Winning the LOTOry

Effective Control of Electrical Energies

Based on CFR §1910.147
CFR §1926.417
NFPA 70E Article 120

Presented to the

Joint Technical Symposium

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Presented By

Lee F. Donahue

- Corporate Director, Field Training – Morrow Meadows
- Member:
- Past lives:
  - Electrician
  - Electrical Contractor
  - Thermographer
  - Project Manager
  - Estimator
  - Safety Consultant
  - Technical Consultant
  - Safety Manager





I. Tell. Stories.



Quick Picks

- Identify greatest LOTO deficiencies
- LOTO Exceptions
- Quick Fixes
- Product “Placement”
- Inevitability of Change



OSHA's Top Ten

LOTO placed ~~5th~~ **3rd** in the notorious Top Ten



Source: United State Dept. of Labor https://www.osha.gov/top10citedstandards

LOTO Deficiencies

Top five sections cited – *FOUR were in 1910.147(c) General*

1) 1910.147(c)(4) *Energy control procedure (675)*
2) 1910.147(c)(7) *Training and communication (422)*
3) 1910.147(c)(6) *Periodic inspection (345)*
4) 1910.147(c)(1) *Energy control program (208)*
5) 1910.147(d) *Application of control (152)*

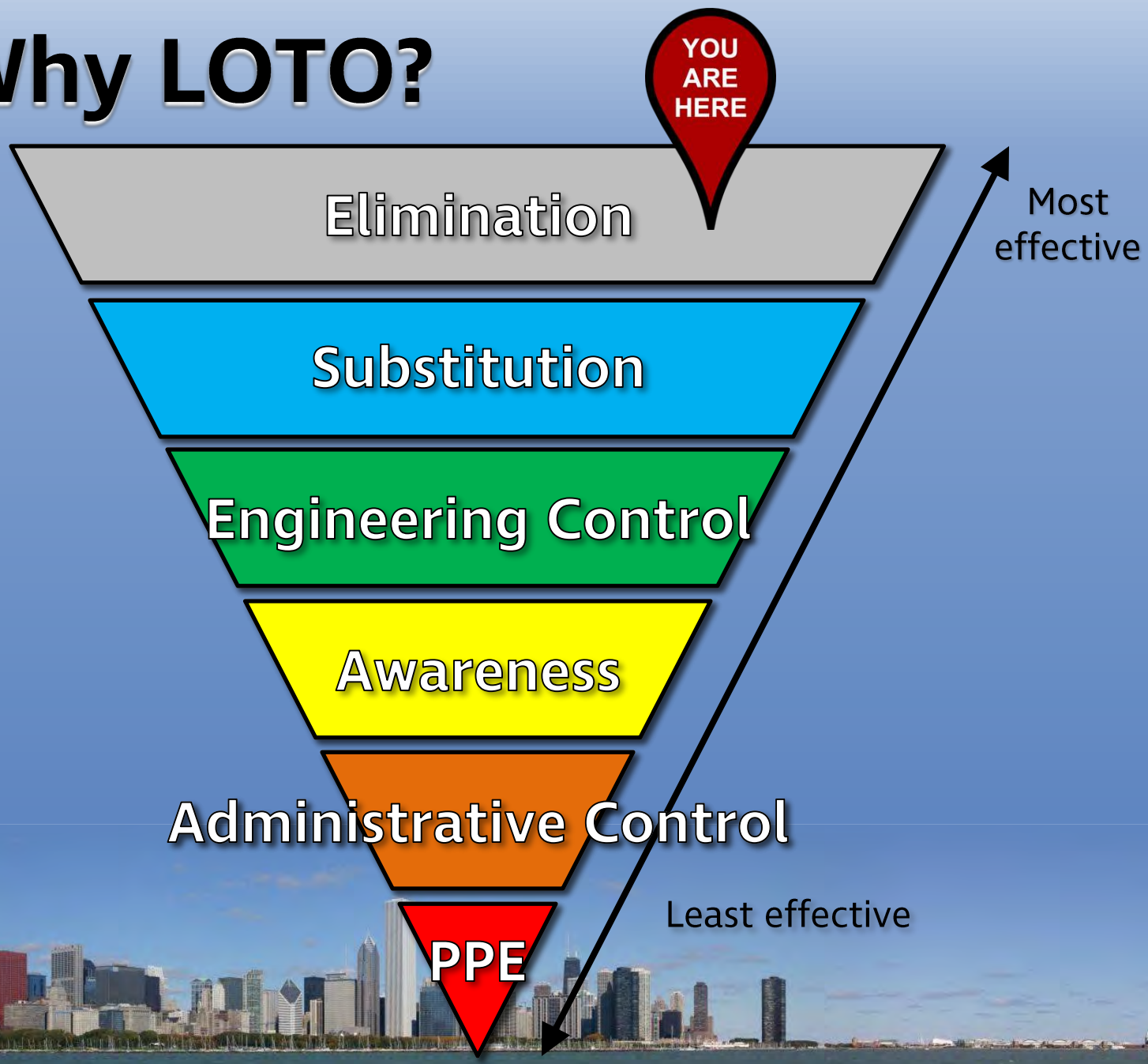
There's been no change in these!

Published in *Safety+Health*, November 24, 2025 https://www.safetyandhealthmagazine.com/27597-the-most-frequently-cited-standards-in-fy-2025/



Why LOTO?

Elimination level of Hierarchy of Controls



Example of Application of Hierarchy



Electrical Exceptions

Additional or increased hazards by interrupting:

- Life support equipment
- Emergency alarms
- Hazardous location ventilation



More Electrical Exceptions

Infeasible due to equipment design
or operational limitations:

- Diagnostic work or troubleshooting
- Start up or commissioning
- Part of a continuous process…*ish*



Continuous Process



"The Simpsons" 1989 - ∞

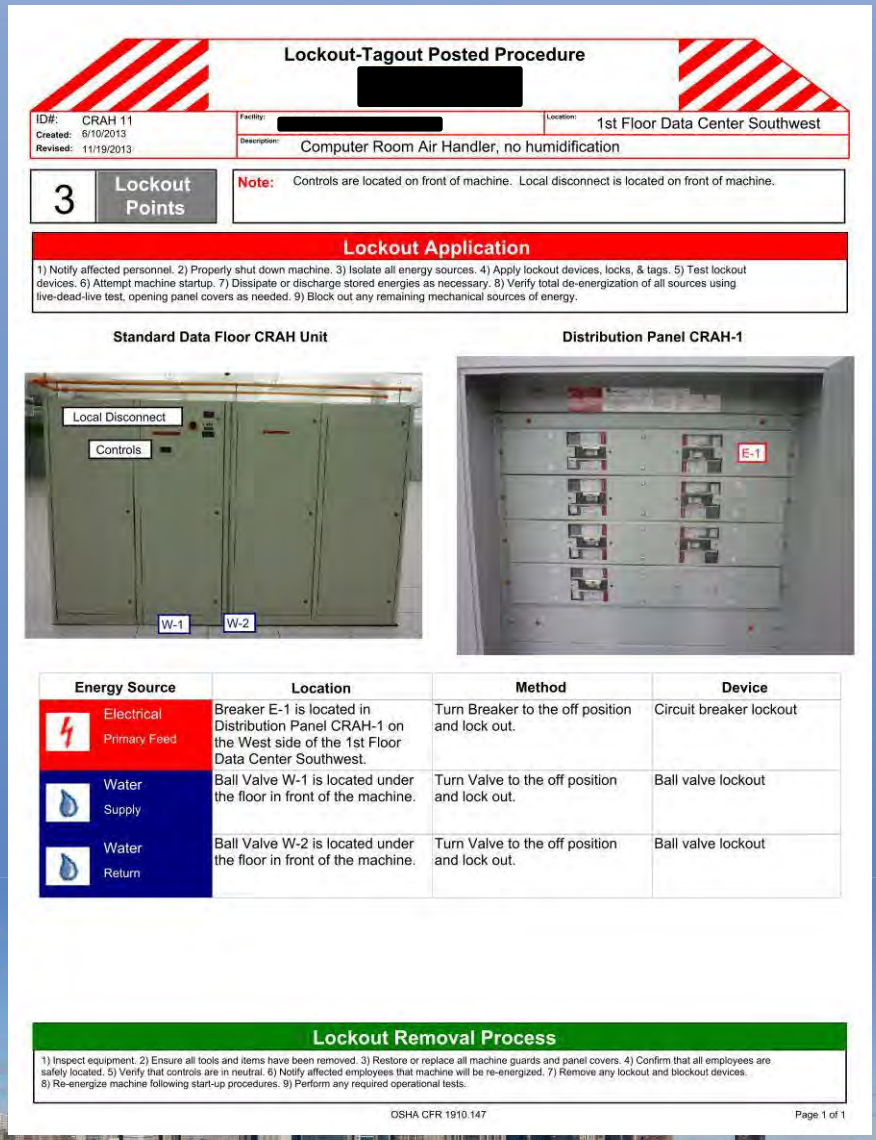
Quick Fixes

- Have a program



Quick Fixes

- Have a program
- Have procedures



Lockout-Tagout Posted Procedure

[redacted]

ID#: CRAH 11
Created: 6/10/2013
Revised: 11/19/2013

Facility: [redacted]
Location: 1st Floor Data Center Southwest
Description: Computer Room Air Handler, no humidification

3 Lockout Points

Note: Controls are located on front of machine. Local disconnect is located on front of machine.

Lockout Application

1) Notify affected personnel. 2) Properly shut down machine. 3) Isolate all energy sources. 4) Apply lockout devices, locks, & tags. 5) Test lockout devices. 6) Attempt machine startup. 7) Dissipate or discharge stored energies as necessary. 8) Verify total de-energization of all sources using live-dead-live test, opening panel covers as needed. 9) Block out any remaining mechanical sources of energy.

Standard Data Floor CRAH Unit

Distribution Panel CRAH-1

Energy Source	Location	Method	Device
Electrical Primary Feed	Breaker E-1 is located in Distribution Panel CRAH-1 on the West side of the 1st Floor Data Center Southwest.	Turn Breaker to the off position and lock out.	Circuit breaker lockout
Water Supply	Ball Valve W-1 is located under the floor in front of the machine.	Turn Valve to the off position and lock out.	Ball valve lockout
Water Return	Ball Valve W-2 is located under the floor in front of the machine.	Turn Valve to the off position and lock out.	Ball valve lockout

Lockout Removal Process

1) Inspect equipment. 2) Ensure all tools and items have been removed. 3) Restore or replace all machine guards and panel covers. 4) Confirm that all employees are safely located. 5) Verify that controls are in neutral. 6) Notify affected employees that machine will be re-energized. 7) Remove any lockout and blockout devices. 8) Re-energize machine following start-up procedures. 9) Perform any required operational tests.

OSHA CFR 1910.147

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Quick Fixes

- Have a program
- Have procedures
- Perform inspections



Quick Fixes

- Have a program
- Have procedures
- Perform inspections
- Hold training/ provide awareness



Effective Training



"Titus" 2000-2002

What's Next?

- Those broad strokes address the first four
- Managing the rest takes creativity



Recognizing Exposure

Affected Employee(s):

- Normally operates machine being serviced
- Works in the area where maintenance is being performed



Authorized Employee(s):

- Trained and authorized by the company
- Responsible for and in control of LOTO of equipment in order to perform maintenance



Sources: https://commons.Wikimedia.org and https://www.navy.mil via picryl.com public domain media

Look at Stored Energy

How many stored energies are present?



Mouse Trap, by Hasbro

Energy Sources



"This Too Shall Pass" by OK Go

Energy Sources

- Electrical
- Steam
- Thermal
- Pneumatic
- Mechanical
- Gravity
- Chemical
- Hydraulic
- Pressurized Water



Stored Energies - Examples

- Electrical
  - Capacitors
  - Batteries
  - Induced voltages
- Mechanical
  - Springs
  - Levers
- Hydraulic
  - Compressed liquids
  - Pressurized systems
- Pneumatic
  - Compressed gases
  - Pressurized systems
- Gravitational
  - Elevated loads
  - Improperly secured "stuff"
- Thermal
  - Objects in direct sunlight
  - Operational systems
  - Smoldering objects
- Chemical
  - Batteries
  - Chemical processes/reactions
- *Any others…?*



"The Flintstones" 1960-1966

Recognize Potential

The Story of the AwesomeSaw and the Common Garage



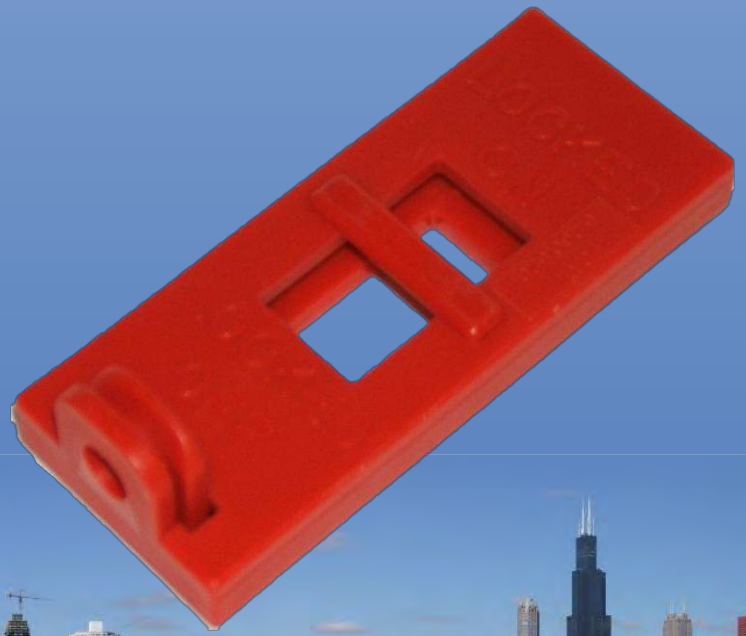






Compensate for Others

The Story of the Ceiling Fan and the Careless Roommate







Problem Attitudes

The Story of the Impatient General Contractor and the…well, really that was it.





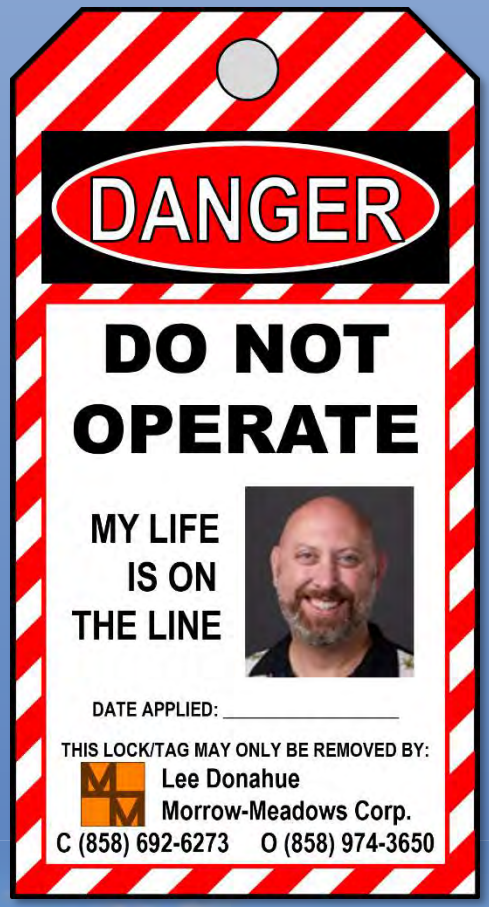
Problem Attitudes

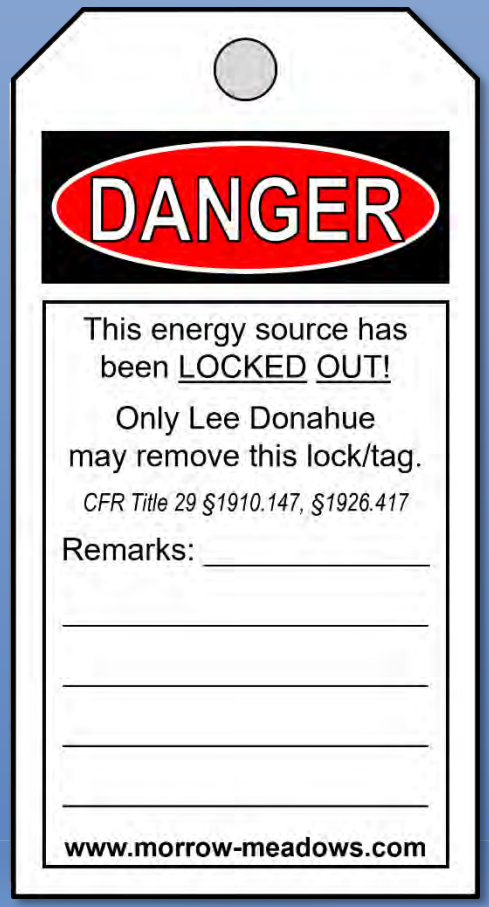
Tag MUST indicate:

- DANGER: Do Not Operate
- Worker's name
- Date applied*

Bonus points:

- Contact information
- Expected restoration date
- Photo of worker

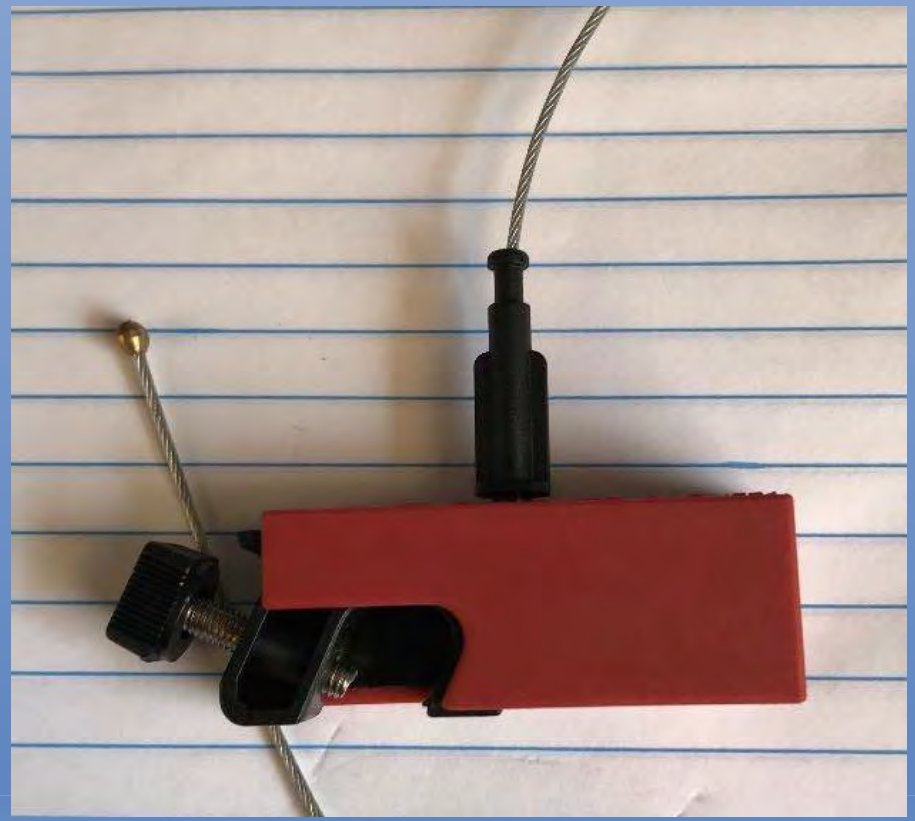






Circuit Breaker Application

The Story of "We Can't Lock It Out"







Tricky Situations

How many locks can be applied to a hasp?



FIVE.

Cannot prevent worker #6 from applying a lock!

More Trickery – Using E-Stops

Emergency stops are not acceptable as sole means of lock-out.





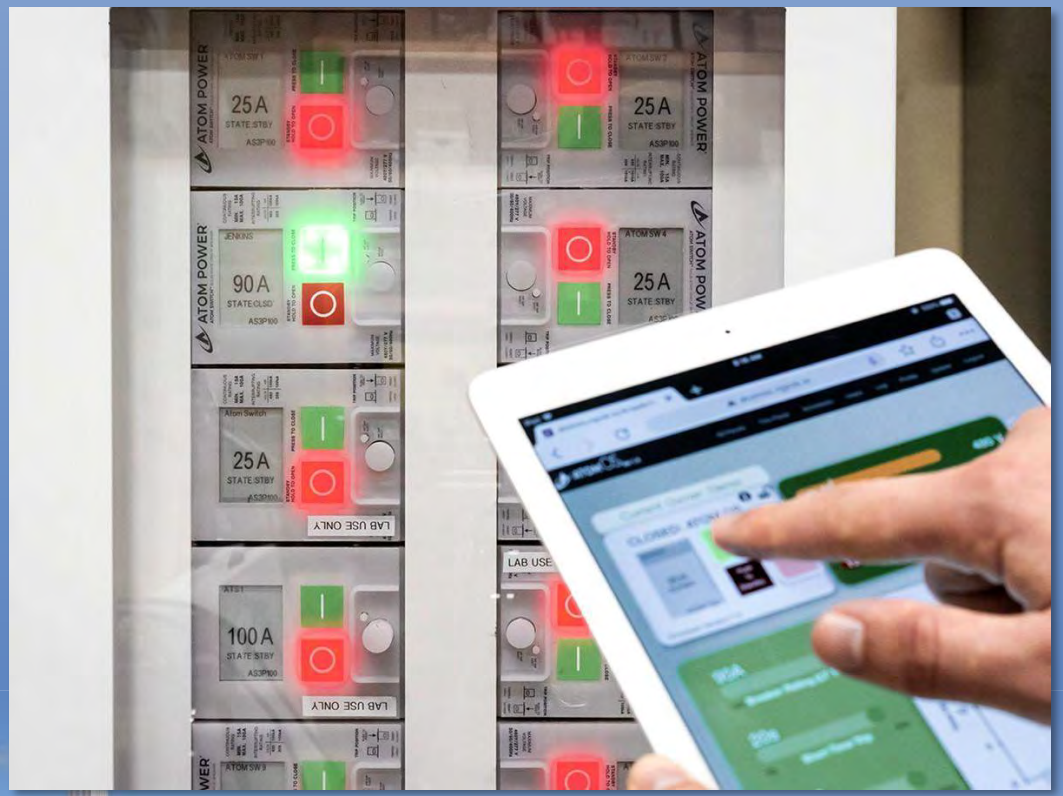


More Trickery – Using E-Stops

Emergency stops are not acceptable as sole means of lock-out.

This is currently being revisited:

- Newer equipment specifications
- Increase of robotic operations
- Electronic switching methods



Product by Atom Power, as seen in IEEE Spectrum, May 21, 2019

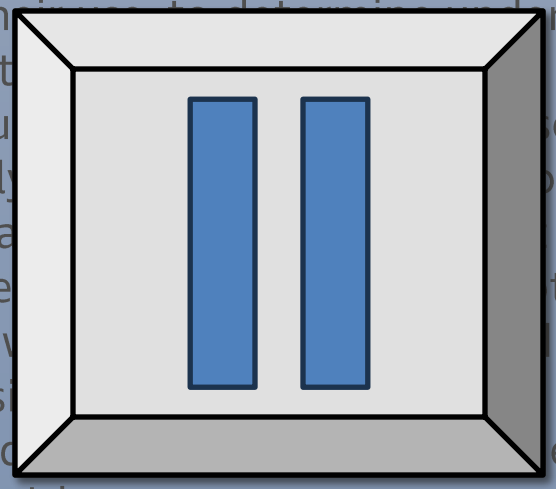
OSHA Thinks It Over...

OSHA Requests Information on Possible Updates to the Lockout/Tagout Standard

May 17, 2019

Washington DC – The U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) is requesting information on a possible update to the Control of Hazardous Energy (Lockout/Tagout (LOTO)) standard. The Agency is interested in comments on the use of control circuit-type devices to isolate energy, as well as the evolving technology for robotics.

OSHA is requesting information about how employers have been using control circuit devices, including information about the types of circuitry and safety procedures being used; limitations of th to determine whether what circu ed safel sure to ha of incre ts; and v consi stanc ese new risks.



The current LOTO standard, published in 1989, requires that all sources of energy be controlled during servicing and maintenance of machines and equipment using an energy-isolating device. The standard specifies that control circuit devices cannot be used as energy-isolating devices, but the agency recognizes recent technological advances may have improved the safety of control circuit-type devices.

Comments must be submitted on or before August 18, 2019. Comments and materials may be submitted electronically at http://www.regulations.gov, the Federal e-Rulemaking Portal, or by facsimile or mail. See the Federal Register notice for submission details.

Products

There's Something For Everything



Collect Your Winnings

- The major transgressions are administrative
- The finer points are trickier:
  - Attitude is a major factor
  - Energy is everywhere
  - Specific examples can lead to broader behaviors
- **Everything** has a solution





Thank You!

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