Check the job description of a typical mine safety manager and you will find a long list of responsibilities. Developing and directing facility-wide safety programs are a critical element of the role, and implementing an effective lockout/tagout (LOTO) program can be a challenging initiative. It includes LOTO procedure development and employee training, as well as managing dozens, hundreds or even thousands of padlocks and lockout devices within a facility.

Since 1990, at least 75 fatal and 1,850 nonfatal incidents have occurred in the mining industry, which were classified by MSHA as electrical. Many of these could have been prevented if the circuits were locked, grounded and tagged prior to any maintenance work being performed. Every company is responsible for training employees on the lockout/tagout procedures used within their workplace.

While a company may have purchased lockout padlocks and devices for a wide range of applications, it is critical to ensure that employees are appropriately trained to perform the actual lockout procedures. Authorized workers must know how to properly isolate equipment to ensure that hazardous energy is reduced to a “zero state” and stays that way until servicing is complete. Otherwise, the risk of injury or death is imminent.

**Efficient, Thorough Training**

According to MSHA, at least 75 fatal and 1,850 nonfatal incidents have occurred in the mining industry since 1990 that MSHA classified as “electrical.” Most of these accidents could have been prevented if the circuits were locked, grounded and tagged prior to any maintenance work being performed. MSHA regulations for both metal/nonmetal and coal require locking and tagging electrical circuits prior to performing maintenance on the circuit or the mechanical equipment supplied by the circuit.

MSHA has a variety of standards that relate to LOTO, depending on commodity. They are:

- 30 CFR 56/57.12016 (surface/underground metal/nonmetal);
- 30 CFR 56/57.12017 (surface/underground metal/nonmetal);
- 30 CFR 56/57.14105 (surface/underground metal/nonmetal);
- 30 CFR 75.509 (underground coal);
- 30 CFR 75.511 (underground coal);
- 30 CFR 75.705 (underground coal);
- 30 CFR 75.820 (underground coal);
- 30 CFR 75.1725 (underground coal);
- 30 CFR 77.404 (surface coal);
- 30 CFR 77.500 (surface coal);
- 30 CFR 77.501 (surface coal);
- 30 CFR 77.704 (surface coal).

Under MSHA standards, training is required under Part 48 or Part 46 to cover basic LOTO principles, as well as specific task training that can include the LOTO procedures for each piece of equipment that may be serviced or maintained. MSHA has also made its LOTO standards part of its “Rules to Live By” campaign, where violations may incur specially assessed penalties.

Where does one start to implement a LOTO program to reduce the odds of future accidents? A simple recommendation is to begin with general training for all workers who will use or will be affected by LOTO within their environment. Explain what LOTO is, why it is needed, what to do and, just as importantly, what not to do during a lockout procedure. Also hold machine- and lockout device-specific training for employees. There is flexibility in how to train, but the responsibility always resides with the company.

Many companies hire safety consultants to train employees for several reasons. Thorough training techniques require a significant and focused time commitment. Many safety managers often are challenged to devote the extensive time necessary for training due to their multiple other responsibilities. The bottom line is that safety consultants are tasked with the responsibility to make sure employees receive the proper training. When considering this route, look for an experienced provider who can understand the specific requirements of your facility, especially because MSHA and OSHA standards differ. If a full-service consultant develops your safety lockout procedures, s/he would make an excellent choice for providing the training as well.

General safety training videos can be appropriate in some situations, such as overall employee LOTO awareness or the recommended annual “refresher” viewing. Various training firms offer such options. If you have experienced staff with training know-how, they may be your preferred option.

**One Padlock, One Key Per Employee**

To select the best safety padlock for your facility, first consider the number of employees who require safety
padlocks to lock out energy sources. This determines the number of key codes your facility requires since employees should have their own unique key under the “one lock, one key per employee” premise. This prevents workers from inadvertently opening each other’s padlocks and introducing a potential safety hazard.

Choose a safety padlock style that not only has enough key codes to meet your current requirements, but can also accommodate future facility and workforce expansion. Key codes for all locks sold to a facility should be recorded and saved under an assigned user ID. This key record can be referenced to confirm that new key codes are always assigned to safety locks purchased by a facility.

One exception to consider: although “keyed different” padlocks are primarily used for safety lockout purposes, there are cases where an employee needs several personal padlocks. In this circumstance, the appropriate number of locks can be “keyed alike” so the worker can use a single key rather than fumbling with a ring full of different keys. As long as the keys are safely controlled, this should ensure that the keyed-alike padlocks can only be opened by the assigned employee.

Regardless of where they are used, padlocks for lockout/tagout need to be unique and visibly different from padlocks used for general security purposes. Using different color models and styles is ideal to identify padlocks for LOTO purposes. It also alerts workers to LOTO proceedings, helping ensure proper observance.

**Major Issues & 7 Key Steps**

Workplace realities, including those at mining operations, indicate that procedures in many facilities would benefit greatly from more efficient LOTO direction with machine-specific instructions. The sheer volume and diversity of plant equipment add a certain level of complexity to LOTO actions. Despite all efforts, oversights and errors result in injuries, equipment damage or worse. But costly mishaps can be prevented using a methodical plan of attack.

A seven-step LOTO guideline process is outlined here, but you should always keep in mind three major issues:

- **Affected workers.** Workers operating the equipment that needs to be locked out must be aware of and comply with LOTO procedures, along with the others working in the area where LOTO is used (e.g., contractors). Miners operating ancillary and sequential production process equipment should also be made aware of machinery that is locked out or when LOTO procedures are scheduled. This is important so they do not inadvertently miss a step in the equipment isolation process.

- **Multiple energy source consideration.** When reviewing lockout procedures for the equipment to be serviced, energy sources other than electricity may be identified. If they are present in your LOTO task environment, they must be controlled. Lockout procedure placards should be attached to all machinery, which not only provide the steps required to isolate all energy sources, but also include images to identify the location of all isolation points. Workers who solely rely on familiarity with equipment are at risk since they could inadvertently miss a step in the equipment isolation process.

- **Electrical energy acts and reacts differently than other types.** When a button is pushed or an electrical switch is thrown, the power goes on or off instantly. Other types do not react in this manner. Kinetic energy slowly and gradually keeps gears turning, belts moving and rotors rotating. Engines and components need time to cool down, so even though a machine is turned off, it does not necessarily mean it is safe to proceed with a LOTO procedure.

With a worker-friendly approach and understanding, injuries, damaged equipment and MSHA fines can be avoided. The following steps can help avoid dangerous oversights. The recommended seven-step process includes:

1) **Prepare for shutdown.** Note the types, magnitude and hazards of the energy that need to be controlled and how they need to be isolated. Identify all of the energy sources that need to be locked out, the location of each lockout point and the lockout devices required. Always familiarize yourself with electrical circuits before you perform any electrical work and ask for help or consult a wiring diagram/schematic.

2) **Notify all affected employees that shutdown and LOTO are beginning.** It is wise to provide an audible or visible warning system and always ensure that there is safe access to all working areas.

3) **Shut down the machine or equipment.** Be sure to turn off energy points in the proper sequence to prevent equipment damage and to avoid creating additional hazards. Also, wear appropriate PPE, including electrically rated gloves, hardhat and eye protection. As noted, lockout procedure placards should be attached to all equip-
ment, which visually outline the step-by-step lockout procedure instructions and location of isolation points.

4) Isolate all energy sources, including electric, hydraulic, mechanical and pneumatic, before commencing work. This is done by deactivating valves and by disconnecting switches and circuit breakers as outlined in the lockout procedure.

5) Lock out by applying locks and lockout devices to hold switches and valves in the “safe” or “off” position. Secure all power sources and confirm that each person working on an electrical circuit or system applies his or her own personal lock and tag.

6) Release stored energy. Bleed off pressure, drain all lines, block elevated parts and discharge capacitors as well as residual air, gas, steam and water pressure. Use properly rated noncontact voltage testers to ensure that circuits are deenergized.

7) Verify lockout by first confirming that no employees are exposed to danger, then test machine controls to confirm a zero-energy state exists.

**RELEASE FROM LOTO:**

**AN IMPORTANT & SPECIFIC PROCESS**

When maintenance or repair work is completed, powering-up equipment also calls for several steps to ensure worker safety and to prevent equipment damage. It is important to note that performing the following first two tasks should be done before any LOTO devices are removed.

1) Check machines and equipment. Authorized employees need to replace machine guards, remove tools and nonessential items from the work area. Block devices that were inserted also need to be removed, but in some instances, the machine may need to be restarted first.

2) Check for employees to make sure the work area is clear and that workers are in a safe place and away from the machines or equipment.

3) Remove LOTO devices. Removal should only be performed by the employee who applied them in the first place.

4) Before any machine or equipment is started, notify all affected employees that the LOTO devices have been removed.

5) Restore energy to the machine. As indicated, it may require cautiously reenergizing some machines to remove blocking devices. Additional authorized employee assistance may be needed to reenergize certain sections or parts of the equipment.

A focused, multifaceted procedure can make any mining operation safer. The importance and value of effective safety and health management programs cannot be overstated.

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