Hazardous Energy Control Programs

What is hazardous energy?

Hazardous energy is defined: “any electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, thermal, gravitational, or other energy that can harm personnel”. 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.

In this document, 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.

What are types of energy?

Electrical energy is the most common form of energy used in workplaces. It can be available live through power lines or it can also be stored, for example, in batteries or capacitors. Electricity can harm people in one of three ways:

1. By electrical shock.
2. By secondary injury.
3. By exposure to an electrical arc.

Hydraulic potential energy is the energy stored within a pressurized liquid. When under pressure, the fluid can be used to move heavy objects, machinery, or equipment. Examples include: automotive car lifts, injection moulding machines, power presses, and the braking system in cars. When hydraulic energy is released in an uncontrolled manner, individuals may be crushed or struck by moving machinery, equipment or other items.

Pneumatic potential energy is the energy stored within pressurized air. Like hydraulic energy, when under pressure, air can be used to move heavy objects and power equipment. Examples include spraying devices, power washers, or machinery. When pneumatic energy is released in an uncontrolled manner, individuals may be crushed or struck by moving machinery, equipment or other items.

Chemical energy is the energy released when a substance undergoes a chemical reaction. The energy is normally released as heat, but could be released in other forms, such as pressure. A common result of a hazardous chemical reaction is fire or explosion.

Thermal energy is energy from an explosion, flame, objects with high or low temperatures or radiation from heat sources. Common injuries include burns, scales, dehydration, frostbite, etc.

Radiation energy is energy related to ionizing, low-frequency electromagnetic, optical, or radio-frequency electromagnetic radiation. Effects may include burns, changes to genetic material or reproductive systems, or functional disorders (headache, insomnia, nervous breakdown, etc.).

Gravitational potential energy is the energy related to the mass of an object and its distance from the earth (or ground). The heavier an object is, and the further it is from the ground, the greater its gravitational potential energy. For example, a 1 kilogram (kg) weight held 2 metres above the ground will have greater gravitational potential energy then a 1 kg held 1 metre above the ground.

Mechanical energy is the energy contained in an item under tension. For instance, a spring that is compressed or coiled will have stored energy which will be released in the form of movement when the spring expands. The release of mechanical energy may result in an individual being crushed or struck by the object.

It is important to understand that all of these energy types can be considered as either the primary energy source, or as residual or stored energy (energy that can reside or remain in the system). Primary energy source is the supply of power that is used to perform work. Residual or stored energy is energy within the system that is not being used, but when released it can cause work to be done.

For example: when you close a valve on a pneumatic (air) or hydraulic (liquid) powered system, you have isolated the system from its primary energy source. However, there is still residual energy stored in any air or liquid that remains in the system. In this example, removing the residual energy would include bleeding out the liquid, or venting out the air. Until this residual energy is removed from the system, work can occur, whether on purpose or inadvertently.

Not properly assessing and dissipating stored energy is one of the most common causes for workplace incidents that involve hazardous energy. Control of hazardous energy includes isolating the system from its primary power source **and** residual energy.

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, designs and methods to protect personnel from injury due to the inadvertent release of hazardous energy. 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. Therefore, lockout is one way in which hazardous energy control can be achieved.

What is the purpose of a hazardous energy control program?

In most cases, equipment or systems will have safety devices built in. These safety devices include barrier guards and safeguarding devices to help protect workers during normal operations. 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.
- Contact with a hazard when guards are removed or safety devices have been by-passed or removed.

What methods, other than lockout, exist to control hazardous energy?

Lockout is generally viewed as the most reliable way to protect an individual from hazardous energy because you are bringing the system to a zero energy state. When a system is in a zero energy state the hazard has been eliminated; thus, no hazardous energy exists. However, in some cases, using lockout is not practical because of its impact on operations and various other functions. Therefore, other controls can be implemented as long as adequate risk reduction of the hazard is obtained. This type of control means following a full set of steps to determine the hazards and risks of each task being performed, and determining what controls can be used to minimize and reduce risk to an adequate level. If an adequate level of risk cannot be achieved, then lockout will be the default method of control.

What are the steps involved in developing a Hazardous Energy Control Program?

Hazardous energy control programs involve 5 general steps:

1. Gather information.
2. Perform a task analysis.
3. Perform a hazard and risk analysis.
4. Implement controls.
5. Communication, including training.
6. **Gather Information**

Determine all types of hazardous energy within your workplace that should be covered by the program.

Next, gather documentation from the manufacturer or designer of each system about:

- Where energy isolating devices are located and procedures for their use.
- Step-by-step procedures for servicing or maintaining the system.
- How to safely address malfunctions, jams, misdeeds, or other planned and unplanned interruptions in operations.
- How to install, move, and remove any or all parts of the system safely.

This information will allow you to understand how the system was intended to be used, and will provide you with recommendations on how the tasks can be performed safely.

2. **Perform a Task Analysis**

A task identification analysis is performed by examining all the intended uses of the system from the perspective of both the manufacturer and the user. List all tasks and steps required to accomplish the task. This analysis should also include any tasks related to any possible misuse of the system. When performing the task identification, at a minimum, consider the following categories:

- Machine/process set-up.
- Teaching and programming of machinery.
- Tryout and start-up.
- All modes of operation.
- Product feeding into machine/process.
- Product takeoff from machine/process.
- Process/tool changeover.
- Normal stoppages and restart.
- Unscheduled stoppages (control failure or jam) and restart.
- Emergency stoppages and restart.
- Unexpected start-up.
- Fault-finding and troubleshooting.
- Cleaning and housekeeping.
- Planned maintenance and repair.
- Unplanned maintenance and repair.

3. **Perform a Hazard and Risk Analysis**

Based upon the information from the first two steps, perform a hazard and risk analysis of how workers will be interacting with the system. This analysis should outline where possible hazards are, and what the associated risk of each hazard exists.

The hazard and risk analysis will outline all situations where a worker could be exposed to hazards. Examples include:

- A press cycles accidentally while a worker is changing a die.
- An injection moulding machine gate closes while a worker is in it.
- A robot moves while a worker is trying to program it.
- A hydraulic hose releases pressurized fluid when it is removed for maintenance purposes.
- A barrier or guard has been removed or by-passed.

4. **Implement Controls**

The controls required will follow what hazards and risks were identified during the analysis and assessment. For example, identify what types of hazardous energy are present in a system that needs to be controlled, and what types of energy-isolating and de-energizing devices are required.

5. **Communication, including Education and Training**

Communicate with, and educate and train appropriate staff on how the program works, their role in the program, and what their responsibilities are.

As with all occupational health and safety management system policies or procedures, include mechanisms for documentation, records, feedback, and continuous improvement.