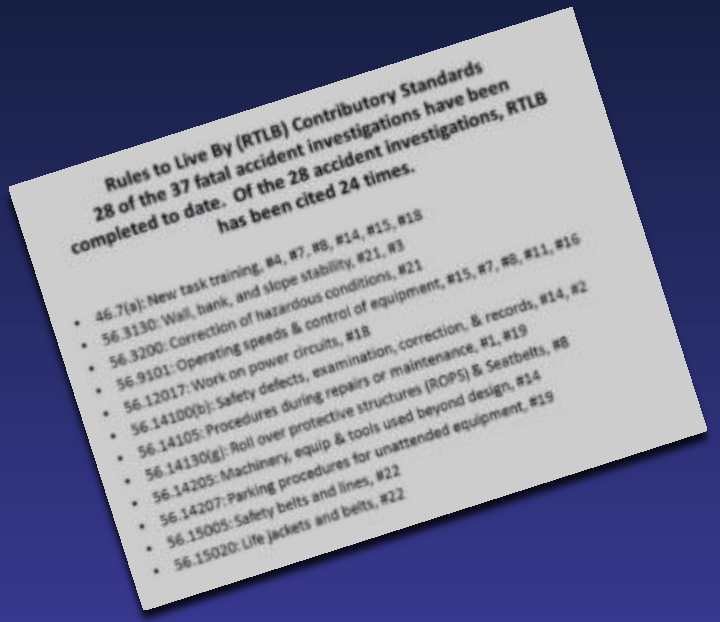
Lock Out – Tag Out & Arc Flash

WHY ARE WE STILL DOING THIS WRONG?

Gregg Webb
The Olen Corporation

Lock Out, Tag Out & Arc Flash

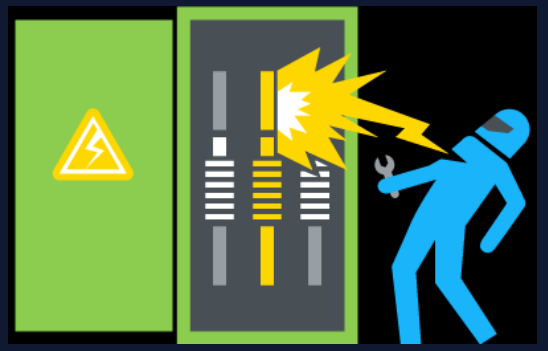
- We know these rules, don't we?
- These rules are some of the most commonly covered, aren't they?
- The implementation of these rules is?
  - Simple?
  - Easy?
  - Understood by the people who need to follow them?



Rules to Live By (RTLB) Contributory Standards
28 of the 37 fatal accident investigations have been completed to date. Of the 28 accident investigations, RTLB has been cited 24 times.

- 46.7(a): New task training, #4, #7, #8, #14, #15, #18
- 56.3130: Wall, bank, and slope stability, #21, #3
- 56.3200: Correction of hazardous conditions, #21
- 56.9101: Operating speeds & control of equipment, #15, #7, #8, #11, #16
- 56.12017: Work on power circuits, #18
- 56.14100(b): Safety defects, examination, correction, & records, #14, #2
- 56.14105: Procedures during repairs or maintenance, #1, #19
- 56.14130(g): Roll over protective structures (ROPS) & Seatbelts, #8
- 56.14205: Machinery, equip & tools used beyond design, #14
- 56.14207: Parking procedures for unattended equipment, #19
- 56.15005: Safety belts and lines, #22
- 56.15020: Life jackets and belts, #22

Lock Out, Tag Out VS. Arc Flash



- Arc Flash is an electrical incident and does not apply to all work.
- LOTO applies to any equipment and any type of work
- Does a person working on a conveyor pulley need to be locked out?
- Is that same person exposed to an AF hazard?
- Do your people understand when they are exposed to an AF hazard?
- Do you have an AF policy? (hint….everyone’s answer is yes)

Lock Out, Tag Out & Arc Flash

- QUESTIONS TO CONSIDER:
- Why is this consistently an area of concern and incidents in the material disseminated from groups such as MSHA & ODNR?
- How often do we cover LOTO in our plant safety meetings, job pre-planning, new miner orientation, refresher days, events such as this one?
- Do we believe the continuing level of mistakes made in LOTO & AF hazards correlates to the QUANTITY of information given?

So……Why are we doing this wrong?

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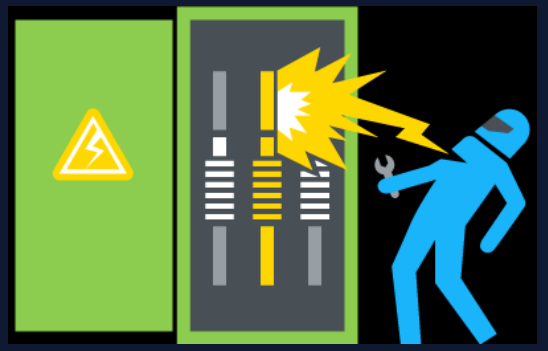

- Review the rules
- Discuss do’s and don’ts, some specific issues
- Stories & examples
- Talk about the gap between people understanding what to do, but still not doing it?
- That gap, that disconnect is where we can do the most good.
- Discuss what causes change?

Some feedback I’ve gotten, some laughs, and hopefully something to think about next time we train.

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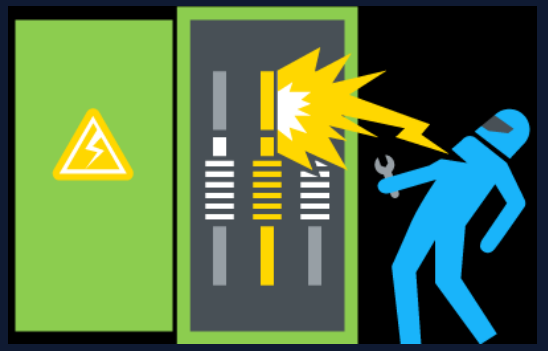

- Brief review of the relevant sections of 30CFR (using section 56)
- I’ve chosen what I believe are the 4 applicable sections
  - §56.12016 Work on electrically-powered equipment.
    - Electrically powered equipment shall be de-energized before mechanical work is done on such equipment. Power switches shall be locked out or other measures taken which shall prevent the equipment from being energized without the knowledge of the individuals working on it. Suitable warning notices shall be posted at the power switch and signed by the individuals who are to do the work. Such locks or preventive devices shall be removed only by the persons who installed them or by authorized personnel.

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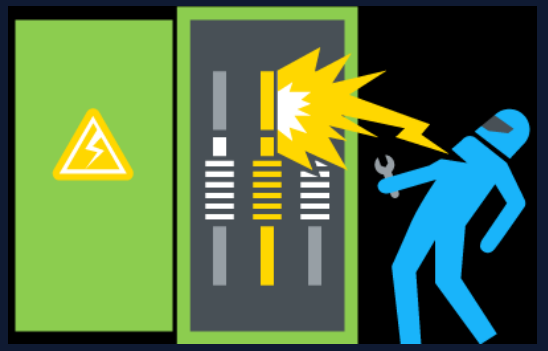

- review of the relevant sections of 30CFR (using section 56)
  - §56.12017 Work on power circuits.
    - Power circuits shall be de-energized before work is done on such circuits unless hot-line tools are used. Suitable warning signs shall be posted by the individuals who are to do the work. Switches shall be locked out or other measures taken which shall prevent the power circuits from being energized without the knowledge of the individuals working on them. Such locks, signs, or preventative devices shall be removed only by the person who installed them or by authorized personnel.

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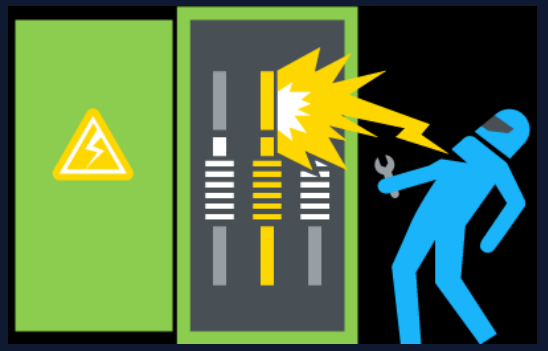

- review of the relevant sections of 30CFR (using section 56)
  - §56.14105 Procedures during repairs or maintenance.
    - Repairs or maintenance of machinery or equipment shall be performed only after the power is off, and the machinery or equipment blocked against hazardous motion. Machinery or equipment motion or activation is permitted to the extent that adjustments or testing cannot be performed without motion or activation, provided that persons are effectively protected from hazardous motion.

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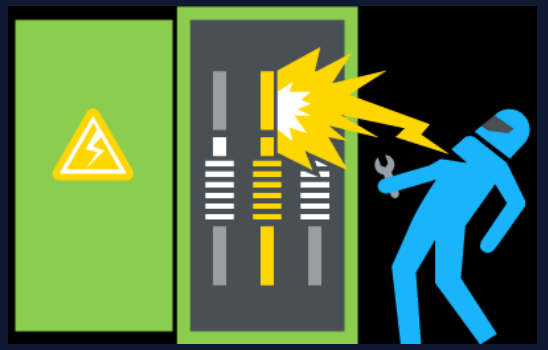

- review of the relevant sections of 30CFR
- §56.12006 Distribution boxes.
  - Distribution boxes shall be provided with a disconnecting device for each branch circuit. Such disconnecting devices shall be equipped or designed in such a manner that it can be determined by visual observation when such a device is open and that the circuit is de-energized, the distribution box shall be labeled to show which circuit each device controls

Lock Out, Tag Out & Arc Flash

- DOING IT CORRECTLY
  - Personally de-energize, lock out and tag out all power circuits and electrical equipment before any work is done on such circuits and equipment.
  - Personally de-energize, lock out and tag out all start-up switches on mechanical equipment before any work is done on such equipment.
  - Make sure that each person working on an electrical circuit or system applies his or her own personal lock and tag.
  - Wear appropriate Personal Protective Equipment, including electrically rated gloves, hard hat, and eye protection.
  - Always maintain de-energizing devices in operable condition.
  - Always block machinery against motion even after it has been locked out and tagged out.

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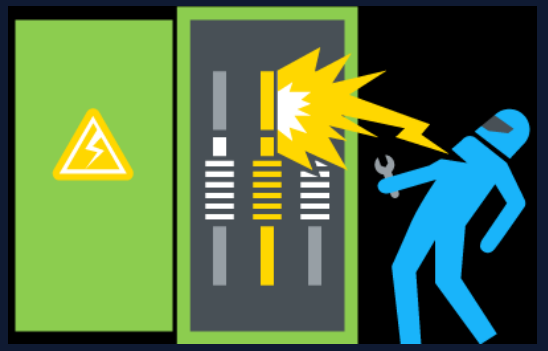

- DOING IT CORRECTLY
  - Always familiarize yourself with electrical circuits before you perform any electrical work. Ask for help or consult a wiring diagram/schematic.
  - Make sure that electrical work is performed only by a qualified electrician or persons trained to do electrical work under the direct supervision of a qualified electrician.
  - Make sure that all electrical circuits and circuit breakers are properly identified before troubleshooting or performing electrical work.
  - Use properly rated non-contact voltage testers to ensure that circuits are de-energized.

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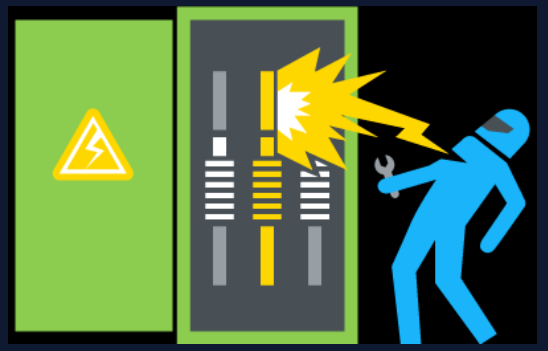

- DOING IT CORRECTLY
  - Maintain electrical meters and testing instruments in good condition to verify that the circuit is de-energized before beginning work.
  - Communicate your intentions to work on an electrical circuit to ensure the circuit is, and remains, protected.
  - Discharge all potential residual energy after the circuit has been locked out.
  - Relieve hydraulic and pneumatic pressure after equipment has been locked out and before performing maintenance.
  - Isolate all energy sources, including electric, hydraulic, mechanical and pneumatic, before commencing work.

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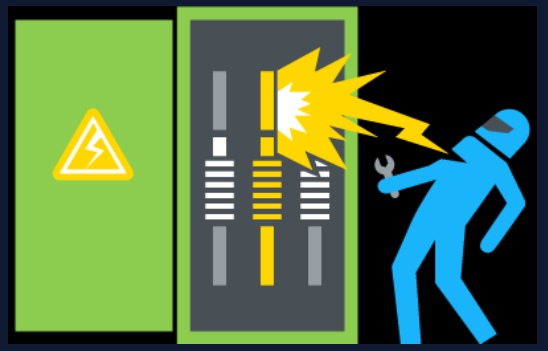
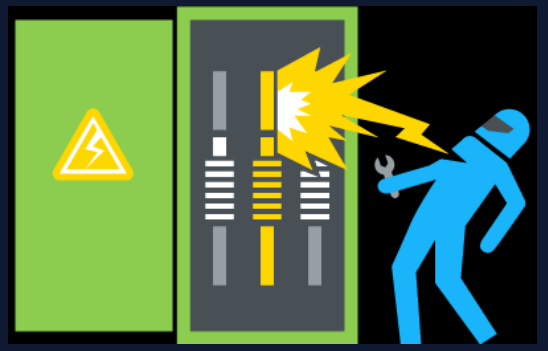


- DOING IT INCORRECTLY
  - Never defeat manual or automatic de-energizing devices.
  - Never remove guarding to perform maintenance or inspection until the machine has been properly de-energized and locked out.
  - Never perform maintenance or work on moving machines.
  - Never rely on someone else to de-energize or disconnect a circuit for you.

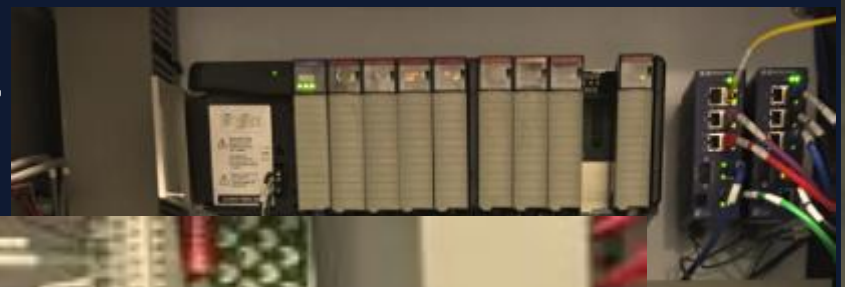
Lock Out, Tag Out & Arc Flash

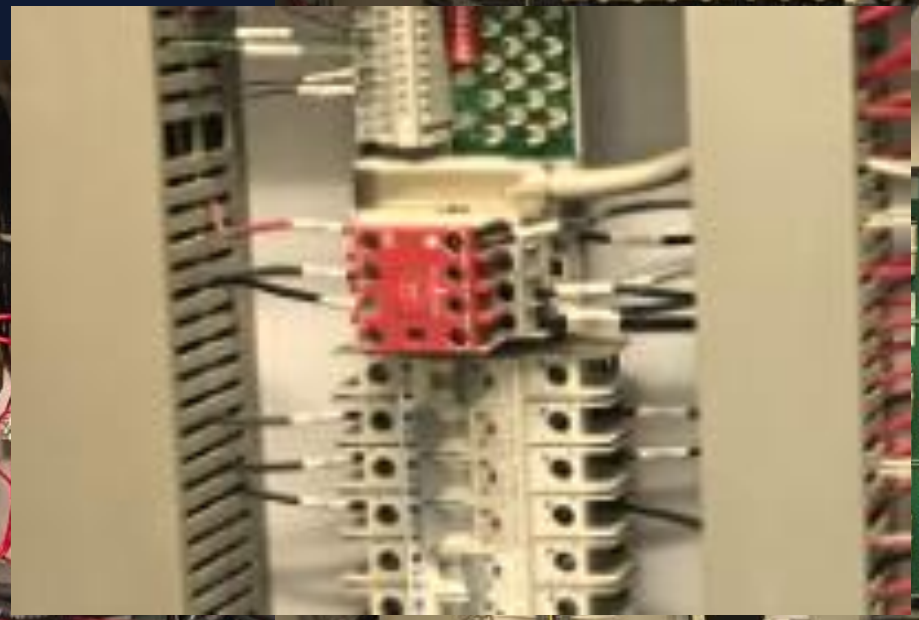


- DOING IT INCORRECTLY
  - Never remove someone else's lock or tag.
  - Never perform work on an electrical circuit before testing to make sure it has been de-energized.
  - Never assume that a circuit breaker will not be reset by someone else. Always lock it out.
  - Never loan or share your lock or key with someone else.

Lock Out, Tag Out & Arc Flash

- EXAMPLES AND EXPLANATIONS
- Control power





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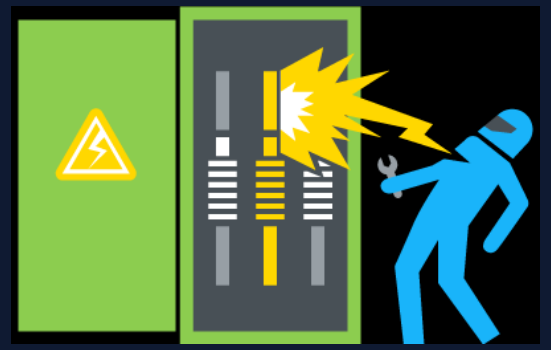
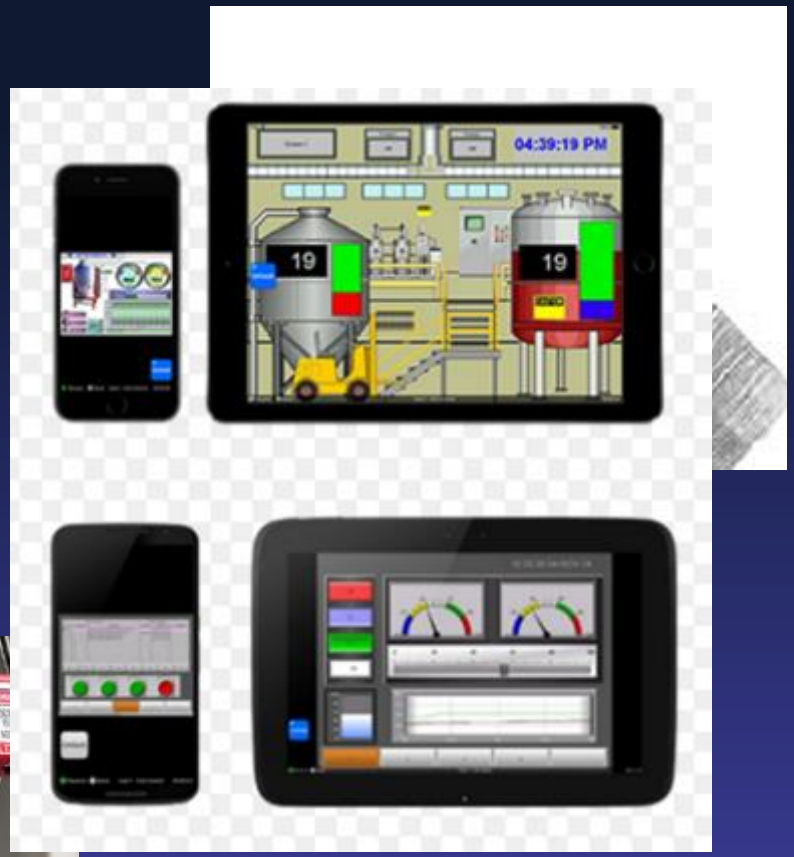


- EXAMPLES AND EXPLANATIONS
- Locking out controls



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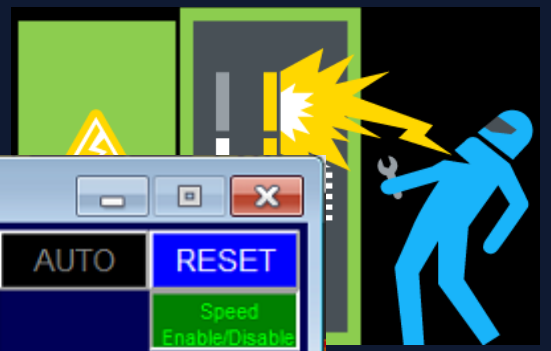

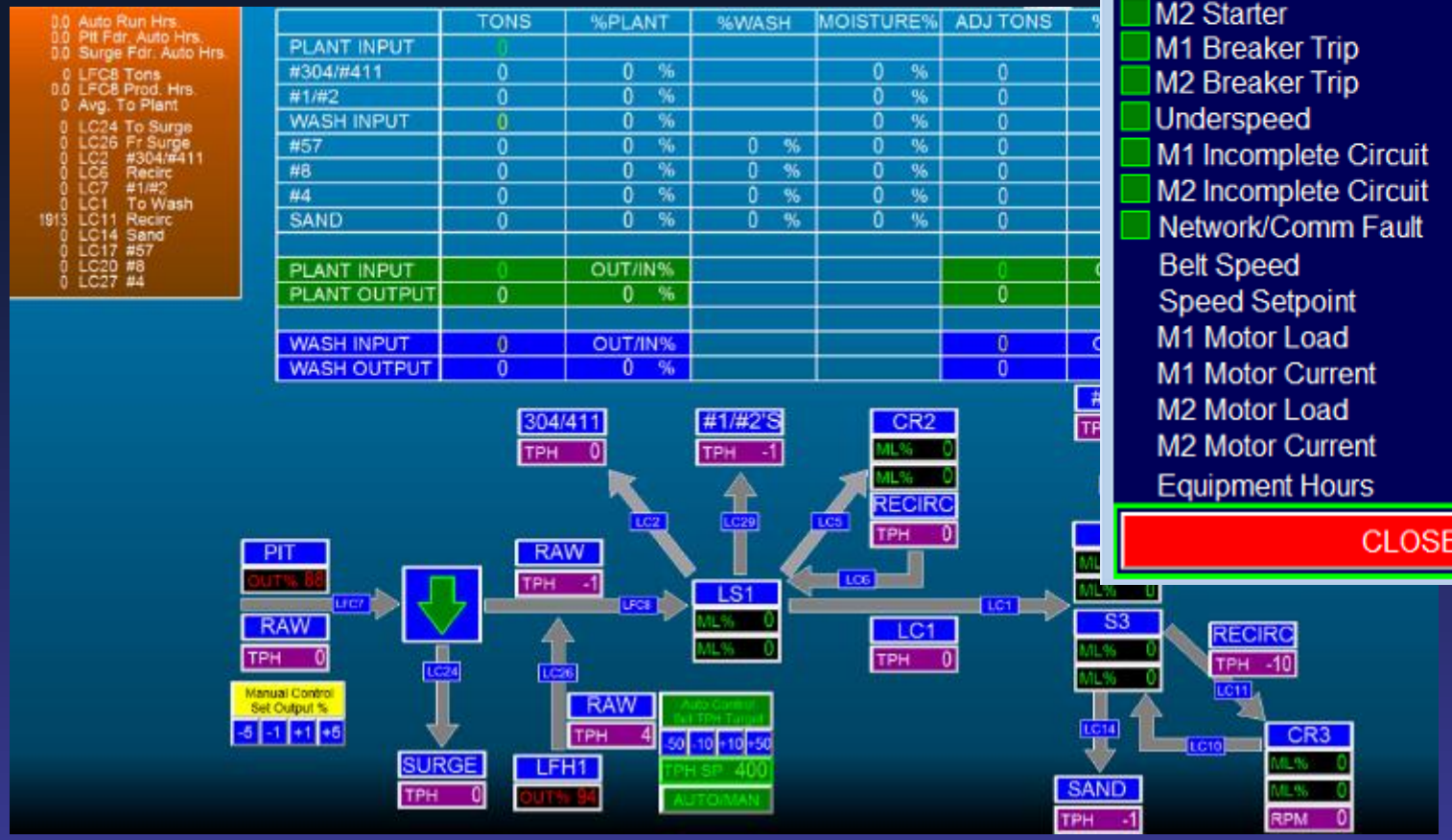

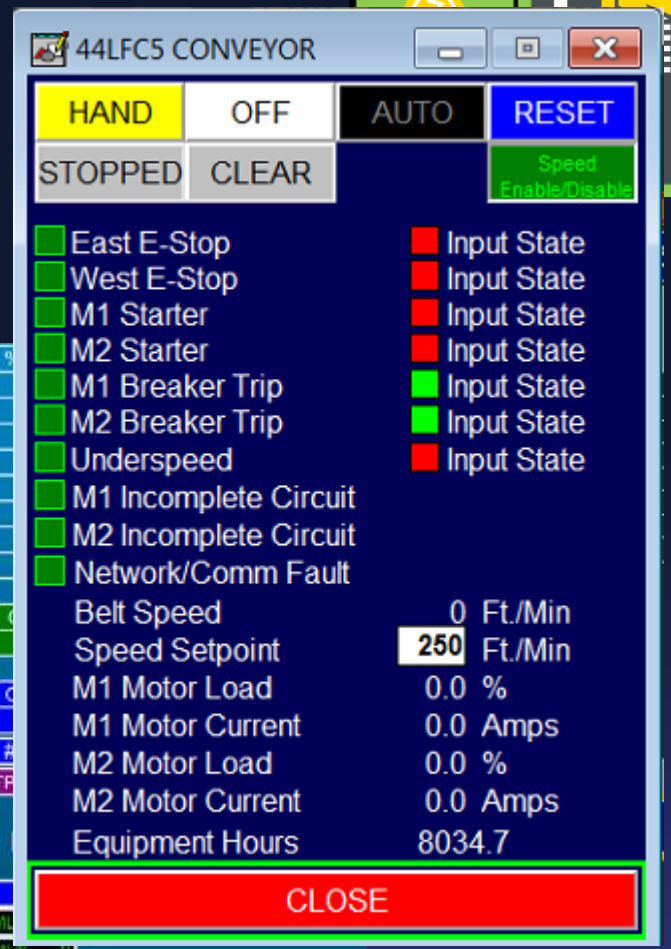

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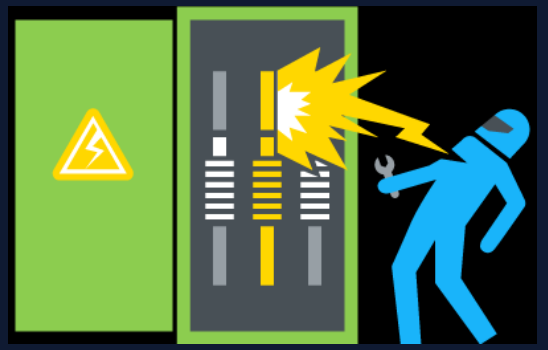
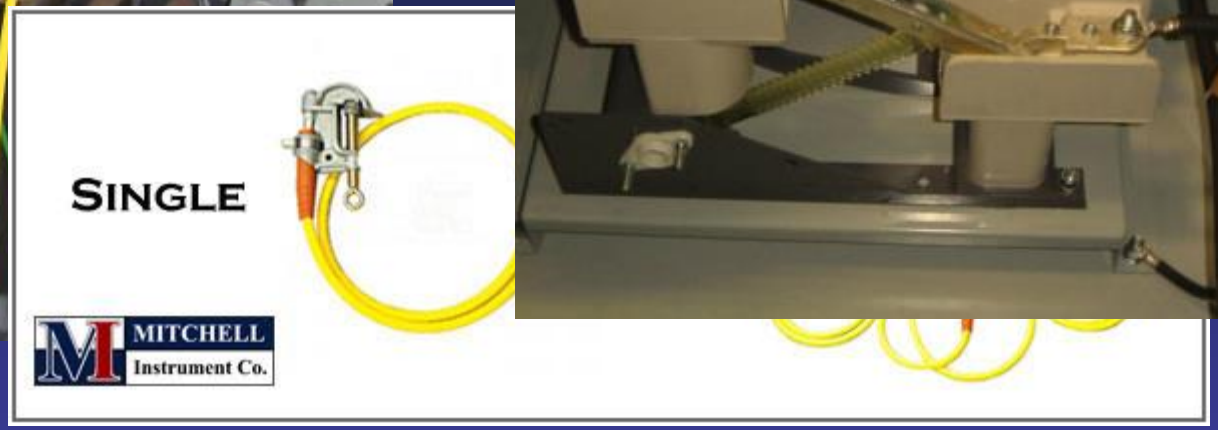


- EXAMPLES AND EXPLANATIONS
- Electrical discharge, static, grounding, bleeding off



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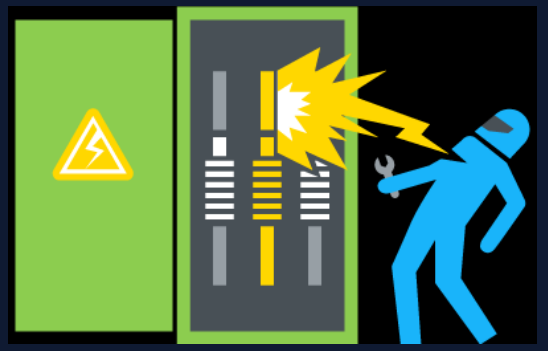
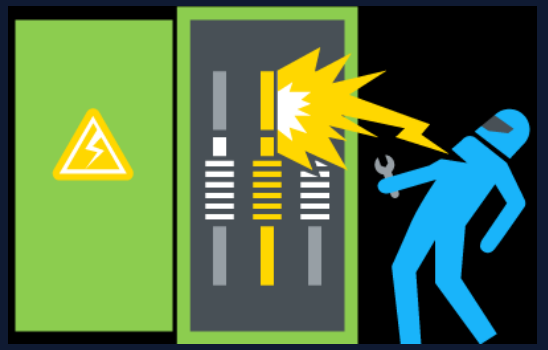


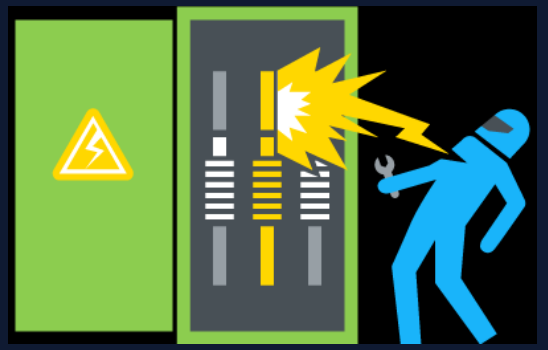
- EXAMPLES AND EXPLANATIONS
- Lock out? Tag out? Try out?
  - How many of us try out? Remember my phone!
- Do you make sure it's clear before re-energizing?
  - Who is responsible for this scenario?
- Leaving the key in the lock, or on top of the cabinet?
- Asking others to lock you out, or remove your lock.
  - What's different than just letting that one person lock out?

Lock Out, Tag Out & Arc Flash



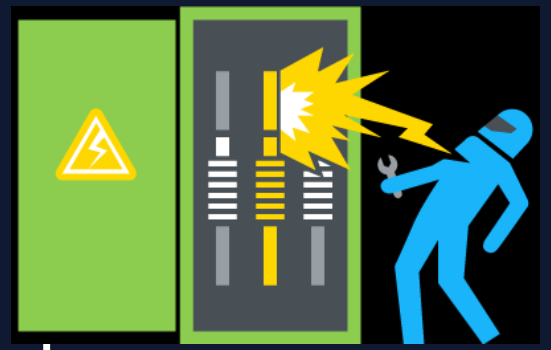
- EXAMPLES AND EXPLANATIONS
- Multiple sources, stored energy, complex situations?
  - Very important that these non-standard situations are identified
  - Have a team of people who work with this equipment
  - Consult with the manufacturer. Use the ops manual.
  - Document and task train on the lock out procedure
  - Post the LOTO procedure at the machine
  - Ask that each person demonstrate how to LOTO

ARC FLASH



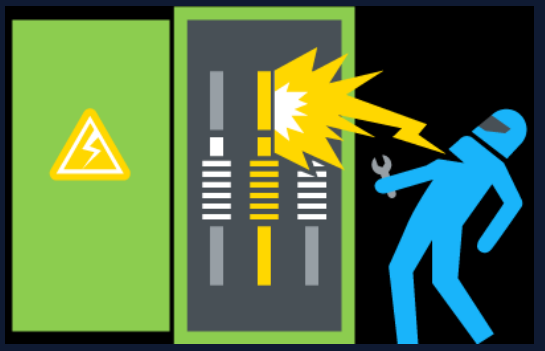
- EXAMPLES AND EXPLANATIONS
- Do you know when you are in an AF hazard situation?
- Is this just a concern for electricians?
- When you put a starter or disconnect handle up and down, you are opening and closing an electrical circuit. You ARE in an AF scenario.
- Do you have people opening doors to reset breakers, check fuses, reset motor overloads. Can they see uninsulated energized components?

ARC FLASH



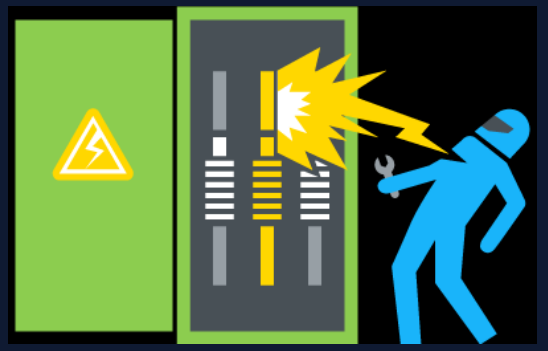
- EXAMPLES AND EXPLANATIONS
- Then you have an AF situation and actually, you have a policy.
- Those people must be trained and have a full understanding of the equipment on which they are working.
- They must be trained in the proper selection and use of PPE.
- If they are not, and these things are happening. THAT is your policy

ARC FLASH



- EXAMPLES AND EXPLANATIONS
- We all either need to have an engineering assessment, an arc flash study performed at the facility, or use the NFPA 70E tables.
- Both of these scenarios also require a policy of training, PPE use, inspections.

ARC FLASH



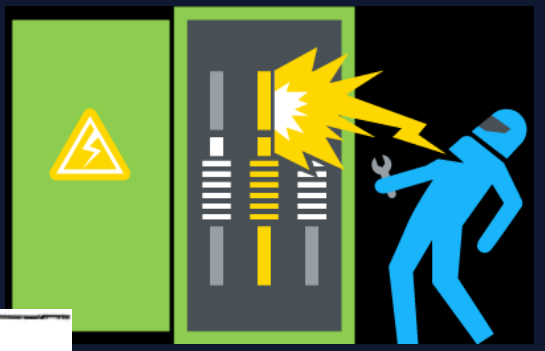
- EXAMPLES AND EXPLANATIONS
- Do you ever measure current?

ARC FLASH

- EXAMPLES AND EXPLANATIONS
- Doors and Bolted Covers

ARC FLASH

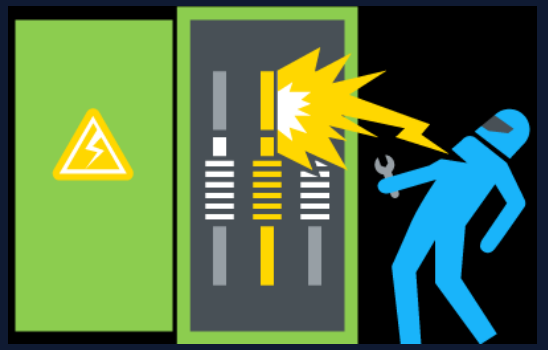
- EXAMPLES AND EXPLANATIONS

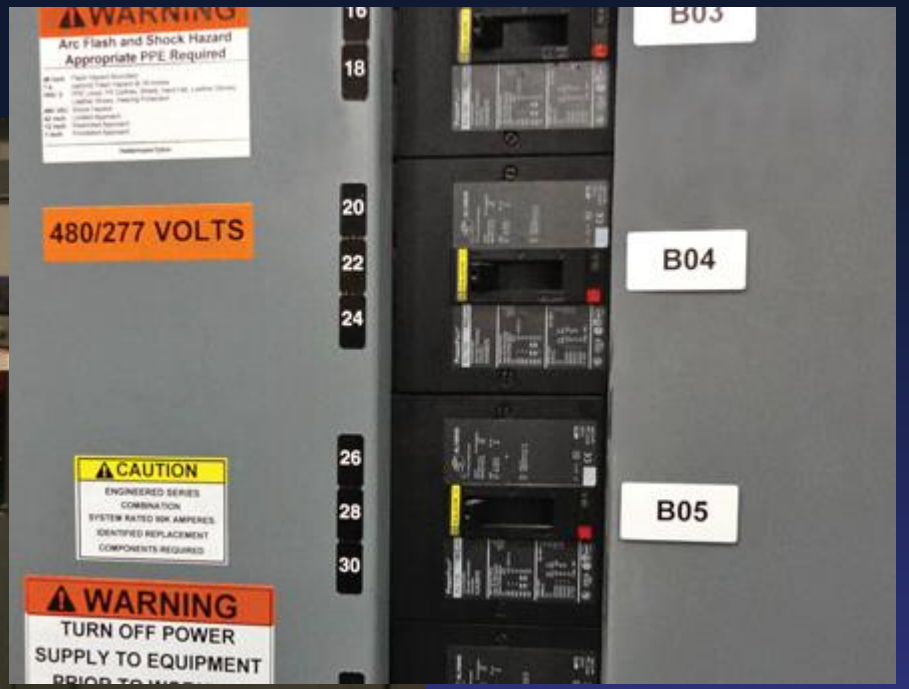


600 V class switchgear (with power circuit breakers or fused switches) and 600 V class switchboards Parameters: Maximum of 35 kA short circuit current available; maximum of up to 0.5 sec (30 cycle) fault clearing time; minimum 18 in. working distance Potential arc flash boundary with exposed energized conductors or circuit parts using above parameters: 233 in.			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	2	N	N
CB or fused switch operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch operation with enclosure doors open	1	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	2	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	2	Y	Y
Application of temporary protective grounding equipment after voltage test	2	Y	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	4	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circ parts)	2	N	N

ARC FLASH

- EXAMPLES AND EXPLANATIONS
- Opening and closing breakers, disconnects, switches





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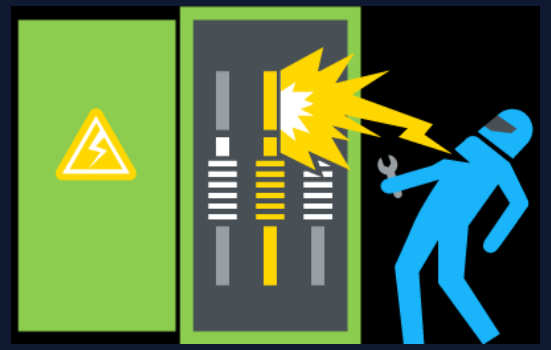

- WHY ARE WE DOING THIS WRONG?
- I took an informal survey, asked 4 questions.
- Wide range of experiences, history
- Some are electricians, others not, but all are working in mining presently

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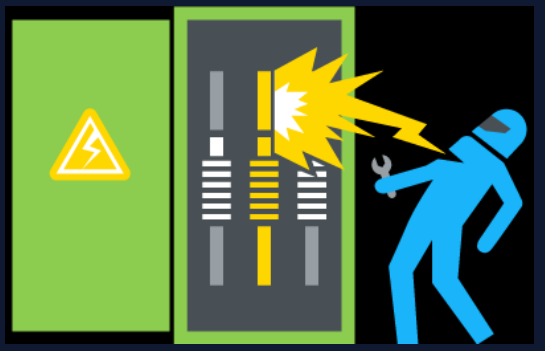

- When you were completely new, what you have liked to have had better explained or demonstrated to you about lockout/tagout or arc flash?
  - *Would like to have better explained exactly where to lockout machinery or equipment.*
  - *From an electrical standpoint I would have liked to have the dangers explained, like how although there is a chance a motor, or field wiring can be energized by someone else if not locked out, you can tell if there is power to a motor or not. Meaning if the motor is running, it's obviously hot in there. It took me a while to realize that everything past the starter is not hot all the time.*

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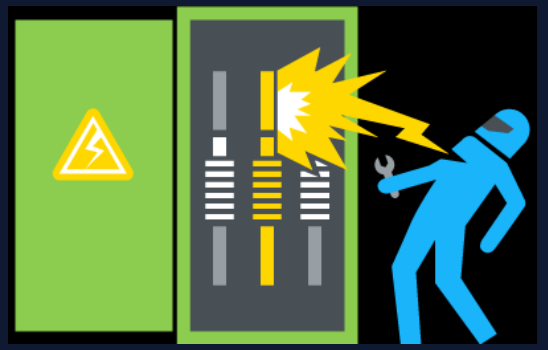

- When you were completely new, what you have liked to have had better explained or demonstrated to you about lockout/tagout or arc flash?
  - *(AF) Distance or the plane where you have crossed and full gear is required / is it the bucket or is it 4 feet from it or 480VAC when equipment is not in use.*
  - *When I first started I thought I would just be a hot flash of light, like a welder. But the truth of it being a body engulfing fireball containing molten particles of whatever is close enough to burn really brought it into perspective. Breathing the smoke can kill you, the amperage can kill you, the fire can kill you, the air blast can hurt you if not kill you. It's a bad deal.*

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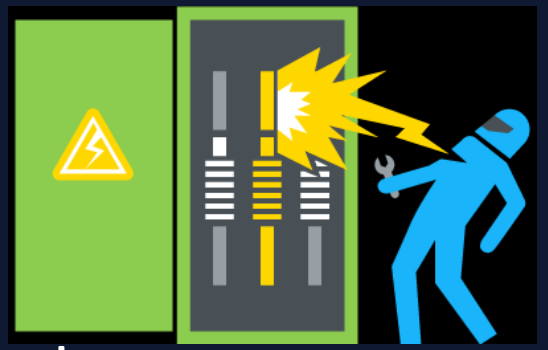

- Assuming you have ever skipped LOTO or AF gear in the past, why did you do so?
  - *MCC was far from equipment and it was a long climb, hike etc.*
  - *Have skipped because I didn't know where to lockout and was working with low voltage.*
  - *I have done it when just opening a cabinet to see what is in there, if I'm not going to putting my hands in the box, bucket, etc. touching and moving things, I usually just open it up to see what I need to see.*
  - *I skipped wearing my ARC flash suit due to excessive heat in summer, and many times due to visibility. (I cannot see well through visor and that is more dangerous to me, IMO) I used gloves and the uniform but the Visor I took off.*
  - *if all I have to do is open something to look inside, I'll probably just do so. But if I'm going have to reach in and work, then I Lock out the source and put on the appropriate PPE.*

Lock Out, Tag Out & Arc Flash

- Did anything in your history here or at other jobs, convince you to start doing this vs. it just being the rules?
  - *At my last job… I seen some things that made me want to leave and do something different. Not really the electrical side, but people climbing in crushers to work on them or un-clog them and their lock out is yelling down, "Hey guys, don't start this thing until I'm outta here." I can't believe they haven't had a fatality there to be honest.*
  - *Personally know people who got seriously injured by not locking out what they were working on.*
  - *I have seen a size 5 starter blow up when it was energized*
  - *Several people in my family have been involved in arc flashes. One was hit up on the primary side of a service drop transformer. (idk voltage) Dad had a starter blow up in his face, Grandpa has similar stories. Not one of them said it was fun.*

Lock Out, Tag Out & Arc Flash

- Has there ever been anything about LOTO or AF protection that you were mistaken about, didn't understand?
  - *I was working on a piece of equipment in an unfamiliar plant, I locked out the starter, and worked on this most of the day. Upon completion I went to test equipment and a different conveyor started?? I had locked out the wrong piece of equipment. I should have tried the equipment prior to working on it.*
  - *No, I make sure I get the right one by completing the try out step, it has been confusing at our different plants with all of the different names for the equipment, but the signs and people at the plant help.*
  - *No, it's pretty straight forward. You're lucky if you get a second chance to mess up, it's easy to become complacent with things that we do every day, and it's easy for people who don't do it every day to make mistakes.*

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- Culture and Behavior?
  - *In those answers, we see that despite all our training and information, we still have UNASKED questions that did not get answered.*
  - *Think about this, a teacher asks a group, " Who doesn't understand?"*
    - *How many hands go up?*
  - *A trainer asks the same question, but points at Joe and says, "Joe can you explain this to me, or can you demonstrate it?"*

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- Culture and Behavior?
  - *No one wants to indicated they don't understand in a group setting*
  - *We need to reinforce the notion that "I don't understand" is a smart thing to say, not a stupid thing to say.*
  - *Reward it publicly*

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- Culture and Behavior?
  - *What changes a culture?*
  - *Use raising children as an analogy.*
    - *You want to do the right thing from day one.*
    - *You teach them by what you do, much more than what you say.*
    - *The same things happen in your plant*

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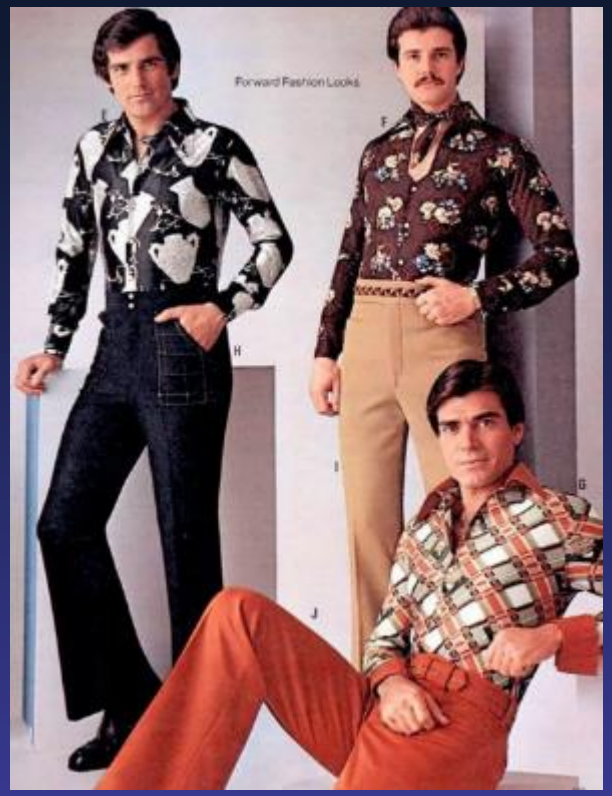
- Culture and Behavior?
  - *Look at your new & young people the same as the analogy to your children*
  - *Lots of people are “training” your new people.*
  - *Our recent safety survey indicated the older groups were more negative*
  - *Who are new people going to work with after new hire orientation?*

Lock Out, Tag Out & Arc Flash

- Leave you with this, what changes a culture?
  - *My age group, growing up in the 70's*
  - *What was cool?*

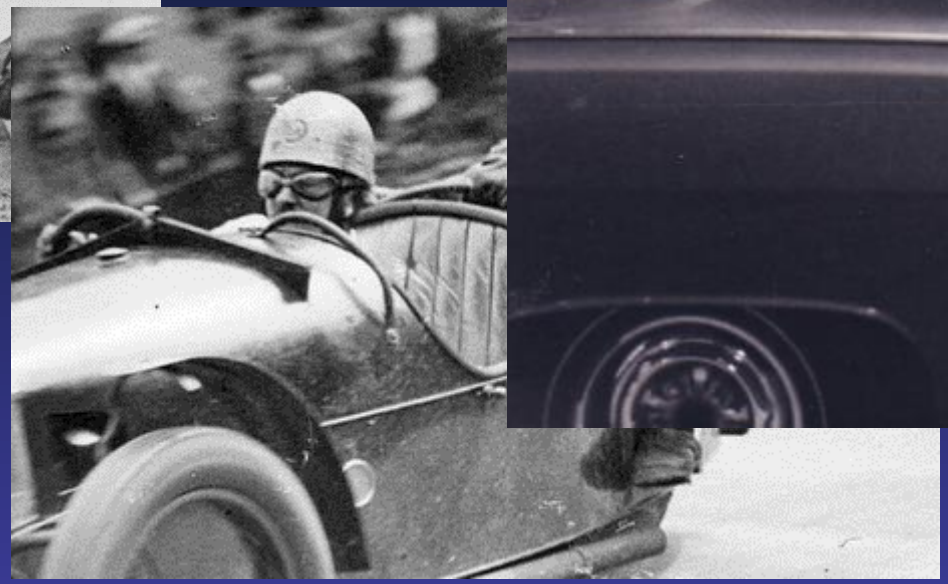


Lock Out, Tag Out & Arc Flash

- Leave you with this, what changes a culture?
- *Cruising, preferably in a Nova or Camaro*

Lock Out, Tag Out & Arc Flash

- Leave you with this, what changes a culture?
- *Cruising, preferably in a Nova or Camaro*
- *No seat belts on*

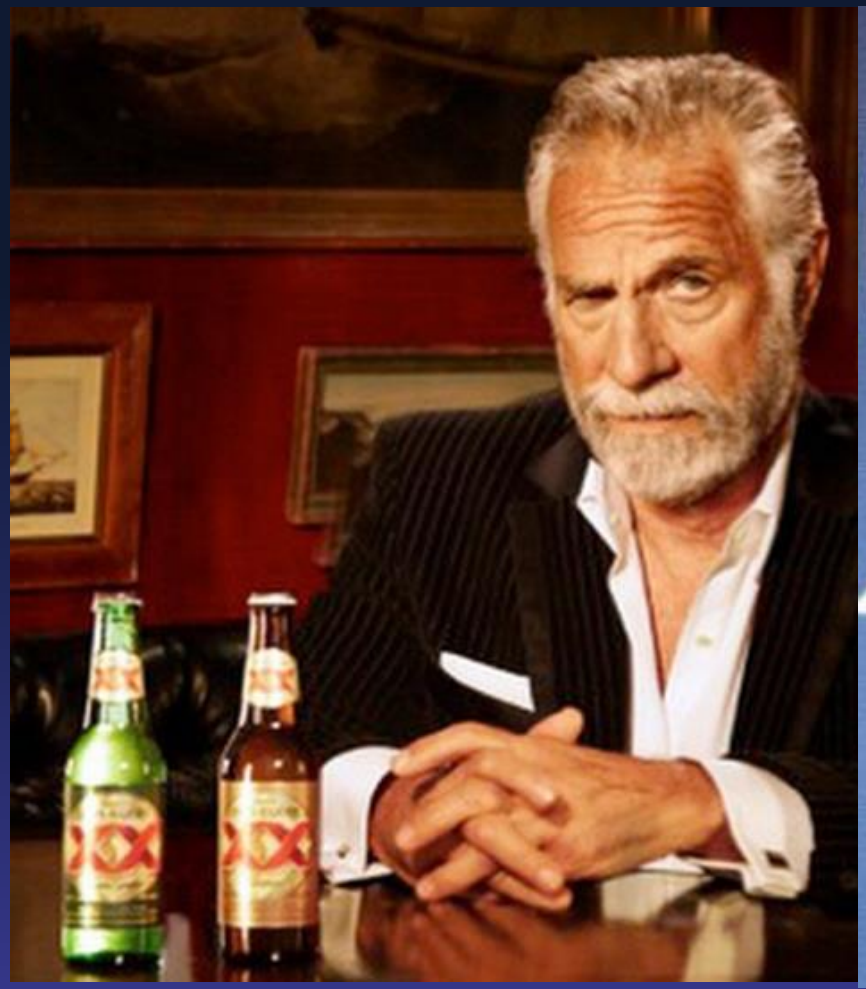


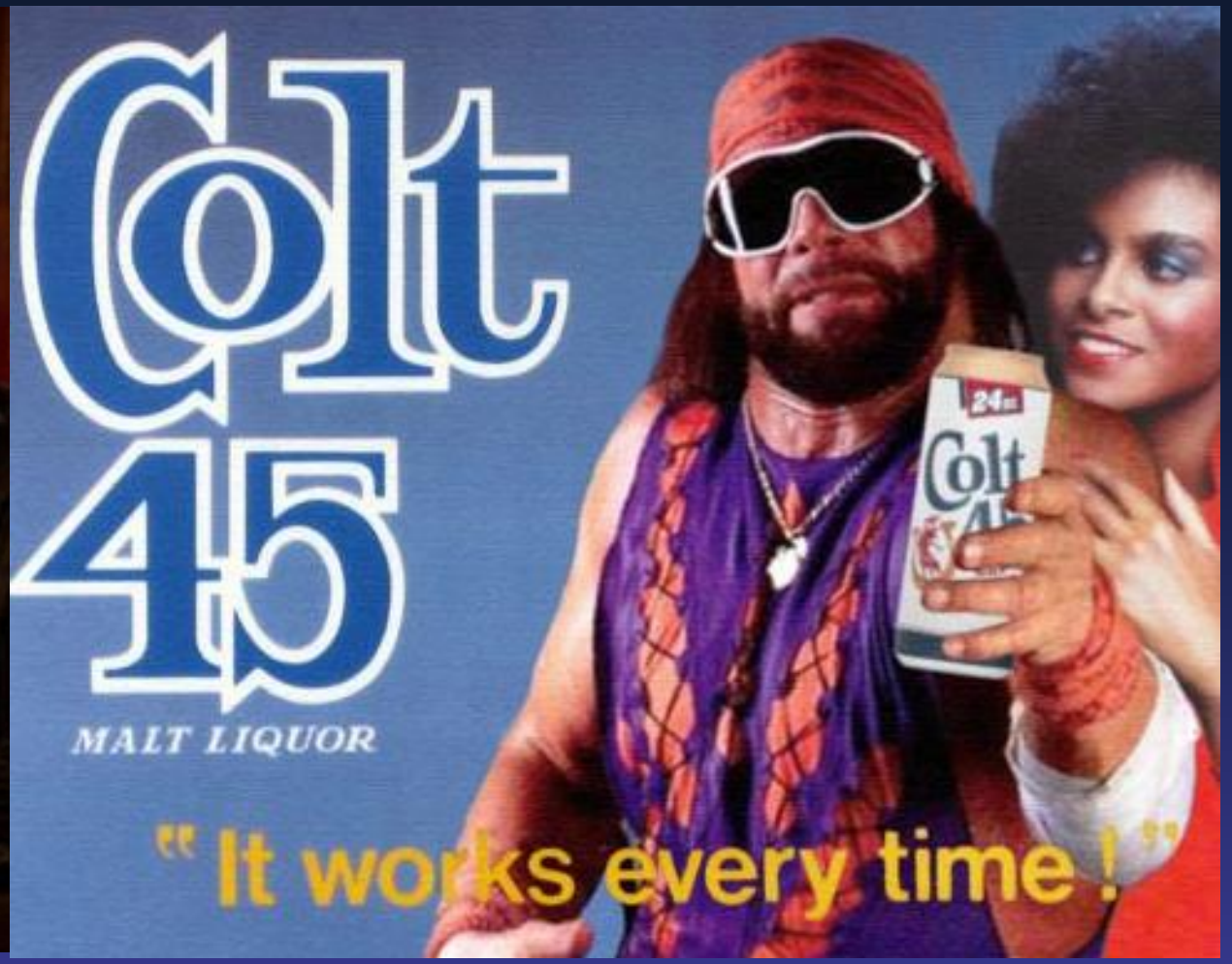
Lock Out, Tag Out & Arc Flash

- Leave you with this, what changes a culture?
- *Cruising, preferably in a Nova or Camaro*
- *No seat belts on*
- *Smoking a cigarette*

Lock Out, Tag Out & Arc Flash

- Leave you with this, what changes a culture?





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What changed that culture?

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- Create that culture
  - Consistent message from day one
  - Encourage and reward “I don’t understand”
  - Train as individually as possible
  - Demonstrate understanding
  - Make sure they AREN’T being trained negatively in your plant
  - Follow up, ask them, involve them