout has accomplished its purpose and that equipment is completely isolated from all energy sources.
5. Neutralize all stored energy.
6. Verify that the system has been neutralized.

NOTE: As stated above, training is an essential component of any effective lockout system. For more detailed information on lockout or to schedule a lockout training program contact a WHSC training services representative near you.

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