Lockout / Tagout Refresher Training

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Motivation

1. A Tri-partite review of the LOTO program exposed several misunderstandings of the purpose of LOTO and how it is implemented.

2. Many workers have maintained their certification to perform LOTO through passing the on-line exam, and may not have reviewed the training materials to stay up-to-date on the LOTO program and its requirements.

3. The LOTO program is an integral part of the Work Planning and Hazard Analysis Program, and is a primary way that we mitigate those risks identified by the HA process.

4. As always, we want to have a safe workplace – for all the right reasons
Topics to be covered

1. Review how LOTO fits into our overall safety program.
2. Review portions of the LOTO program that the interviews and field observations revealed were not well understood or properly implemented.
3. Describe changes to the tags that are used for Configuration Control to follow ASSE / ANSI 535.5.
Beyond Lockout / Tagout: How LOTO fits with the rest of our safety program
Beyond LOTO: **Hierarchy of Control**

- The National Institutes of Safety and Health (NIOSH) has published the *Hierarchy of Controls* as a guide to the most effective ways to mitigate hazards to workers.

![Hierarchy of Controls Diagram](image)

Image courtesy of NIOSH
Beyond LOTO: Hierarchy of Control

- Some versions of this hierarchy add “Awareness” between Engineering and Administrative Controls.
- LOTO is only an administrative control – second from last.
- The more effective controls should be addressed before proceeding to use LOTO.
- There is nothing wrong about “defense in depth,” employing multiple levels and types of hazard controls.
Beyond LOTO: **Risk Management**

- Risk management is not just an ESH&Q concept.
- A risk can even be good, like a winning lottery ticket.
- Risk is simply the combination of the likelihood of an event occurring and the magnitude of its consequences.
- Risk Management is understanding where our exposure to risk is the greatest, and taking the actions and making the plans to mitigate them or prepare for them.
- LOTO is one of the means we use to minimize an undesirable risks.
Beyond LOTO: Work Planning & Hazard Analysis

- LOTO is an important part of Fermilab’s Work Planning and Hazard Analysis program [FESHM Chapter 2060].
- The goal of work planning is “… to initiate thought about the hazards associated with work and how it can be performed safely ”
- “Work planning ensures…
  - “the scope of the job is understood
  - “appropriate materials are available
  - “all hazards have been identified
  - “mitigation efforts established, and
  - “all affected employees understand what is expected of them”
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  - “mitigation efforts established, and
  - “all affected employees understand what is expected of them”
- Note that LOTO is only the “mitigation efforts” part of Work Planning and Hazard Analysis.
Beyond LOTO: Work Planning & Hazard Analysis

- LOTO is part of Hazard Analysis
Beyond LOTO: Work Planning & Hazard Analysis

- Some risks are not addressed by LOTO
Beyond LOTO: Work Planning & Hazard Analysis

- For some jobs, the LOTO procedure may be all you need

HAZARD ANALYSIS

- Exposed electrical conductors
- Gravity

MITIGATION

- Compressed Fluids
- Loaded spring

LOCKOUT / TAGOUT
Beyond LOTO: Emergency Response

- Planning for emergencies can save lives and minimize other potential consequences.
- Not just “Call 3131!”
- Will someone be left standing to make the call?
- Will others besides those in the work crew be affected?
- What will you do while waiting for the Fermilab Fire Department to arrive?
- What will you NOT do?
- What special equipment might you or the Fermilab Fire Department need?
- Do you know where an AED is? A first aid kit? Is your co-worker trained in CPR?
Beyond LOTO: Pre-job Briefing

- Clarify the scope of the work
- Identify hazards that might not be part of a standard Hazard Analysis form, e.g. wasp nest, cold/hot ambient temperatures, slippery surfaces
- Ensure consistent understanding of the work by all crew members
- Opportunity for feedback and questions from all crew members
Beyond LOTO: Questioning Attitude

- Even the best work planning can’t identify everything that could possibly happen or be found.
- When planning doesn’t agree with reality, reality wins.
- Maintain an awareness of the overall work area. It’s easy to get “tunnel vision” and focus only on the task you’re doing.
- Don’t be afraid to pause work when something doesn’t seem right.
- S.T.A.R.
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- S.T.A.R.
  - Or as our FESS-OPS personnel capture that moment when you realize all is not as you expected, “Shoot, That Ain’t Right!”
Key Elements of Lockout / Tagout
If this refresher could deliver only a single message, this is it
This is the most vital step in the LOTO procedure
If you have not demonstrated that your isolation step has actually removed the hazardous energy, you (and your co-workers) may still be at risk

- Notify affected workers
- Prepare to apply LOTO
- Shut down the equipment or system normally
- Isolate and release hazardous energy
- Apply Lock and Tag to energy isolating devices
- Verify hazardous energy is removed
Actually, it always has been about all forms of hazardous energy, but electrical received more attention.

These other hazards can cause injuries just as severe as electricity shock or arc-flash:

- Pressurized gases and liquids
- Corrosive & Flammable Chemicals
- Mechanical
- Gravity
- Springs
- Lasers
It’s not just for electrical anymore

Multiple errors in work planning contributed to this pressure-release fatality.

- Subcontractor employees unfamiliar with the site and work
- No written LOTO procedure for this equipment and system
- No LOTO locks or tags applied
- Verification step not performed before starting the fatal task
- Built-up pressure was equivalent to 400 grams of TNT

21 October 2015, National High Magnetic Field Laboratory, Florida State University, Tallahassee, Florida. Blind flange (missing) killed subcontractor worker by blunt force trauma.
Like electricity, pressure hazards are not directly visible. We have to rely on gauges and meters to inform us about pressure hazards – and gauges and meters can fail.

Personnel performing LOTO on pressure systems will soon be required to take a Pressure LOTO class, which is similar in purpose to the Electrical Safety in the Workplace (NFPA 70E) class the personnel performing electrical LOTO must take.
LOTO reinforcement #3

To LOTO or not to LOTO

LOTO applies to:

• The **control of hazardous energy** during **service and maintenance** of equipment
  • The hazardous energy may be supplied to or contained in the equipment being serviced
  • The hazardous energy might also be supplied to or contained in another piece of equipment that is close enough to the equipment being serviced that the workers are exposed to the adjacent hazardous energy.
  • An example would be plumbers working a roof drain pipe that runs very close to overhead crane power rails. The plumbers would apply LOTO to the crane rail disconnect switch.
To LOTO or not to LOTO

LOTO is not appropriate for:

- **Controlling hazardous energy** when servicing or maintenance is **NOT** being performed
- **Protecting personnel** who are not performing the servicing or maintenance activity from hazardous energy.

If the situation fits one of these two descriptions, do not use LOTO! Use configuration control locks and tags instead.

Placing a lock to protect equipment or persons other than yourself is not LOTO, so don’t use LOTO locks to do that.
Lesson learned from Fluor – Idaho

• On Oct. 04, 2017, an equipment operator returning a forklift to a parking/storage area after use went to hook up the engine warmer cord from a "hot line" and realized that the cord’s plug had been cut away at some undetermined time when the unit had apparently been driven away with the engine warmer still plugged in.

• The use of the Level I LOTO lock as a configuration control on the end of the wire, when servicing and maintenance was not being performed, was not in compliance with company LOTO procedure
The LOTO tag identifies who is protected by the LOTO.

- Unfortunately, one of our standard tags reads “Signed By”
- Many tags have been found with a semi-legible scrawl.

Please print your name on your LOTO tag **neatly** and **legibly**, preferably with a permanent black “Sharpie” type marker.

- Use a LOTO tag with the clear plastic adhesive flap if the tag will be placed outdoors or in a harsh environment.
Fermilab policy: Tagout-only LOTO is permitted only when we are physically unable to place a lockout device, even with the use of various adapters.

- What we were missing: OSHA 1910.147(c)(6)(i)(D) requires that the affected employees, in addition to the authorized employees, be trained when a tagout-only LOTO is used.
- If you use a tagout-only LOTO, affected employees (those who work near the equipment placed under LOTO) must be trained to identify the tagout-only LOTO and what they should or should not do when it is in place.
- If this is a group LOTO, all the Authorized Employees have to be trained too, because they’re also affected by the LOTO.
- If you use tagout-only LOTO, please let your DSO know so we can review the installation and see if it can be improved to accept locks.
OSHA 1910.147 does not specify an interval after which a LOTO placement expires

- LOTO tags were found in main ring service buildings dating back to the Tevatron shutdown in 2011
- Some LOTO tags on outdoor electrical gear were illegible because of fading

- These LOTO tags had to be removed and replaced with configuration control locks and tags since no servicing or maintenance was occurring.
For how long a LOTO you have placed remains effective is your judgement call

- When in doubt, check placement of LOTO locks and tags and repeat the verification steps to confirm that hazardous energy is still controlled
- Are there affected employees that should know you’re restarting your servicing or maintenance after a delay? Notify them!

If the equipment must remain locked out but no work will be done for more than a week or so, convert it to configuration control.

- You will need to re-perform the LOTO application process when you restart work
Two methods of performing group LOTO

• Type A:
  – Most often simpler
  – Best with only a few crew members and a few Energy Isolating Devices
  – All Authorized Employees must verify

• Type B:
  – “B” stands for “box”
  – Accommodates many crew members and Energy Isolating Devices
  – Limits weight and volume of locks on Energy Isolating Devices
  – Only Lead Authorized Employee must verify
  – Accommodates Non-Authorized workers
Clarifying when alternative removals are permitted

- **OLD Criteria:**
  - Employee is “not reasonably available” and equipment is “programmatically urgent”

- **New Criteria:**
  - The person who placed the LOTO device(s) is absent from the Fermilab site and it is difficult or impossible for them to promptly return.
  - The locked-out or tagged-out equipment must be returned to service before the person who placed the LOTO device(s) can return to the site.
  - Alternatives to removing the absent person’s lockout or tagout devices have been evaluated and do not meet laboratory mission needs

- Your supervisor must notify your Division Safety Officer and the DSO must give approval before an alternative LOTO removal is performed!
LOTO reinforcement #9

Written procedure inspection

Two people perform annual written procedure inspections

- Knowledgeable Person – local LOTO-authorized expert on equipment.
- Inspector – LOTO Authorized Employee, but not one of the employees that is trained on the specific written LOTO procedure
- Inspector provides annual training for employees authorized on written procedure

What if a written procedure goes over a year without an inspection?

- The inspection process must be completed before the procedure is used.
- The first use of the procedure can count as the inspector’s observation.
LOTO is permitted to NOT be done if it would result in “additional or increased hazards” or it is “infeasible due to equipment design and operational limitations”

- The decision about whether a particular installation or circumstance meets these criteria is to be made by a Department Manager or more senior personnel.
- The evaluation should be documented and follow the risk analysis process described in Fermilab Quality Assurance Manual 12030, *iTrack Procedures and Risk Assignment*
Similar equipment in a single location presents opportunities for errors leading to property damage, injury, and death.

- 12 September 2018, electricians working at the Central Utility Building (CUB) were assigned to disconnect power wiring to LCW Pump 7 at, which is located between Pumps 6 and 8.
Similar equipment in a single location presents opportunities for errors leading to property damage, injury, and death.

- Electricians LOTOed pump 7’s starter and circuit breaker
Look-alike Equipment

Similar equipment in a single location presents opportunities for errors leading to property damage, injury, and death.

- Pump 6’s motor bore an outdated label identifying it as pump 7.
- This motor had previously been used to run pump 7, but had been serviced, and then reinstalled to serve pump 6, but the “LCW-7” label was never removed.
Similar equipment in a single location presents opportunities for errors leading to property damage, injury, and death.

- Based on the erroneous label, an electrician disconnected the wires and conduit on Pump 6.
Similar equipment in a single location presents opportunities for errors leading to property damage, injury, and death.

- Without correct LOTO in place, automatic or manual controls could have caused Starter 6 to energize the wires on which the electrician was working.
Look-alike Equipment

Similar equipment in a single location presents opportunities for errors leading to property damage, injury, and death.

- If the control system or an operator had tried to start Pump 6, the electrician would have been exposed to electric shock and arc-flash hazards, which could have resulted in INJURY or DEATH.
Similar equipment in a single location presents opportunities for errors leading to property damage, injury, and death.

- The erroneous label, vague documentation, overconfidence in some and inexperience in others, perceived time pressure, and a congested work area are just a few of the factors that helped lead into this near miss.
- There were also offers of help and signs that something wasn’t right, which in retrospect, could have helped avoid this incident.
Strategies to mitigate the look-alike equipment error precursor:

- Permanent labeling (NOT on the replaceable equipment, like motors)
- Work Planning, referencing plans or maps when possible
- Coordinate with equipment SMEs
- Temporary barricades and signs
- Questioning Attitude (S.T.A.R.)
Changes to Configuration Control tags

“Warning signs are to accurately reflect the degree of hazard present.”

**DANGER:** “indicates an imminently hazardous situation which, if not avoided, **will** result in death or serious injury. This signal word is to be limited to the most extreme situations”

**WARNING:** “indicates a potentially hazardous situation which, if not avoided, **could** result in death or serious injury.”

**CAUTION:** “indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices”

**NOTICE:** “is appropriate for property-damage-only hazards. (Caution without the safety alert triangle is now obsolete)”
The “DANGER” dilemma

ANSI Z535.5 says:
“DANGER: indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations”

29 CFR 1910.147(c)(5)(ii)(B) says:
“Standardized: Lockout and tagout devices shall be standardized within the facility in at least one of the following criteria: Color; shape; or size; and additionally, in the case of tagout devices, print and format shall be standardized.”

Resolution:
Because a hazard mitigated by LOTO could meet the ANSI Z535.5 criterion for a “DANGER” warning, and 1910.147 demands uniformity, the standardized Fermilab LOTO tag will continue to use the word “DANGER” (with “Do Not Operate”)
“DANGER” is NOT restricted to LOTO tags only, but other danger signage will be formatted in an obviously different way from LOTO tags.
Getting and Using the New Tags

The existing CAUTION tags (without the safety alert triangle) will be used until stock is depleted. An announcement will be made on the Fermilab website when the new tags are available with the new stockroom numbers.

- The revised CAUTION tag will use the same stockroom number as the existing tag.

In rare situations, the correct tag to use may not clear. In such cases, pick the tag with the higher-level warning.

![Safety alert triangle]
Questions?

Please direct questions about Lockout / Tagout (and other safety-related concerns) to your Division Safety Officer

Visit https://eshq.fnal.gov/atwork/safety-occupational/ to find the DSO for your Division, Section, or Project, or call 630.840.5811

A “town-hall” LOTO discussion for your Division or Section will be scheduled in the coming months. You will receive notification through your DSO.
This completes the update training. Please click on the link below to access the refresher quiz.

(If you right-click on the link and select “Open in New Tab,” you can refer back to this training as you take the quiz.)

Take the test