

HAZARDOUS ENERGY CONTROL WORKING GROUP

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Overall Goals and Deliverables

- Support for LBL Data Gathering Effort
- Best Practice – Hazardous Energy Control Procedure
- Electrical Safety Month 2014

LBL Data Call

- Please provide data to me or directly to Stefanie Collins by Monday
- Critical to ensure that they can get the adequate benchmarking
- Will be useful in other site's management of construction hazardous energy control

Group I – Electrical Safety Month

- Overall theme – Hazard identification and recognition
 - Issue: Qualified and unqualified workers continue to fail to recognize that activities and equipment may expose them to electrical hazards
- Deliverables:
 - 3-4 topical presentations
 - Other training/visual aids
 - Follow-on support
- Finalized at IEEE workshop in February

Targeted Areas

- Three primary subject areas
 - Hazard Identification:
 - At Work
 - General Workers, Contractors
 - At Home
 - GFCI, AFCI, etc.
 - On Leisure
 - Hotel hazards, swimming pools, carnivals etc.
- Group will continue to develop content, with final outbrief to committee at Spring Meeting / IEEE Workshop

Group II – Combined Hazardous Energy Control Procedure – Best Practice

- Goal – resolve basic conflicts between various standards to provide something that sites can reference in support of their lockout/tagout programs
 - Use of controls as energy isolation
 - When does LAB apply, especially during construction
 - Construction vs. General Industry vs. OSHA vs. 70E. vs. ANSI Z244.1
- Deliverable – draft LOTO procedure with most holes filled in, with follow-on assignments to fill in the holes by the end of the FY suitable for inclusion as BP on EFCOG website and ultimately as an appendix to DOE ES Handbook

WORK CONTROL AREA

Richard Waters, INL

LOCKOUT / TAGOUT HAZARDOUS ENERGY THRESHOLDS

Purpose

To identify complex-wide LOTO hazardous energy thresholds and compile them into a single reference table.

Approach:

Hazardous energy lockout tagout thresholds were collected from the following sites, reviewed and integrated into a single guidance table:

- Y-12
- Idaho National Lab
- Stanford Linear Accelerator Center (SLAC)
- Pantex
- Savannah River Site
- EFCOG Electrical Severity Measurement Tool Rev. 3

Hazard Energy Levels and Application of LOTO

Energy Form	Consider use of LOTO based on Evaluated Hazard	LOTO Required
Electrical (AC and DC)	< 50V AC or DC and < 1000 W OR <10 J stored energy in a capacitor	Per DOE FAQ to ORPS order
Thermal (Hot)	Liquids or gases < 120°F Surfaces < 140°F (Surfaces are defined as having no leakage of liquid or gas outside of the pipe, containment, vessel, etc.)	Liquids or gases ≥ 120°F Surfaces ≥ 140°F
Thermal (Cold)	Liquids and surfaces ≥ 27°F (Surfaces are defined as having no leakage of liquid or gas outside of the pipe, containment, vessel, etc.)	Liquids and surfaces < 27°F
Mechanical Motion (Kinetic)	Each situation must be evaluated	
Potential	Each situation must be evaluated	

Hazard Energy Levels and Application of LOTO (cont.)

Energy Form	Consider use of LOTO based on Evaluated Hazard	LOTO Required
Pneumatic (Compressed Gas) *Does not apply to cylinder changeout	$\leq 2''$ Nom. Pipe and ≤ 150 psig OR $\leq 4''$ Nom. Pipe and ≤ 40 psig OR $\leq 6''$ Nom. Pipe and ≤ 15 psig	> 150 psig (any size) OR $> 2''$ Nom. Pipe and > 40 psig OR $> 4''$ Nom. Pipe and > 15 psig OR $> 6''$ Nom. Pipe (any psig)
Hydraulic (Fluids)	≤ 150 psig OR Any fluid with flash point $> 200^{\circ}\text{F}$	> 150 psig OR Any fluid with flash point $\leq 200^{\circ}\text{F}$
Chemical (including explosive/flammable liquids and gases)	Each situation must be evaluated	
Lasers	Class 3B or Class 4- Each situation must be evaluated; contact the Laser Safety Officer (recommended for Class 3A)	
Ionizing Radiation	Each situation must be evaluated; contact the Radiation Safety.	

OVERALL PROGRAM DEVELOPMENT

Program Development

- Accomplishments
 - Plug and Cord, Minor Tool Change controls
 - Alternative Isolation Methods
 - Controls (ANSI Z244.1)
 - Air Gap
 - Temporary Guarding
 - Alternative Verification Methods
 - Lamps
 - External Test Points
 - Other Groups – covered work control areas and hazardous energy definitions

Still to do

- Finish LOTO Procedure
 - General guidelines (1910.147 / 70E Art. 120)
 - Basic
 - Complex
 - “When to use” table (LBL Guidelines table)
 - Group control
 - Vehicle hazardous energy control
 - Construction hazardous energy control
- Gain Consensus
 - Best Practice (9/30/14)
 - ES Handbook Appendix (next revision)
 - Designed as guidance for the complex, not a hard and fast methodology BUT will provide some guidance on “tricky” situations to aid sites

Backup Slides

Energy Forms

Electrical (AC and DC)

Electrical energy includes all electrical power sources including control power, capacitors, batteries, and static energy. The threshold for hazardous electrical energy is 50 volts. Energy levels less than 50 volts should be evaluated for additional hazards (arc flash, high current, thermal, explosion, system impacts, etc.) to determine if LOTO is needed.

Energy Forms

(cont.)

Thermal

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). 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. The threshold for injury due to contact with hot liquids (which can cause burns or scalding) is 120°F (52°C). The threshold for injury to tissues due to cold is slightly below freezing (27°F [-3°C]). 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.

Energy Forms

(cont.)

Mechanical Motion/Kinetic

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, if hazardous, must be dissipated. No threshold is proposed for kinetic energy; each situation must be evaluated.

Potential

Potential energy can be thought of as the energy stored within a physical system. Objects at an elevated level, for instance, contain more potential energy than when they are physically lowered.

Potential energy can be eliminated by lowering an object in a controlled manner.

Potential energy is also stored in a compressed spring, which can also be released in a controlled manner. No threshold is proposed for potential energy; each situation must be evaluated.

Energy Forms

(cont.)

Pneumatic and Hydraulic

Pneumatic and hydraulic energy refers to the energy inherent in the pressure that a gas or liquid is under. Pressure is generally expressed as psig (pound-force per square inch gauge), which expresses pressure relative to the surrounding atmosphere. A system can be under positive pressure (greater than atmospheric pressure) or negative pressure (vacuum).

Pneumatic refers to pressurized air or gas, as in compressed air or gas in a compressed gas cylinder. Hydraulic refers to pressurized liquid, such as water in a hose pressurized by a pump. Releasing pneumatic or hydraulic pressure involves identifying the pressure source. If equipment is producing pressure, turn it off. If the pressure is stored, allow it to release or dissipate under controlled conditions.

Note This section discusses non-hazardous gases; hazardous gases and liquids at any pressure must be locked out due to their chemical hazards (for example toxic, flammable, reactive).

Energy Forms

(cont.)

Pneumatic Injury

Provided that skin and eyes are protected and no potential for deadheading (point blank exposure of the jet to bare skin) exists, the pressure required to inflict pneumatic jet injuries to healthy unbroken skin is over 600 psi.

Pneumatic sources directed at eyes or ears can cause injuries at significantly lower pressures, depending on the proximity and diameter of the jet. The federal Occupational Safety and Health Administration (OSHA) places the threshold for air pressure that can penetrate through open wounds or cause damage if directed at body openings at 30 psig.

Note: The OSHA limit of 30 psi for using compressed air to clean clothes does not protect from particulates that may be generated by cleaning with pressurized air below 30 psi.

Energy Forms (cont.)

Hydraulic Injury

The pressure required to break intact healthy skin delivered by a hydraulic jet is more than 600 psi. Depending on the diameter of the jet and distance between it and the affected area, much lower pressures are hazardous to eyes, ear drums, and open wounds. Hydraulic injection injuries at distances up to 4 inches between the skin and jet have been recorded. In larger piping systems, a hazard may be present if the liquid momentum conveyed by water and other liquids is sufficient to knock a worker down.

Compressed Air and Water Utility Systems

Nearly every industrial or commercial installation uses utility water or compressed air systems operating at pressures up to 150 psig. Common practice has shown that wearing normal PPE such as coveralls, gloves, and safety glasses provides worker protection and lockout is not normally used or required for servicing and maintenance of these systems. The need for lockout may be indicated at relatively low pressures in such systems due to secondary factors such as working at elevation, since a sudden release could activate the startle reflex that may cause a fall. Take into account all secondary hazards present in a particular work environment.

Energy Forms (cont.)

Chemical

There is no threshold below which it can be categorically stated that no hazard exists for a system that may release hazardous chemical solutions at any pressure. This also applies to systems that contain flammable liquids or gases or any gases with a potential of creating a hazardous atmosphere, including gases used for fire suppression systems. Lockout may be necessary based on the hazardous properties of the chemical or to prevent a chemical release that poses environmental consequences.

Lasers

Where workers could be exposed to beams from Class 3B and Class 4 lasers while performing service or maintenance on those systems, procedures to achieve control of hazardous energy must be evaluated, including the possible need for lockout. Lockout may apply in such situations as :

- Connecting or disconnecting fiber terminations if the fiber transmits Class 3B or Class 4 laser radiation
- Maintenance or service work on equipment associated with a laser transport line

Energy Forms (cont.)

Ionizing Radiation

When the potential exists for a worker to exceed an administrative control level in a short time period, consider the use of lockout as part of the work planning phase.

Lockout may apply:

- To prevent external radiation exposure during service or maintenance of radiation-generating devices
- To prevent external radiation exposure during use of exposure systems with sealed sources having pneumatic or mechanical transport systems