Always Practicing Safety!

Hazardous Energy and Lock Out/Tag Out

Over the past few weeks I've included ORPS reports from hazardous energy control incidents across the complex. The proper identification, precautions, control and zero-energy verification are vital for the safety of ANYONE working on -or in the vicinity of- hazardous energies.

Control of hazardous energy has a set of requirements codified in the OSHA Rule, 29 CFR 1910.147 *The Control of Hazardous Energy (Lockout/Tagout),* which defines *Energy Source* as "any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other energy." The Rule requires employers to develop an Energy Control Program, such as Argonne's ESH-7.1 *Control of Hazardous Energy and Lockout/Tagout*.

While these programs are commonly referred to as LO/TO and associate with electrical energy, they apply to all the types of energy sources listed above, and further defined below.

What is Hazardous Energy?

Electrical energy is the most commonly identified form of energy in workplaces. It can be available through power lines, induced, or it can be stored, for example, in batteries or capacitors.

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 molding machines, power presses, and the braking system in cars.

Pneumatic potential energy is the energy stored within pressurized air or gasses under pressure. Like hydraulic energy, when under pressure, air or gasses can be used to move heavy objects and power equipment. Examples include spraying devices, compressed gas systems, or pneumatic powered machinery.

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. An extreme result of a hazardous chemical reaction can be fire or explosion.

Thermal energy – what we experience as heat or cold is commonly produced by mechanical devices (combustion and/or friction), electrical resistance, and chemical reactions (or changes of state like cryogenic materials). Thermal energy can be controlled and/or dissipated. Burns can occur due to both heat and cold, and the severity of a burn depends on temperature and duration or contact. According to a publication from NASA, the threshold for injury due to contact with hot liquids (which can cause burns or scalding) is 135˚F. Hot surfaces can vary by duration of contact with a maximum temp of 157˚F for a 1 second contact to about 115˚F for continuous contact (greater than 1 hour) and 5 minute contact equal to about 135˚F continuous contact. The threshold for injury to tissues due to cold is slightly below freezing -27˚F- at deep tissue with surfaces less than 0˚F being the limit for short term contact without controls or PPE. All cryogenic liquids present a cryogenic burn hazard. Contact hazards with hot or cold surfaces are typically controlled with insulation, personal protective equipment (PPE), and/or time sufficient to allow cooling or warming.

Non-Ionizing Radiation energy is energy from electromagnetic sources. This energy covers all radiation from visible light, lasers, microwave, radio frequency (RF), infra-red (IR), and ultraviolet (UV).

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,

J. McGhee 7/23/2017, updated 7/25 for aps

the greater its gravitational potential energy. The potential impact and crushing force is the concern.

Kinetic energy is the extra energy an object possesses due to its motion. Setting an object into motion requires that the object be accelerated to attain motion, and this energy.

Mechanical potential 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.

Primary, Potential, Residual and Stored Energy

It is important to understand that all of these energy types can be considered as a primary energy sources, but you can create a potential energy source when you isolate a primary source and have residual or stored energy residing or remaining in the system after the primary energy source is isolated.

The primary energy source is the energy 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 downstream system -such as the hoses from the tank or pump- from its primary energy source. However, there is still residual energy stored in any air or liquid that remains in the hoses. In this example, removing the residual/stored energy hazard would include a step where bleeding out the liquid or venting the air is accomplished to reach a zero-energy state. Until this residual energy is removed from the system, a hazard is present.

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/stored energy from the system coupled with a zero-energy verification of the complete system.

Some systems have multiple energy sources, for each of these there is required to be a detailed procedure for isolation of energy sources, any processes or procedures for releasing residual or stored energy and how to perform zero-energy verifications for each energy source and location.

Lockout/Tagout is the Same as Hazardous Energy Control, Right?

NO! It is not. 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. LO/TO is the placement of a lock and/or tag on an energy-isolating device in accordance with an established procedure and is coupled with the requirements of the hazardous energy program, such as verification of zero energy state, notification of affected employees etc. to provide effective control and prevent injuries.

Zero-Energy Verification

The final and most critical step, in preparing to work on a system following the control of the hazardous energies involved is the zero-energy verification.

This process provides assurance that the system or component on which you are about to work on, or others will be in the vicinity of when you are performing work has been put into a safe configuration without any hazardous energy that can be released.

Failure to complete a zero-energy verification is a failure of the hazardous energy control program.

J. McGhee 7/23/2017, updated 7/25 for aps