Chapter 8.2 Lockout/Tagout Practices

This could be you . . .

An electrician received a shock from a 480-volt alternating current source while modifying a motor controls panel. The hot junction was an undocumented change to the panel. The electrician could have been killed but only suffered injury since the current passed through the arm only.

An operator failed to turn off and lockout a pipe-cutting machine after it stalled. He lost a finger as a result because he was touching the chain and sprocket drive when the machine unexpectedly restarted.

Employees who were not certified to service or operate a crane violated a Do Not Operate tag and operated the crane. They damaged highly valued equipment.

8.2.1 Applicability of this chapter

8.2.1.1 You are required to follow this chapter if you do any of the tasks listed in paragraph 8.2.4 below at JSC, including Ellington Field or Sonny Carter Training Facility, whether a civil service or contactor employee. If you work at a JSC field site, follow local requirements that meet the intent of this chapter.

8.2.2 JSC's LO/TO program

8.2.2.1 This chapter is JSC's LO/TO standard, which is designed to implement 29 CFR 1910.147, "The Control of Hazardous Energy (Lockout/Tagout)." It provides a consistent and uniform policy and *minimum* requirements for locking out and tagging out energy-isolating devices during maintenance, service, or repairs on machinery, equipment, or systems. The intent of JSC's LO/TO program is to ensure machines, equipment, and systems are properly and uniformly locked out and tagged out throughout JSC, and *ALL* employees are protected from exposure to an unexpected energy release. Projects, contractos, and organizations:

a. May take this basic LO/TO standard and develop addendums to meet their particular operations and procedures, as long as the intent of the standard is met or exceeded. Addendums shall be followed by all employees, and strictly enforced.

b. Shall develop, document, and use procedures for controlling potentially hazardous energy unless specifically exempted under 29 CFR 1910.147(c)(4)(i). These procedures are required to meet the requirements in this chapter and clearly and specifically outline the scope, purpose, authorization, rules, and techniques to be used for controlling hazardous energy and the means to enforce compliance including, but not limited to, the following:

   (1) A specific statement of the intended use of the procedure

   (2) Specific procedural steps for shutting down, isolating, blocking, and securing machines or equipment to control hazardous energy

   (3) Specific procedural steps for placing, removing, and transferring LO/TO devices or tagout

devices and who is responsible for them

(4) Specific requirements for testing a machine or equipment to verify the effectiveness of lockout devices, tagout devices, and other energy control measures before starting the maintenance, repair or service work

8.2.3 Operations not covered by this chapter

a. Work on cord- and plug-connected electrical equipment where the hazard of unexpected energizing or start up of the equipment is controlled by meeting both of the following conditions:

(1) Unplugging the equipment from the energy source.

(2) Keeping the plug under the exclusive control of the employee performing the servicing or maintenance. At no time should servicing or maintenance be performed while the equipment is plugged in. You may troubleshoot electronic circuits if you have an approved safe procedure and follow the requirements in chapter 8.1, “Electrical Safety.”

b. Hot tap operations involving transmission and distribution systems for substances, such as gas, steam, water, or petroleum products on pressurized pipelines, provided that the project, contractor, or organization demonstrates that all of the following are true:

(1) Continuity of service is essential.

(2) Shutdown of the system is impractical.

(3) Documented procedures were followed and special equipment was used to provide proven effective protection for employees.

c. Operation control of equipment when lockout/tagout is not required, but control is needed to prevent damage or for other operational issues. This is covered in attachment 8.2B, Appendix F, “Operational Control.”

8.2.4 LO/TO Employee Categories

8.2.4.1 Specific categories of employees under this chapter are:

a. *Authorized employee*: A person who locks out or tags out machines or equipment to service or maintain those machines or that equipment.

b. *Affected employee*: An employee whose job requires him or her to operate or use a machine or equipment that is being serviced or maintained under lockout/ tagout, or whose job requires him or her to work in an area in which the servicing is being done. An affected employee becomes an authorized employee when the employee’s duties include servicing or maintenance covered under LO/TO.

c. *Other employee*: An employee whose work operations actually is, or potentially may be, in an area during the period when energy control procedures will be used.

d. *Task Group Representative (TGR)*: A person who is responsible for the identification and locking/tagging of the energy isolation points during group LO/TO.

8.2.5 Contracts involving LO/TO at JSC

8.2.5.1 The following requirements apply for contract work involving LO/TO in JSC facilities:

a. If you contract or sub-contact for services, you are responsible for notifying contractors or subcontractors of JSC's LO/TO program requirements, and shall provide a copy of this chapter to the contractor or subcontractor.

b. All contractors shall make sure that their employees understand and follow this chapter.

8.2.6 General requirements and enforcement

8.2.6.1 The following requirements apply to all employees, machines, and equipment at JSC:

a. If you see a piece of equipment that is locked out or tagged out, you **shall never** attempt to start, energize, or use that machine or equipment except as required to verify isolation in subparagraph 8.2.7.1.g. below.

b. If you are an "authorized employee," you shall follow the steps listed in subparagraph 8.2.6.1 below when locking out or tagging out a component or system.

c. If you violate LO/TO, you are subject to disciplinary measures by your employer as described in Chapter 3.7, "Disciplinary System."

d. When installing new machines or equipment, or when replacing, repairing, renovating, or modifying existing machines or equipment, you shall design the energy-isolating devices to accept a lockout device.

8.2.7 JSC's basic LO/TO requirements

8.2.7.1 You shall follow these steps when maintaining, servicing, or repairing equipment:

a. Prepare for shutdown. Determine the types and magnitudes of the energy sources (such as mechanical, electrical, chemical), assess the hazards of each energy source, and define the method or means to control each energy source.

b. Notify "affected employees" who operate the equipment that you will be working on.

c. Shut down equipment using procedures established for that machine or equipment.

d. Isolate all energy sources.

e. Attach LO/TO isolation devices as described in paragraphs 8.2.8 and 8.2.9 below. Also note the requirements for group lockout and shift changes in paragraphs 8.2.13 and 8.2.14 below.

f. Release all potential or stored energy, as described in paragraph 9 below.

g. Verify the isolation, including testing; see paragraph 8.2.11.

h. Service, repair, or maintain the equipment.

i. Inspect the work area to ensure all nonessential items have been removed and machine or equipment components are operationally intact. Make sure all employees have been safely positioned and are not in the operational area before re-energizing the equipment.

j. Notify “affected employees” that lockout or tagout devices will be removed.

k. Remove LO/TO isolation devices as described in paragraph 8.2.12 below.

l. Restore the equipment to operation.

Note: If the equipment you will be working on has another lock or tag, such as the WARNING: DO NOT OPERATE tag, or another employee’s lock and tag, you still need to lockout and tagout the equipment per this chapter before working on it. This includes evaluating the situation to determine if your lockout/tagout devices can be applied in addition to the existing lock or tag or whether you must have the other lock or tag removed. Revise your lockout/tagout procedure as needed.

8.2.8 Hardware (locks and lockout devices)

8.2.8.1 Attaching locks, tags, and other necessary hardware will ensure the energy isolation device cannot be inadvertently switched or changed during maintenance or repair activities. To get locks for lockout, follow the “Policy on issuing locks and tags” in Attachment 8.2A, Appendix F. The following requirements apply to locks and lockout devices:

a. **Locks**. You shall only use locks provided by JSC for isolating, securing, or locking equipment from identified energy sources. Dedicated lockout padlocks at JSC are RED in color and individually keyed and numbered. Never use a RED lock for any other purpose. Orange locks with RED shrink wrap shall designate high voltage lockout/tagout by the Center Operations Directorate.

b. **Other lockout devices.** These include, but are not limited to, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware for isolating, securing, or blocking machines or equipment from energy sources. Your company or organization shall provide these devices. They shall be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as bolt cutters or other metal-cutting tools.

8.2.9 LO/TO tags

8.2.9.1 Tags are essentially informational devices attached to the lockout devices. Tags do not provide the physical restraint provided by a lockTo get tagout tags, follow the “Policy on issuing locks and tags” in Attachment 8.2A, Appendix 8F. The following requirements apply to tags:

a. If you are going to personally work on a system, you shall only use the red LO/TO form (JSC Form (JF) 1291) and attach it by putting the red padlock through the grommet or by using nylon cable ties provided by JSC to attach it to the padlock or same point as the padlock.

b. Tag information shall be legible and understandable.

c. If an energy-isolating device is not capable of being locked out, you shall use a tagout device instead.

d. You shall never use the red LOCKOUT TAGOUT tag as a WARNING, DO NOT OPERATE tag. The DANGER, LOCKOUT TAGOUT (JF 1291) tag means one thing and one thing only: that you are personally working on the system.

e. If you use a tag without a lockout device, you shall also use other methods to isolate all sources of energy, such as block and bleed, blinds, valve hand-wheel removal, etc.

f. You shall also use all reasonable means to make sure that the energy-isolating device is not operated.

g. You shall document that these other methods are at least as effective as a lockout device would have been, if it were used. This shall meet all tagout provisions of 29 CFR 1910.147, and specifically paragraph 147(c)(3)(ii).

h. When a tag is attached for energy isolation, no one may remove it without the authorization of the person responsible for the tag. It shall never be bypassed, ignored, or otherwise defeated. Never energize the system when a tag is in place except under specific conditions per written procedure outlined in this chapter (testing system to ensure that there is no power, etc.).

i. For energy-isolating devices not capable of being locked out, you shall attach the tag to the device or as closely as safely possible to the device and in a position immediately obvious to anyone attempting to operate the device.

j. JSC tags contain log and tag number spaces, which you may use as best fits your needs, but you shall address the log and tag numbers in any LO/TO procedures you develop.

8.2.10 Releasing stored energy

After attaching lockout or tagout devices to energy isolating devices, you shall relieve, disconnect, restrain, and render safe all potentially hazardous stored or residual energy. Stored or residual energy could include, but is not limited to, electrical capacitors, batteries, contained hydraulic or pneumatic pressure, springs, and suspended weights. If the stored energy could re-accumulate to a hazardous level, continue to verify isolation until the servicing or maintenance is completed, or until the possibility of the energy accumulation no longer exists.

8.2.11 Verifying isolation

8.2.11.1 Before starting work on the machinery, equipment, or system that has been locked out or tagged out, you, as an authorized employee, shall verify that the equipment has been isolated and de-energized by the following:

a. Verify personnel are not exposed to potential danger.

b. Test the isolation of the equipment by *attempting to energize it, using the normal operating controls* (where possible) to make certain that the machinery, equipment, or system will not operate.

c. Verify, using the appropriate equipment, that exposed, previously energized parts are free of energy before removing electrical PPE or exposing any unprotected persons. If the circuit to be tested is over 600 volts, test the test equipment used for proper operation immediately before and immediately after the test.

d. Verify on a gauge, open a vent valve, or use other positive verification methods, if pressure sources are involved.

Caution: Return operating controls to neutral or off position after attempting to start.

8.2.12 LO/TO lock release or removal

8.2.12.1 Only one key is authorized for each red LO/TO lock and LO/TO tag and *only* the person who attached the lock is authorized to remove the lock and maintain custody of the key. The TGR is the only person who is authorized to release and remove the LO/TO lock and tag from his or her assigned group lock box. There is a *special condition to this rule*: If the employee who attached the red LO/TO lock and LO/TO tag is not at the facility and is unavailable to remove the lock, the trained supervisor is authorized to remove the lock after following the procedure below. If you need a red LO/TO lock removed, you shall contact the employee's supervisor. If you, as a supervisor, are asked to remove a red LO/TO lock with a LO/TO tag, you shall develop a procedure that includes these steps and others pertinent to your organization or the specific situation:

a. Confirm the employee who attached the lock is not at the facility and not available to remove the lock.

b. Attempt to contact the employee. Call home phone, cell phone, or pager. Document all attempts to contact the employee.

c. Make sure all work is completed and no employees are exposed to any type of hazards created by removing the LO/TO device(s).

d. Notify all affected employees that you will be removing the lock.

e. Have an authorized employee test and visually inspect the equipment, as necessary, to verify all tools, electrical jumpers, shorts, grounds, and other such devices have been removed so the circuits and equipment can be safely energized.

f. Remove the lock. Avoid destroying the lock, if possible, by cutting the chain, hasp, or other restraining device.

g. Immediately inform the authorized employee whose lock you removed that the lock has been removed when he or she returns to the facility or becomes available, *and before* he or she returns to the task or system where the lockout was in effect. You may need to notify coworkers, leave a phone message, an email, or use other means to notify him or her to report to you before going to the task or system where the lockout was in effect. Your message shall say that their lock has been removed and the system is now live or dangerous if work is resumed.

h. Return an undamaged lock to the employee with an explanation of circumstances as soon as possible.

8.2.13 Group lockout

8.2.13.1 An LO/TO application may involve more than one maintenance, repair, or servicing employee or more than one point of energy isolation. Several options exist for "group" LO/TO procedures. The examples in subparagraphs d–g below for group LO/TO illustrate the range of approaches. These examples are not intended to represent the only acceptable procedures for group LO/TO. The primary requirement is that the process used shall provide the employee protection equivalent to using a personal LO/TO. This would include use of "controlled key locks" and LO/TO tags per a written procedure for the task. The following requirements apply:

a. The group or supervisor shall designate a TGR for any group LO/TO to maintain control of the group lock box during the entire duration of the maintenance or service task. Specific responsibilities for the TGR are found in 29 CFR 1910.147(f)(3)(ii).

b. An important element of "group LO/TO" is to enable the TGR to initially lockout and tagout the system and place all LO/TO keys and tag tabs in a group lockbox. Then the TGR hangs an LO/TO tag with a red LO/TO lock on the lock box. The TGR controls the key while he or she is working the task. Each authorized person shall install his or her individual red LO/TO lock and LO/TO tag on the lockbox.

c. The energy isolation devices shall never be released until all authorized personnel and the TGR have removed all locks and tags from the lockbox. The TGR is responsible for control of the lock box and key. The control responsibility of the TGR may be transferred between shift changes and job reassignments.

d. Single energy source, multiple maintenance, servicing personnel, and ***single point with use of multi-lock adapter (Figure 8.2-1)***:

   (1) If the equipment operation is the responsibility of a system owner or user, that individual may configure the equipment for operational control before the group applies any tag or lock. (see Appendix F, attachment 8.2B)

   (2) Each authorized person who will be performing the maintenance or service task shall install an individual red LO/TO lock and LO/TO tag at the de-energized single-energy control point before starting work. This will often require the use of a multi-lock adapter to accommodate the numerous locks.

   (3) If energy isolation is required during periods where the work area may be unattended by authorized personnel, a TGR installs a separate red LO/TO tag and red LO/TO lock at the single-energy control point at the time of isolation. The TGR shall maintain control of the key throughout the maintenance or service task period.

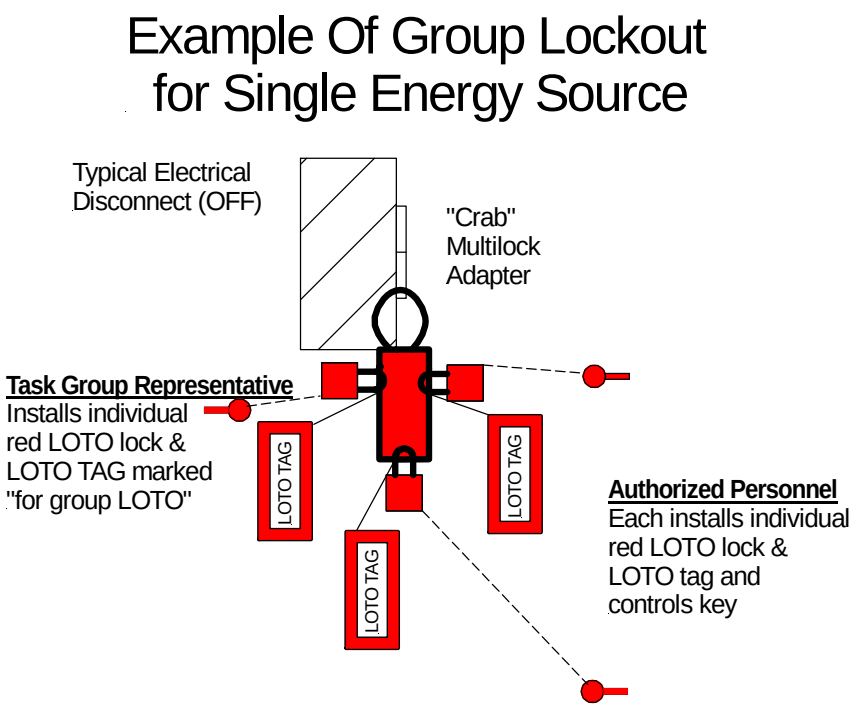

Figure 8.2-1. Group lockout/tagout concept for single energy control point.

e. Single energy source, multiple maintenance, servicing personnel, and ***single point with use of lockbox***:

(1) An alternate approach is to use a lockbox when the number of locks and tags are too numerous to be supported by the single energy control point.

(2) If the equipment operation is the responsibility of a system owner or user, that individual may configure the equipment for operation control before the group applies any tags or locks (see Appendix F, attachment 8.2B).

(3) The TGR shall attach a red LO/TO tag marked or stamped with the words “for group LO/TO” and a red LO/TO lock at the de-energized single energy control point at the time of isolation. The key is then placed in the lockbox.

(4) The TGR shall install a red LO/TO tag and a red LO/TO lock on the lockbox.

(5) The TGR shall maintain control of the key throughout the maintenance or service task period until all work is completed and the equipment is safe to reactivate. This provides energy isolation during periods where the work area may be unattended by authorized personnel.

(6) The authorized personnel who will be performing the maintenance or service task shall each install an individual red LO/TO lock and LO/TO tag on the lockbox before working.

f. Multiple energy sources, multiple maintenance, servicing personnel, and ***multiple point sources using lockbox (Figure 8.2-2)***:

(1) An alternate approach is to use a lockbox when there are multiple energy control points. In this case, a system owner or user may have applied other tags and locks for operational control per Attachment 8.2B, Appendix F. The group would apply its devices in addition to the other locks or tags.

(2) The TGR shall attach a red LO/TO tag marked or stamped with the works “for group LO/TO” and a red LO/TO lock at each energy control point at the time of isolation. The keys are then placed in the lockbox.

(3) The TGR shall install a red LO/TO tag marked or stamped with the words “for group LO/TO” and a red LO/TO lock on the lockbox.

(4) The TGR shall maintain control of the key throughout the maintenance or service task period until all work is completed and the equipment is safe to reactivate. This provides energy isolation during periods where the work area may be unattended by authorized personnel.

(5) The authorized personnel who will be performing the maintenance or service task shall each install an individual red LO/TO lock and LO/TO tag on the lockbox before working. This option requires the least number of locks and ensures each person has control of the total system when he or she is working on the system.

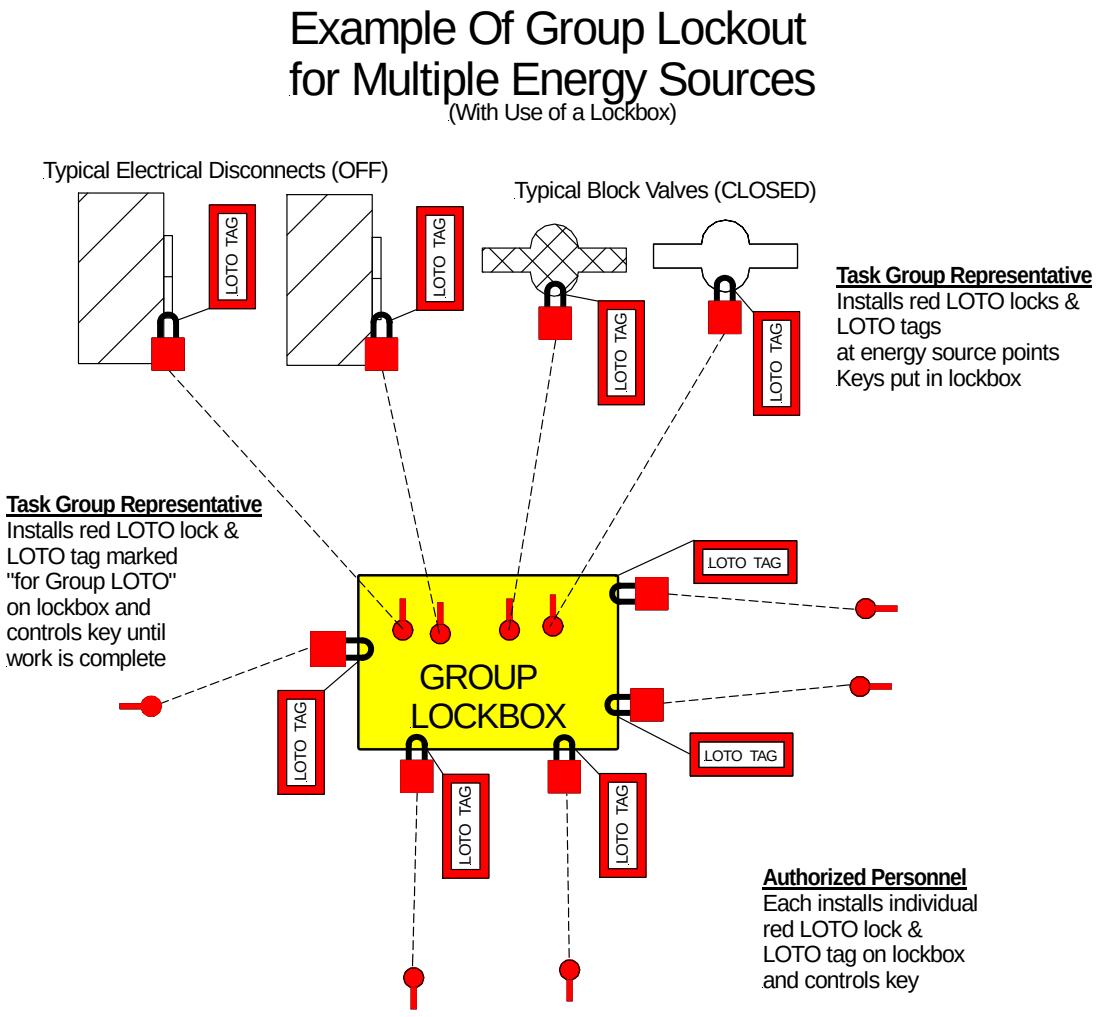

Figure 8.2-2. Group LO/TO multiple energy source control points.

g. Multiple energy sources, multiple maintenance, servicing personnel, and ***multiple point sources using multi-lock adapters***:

(1) If the equipment operation is the responsibility of a system operator or user, the user or operator may have to use other tags for operational control (such as the “Do Not Operate” tag) with appropriate shop or craft locks, per Attachment 8.2B, Appendix F.

(2) Each authorized person who will be performing the maintenance or service task shall install an individual red LO/TO lock and LO/TO tag at each of the multiple energy control points before starting work. To accommodate multiple objectives, this will often require the use of a multi-lock adapter to accommodate the numerous locks.

(3) The TGR shall attach a red LO/TO tag marked or stamped with the words “for group LO/TO” and a red LO/TO lock at each energy control point at the time of isolation. This provides ongoing, uninterrupted lockout during periods where the work area may be

unattended by authorized personnel.

(4) The TGR shall maintain control of the keys throughout the maintenance or service task period.

8.2.14 LO/TO during shift changes

8.2.14.1 During the course of work, work crews or individuals may take turns working on the locked out equipment. The following requirements apply:

a. If a new authorized person or crew of authorized persons carries on the work started by an earlier person or crew, there are two options:

(1) Arriving employees attach their own locks and verify energy isolation, and departing employees remove their locks, or

(2) Each departing employee transfers his or her key to an arriving employee, so that each arriving employee has a key and corresponding lock.

b. Each authorized person shall use his or her own red LO/TO lock. When multiple shifts work on a locked-out system, the TGR will be responsible for making sure all authorized personnel have either installed individual red LO/TO locks and tags at all energy sources or the appropriate group lockbox.

c. Arriving employees shall verify energy isolation.

d. When a system must be handed over to a new crew to continue the work, and there is equipment already locked and tagged out, this constitutes a shift change and you shall follow these steps:

(1) Inform the arriving shift or crew of the devices, hazards, and other employees involved in this particular lockout/ tagout operation.

(2) The employees on the arriving shift or crew attach their lockout and tagout devices on the isolation device(s) currently locked and tagged or receive keys form the departing employees.

(3) The employees on the departing shift remove their lockout and tagout devices, or transfer keys to the arriving employees.

(4) The TGR for the departing group will be the last person of the departing group to remove his or her lock or transfer a key; this ensures energy isolation at all times until the new TGR is ready to accept the responsibility. If they opt for lock changeout, the arriving TGR will be the first person of the arriving group to attach his or her lock prior to or immediately after the previous TGR removed his or her lock. Both TGRs will witness the transfer of energy isolation control and note the transfer in the task documentation.

(5) The current TGR shall verify energy isolation for the system.

e. During a TGR shift change, transfer of the control of a group lockout/tagout may consist of transferring a key to a secure cabinet that contains the lockout padlock on the group lockout box.

f. When LO/TO is to be handed over from one TGR to another while the work is continued by the

same authorized employees, this does not constitute a shift change. However, the task documentation shall be annotated to document this transfer of energy isolation control.

(1) Inform all authorized personnel working on the system of the impending transfer of LO/TO authority.

(2) The departing TGR will remove his or her lock and the new TGR will attach his or her lock prior to the previous TGR removing his or her lock or the TGRs transfer the key. Both TGRs will witness the transfer and note the transfer in task documentation.

8.2.15 Training for LO/TO

8.2.15.1 A competent person shall conduct LO/TO training, and the training needs to follow the requirements of Chapter 4.1 for conduct and documentation.

a. **Initial training**. Each employee involved in LO/TO or energy control as described below shall be trained in the purpose and scope of the LO/TO program, recognizing hazardous energy sources and the methods and means necessary for energy isolation, and using the LO/TO procedures. Training for the four types of employees (*authorized*, *affected*, *other,* and *supervisor*) is based on the relationship of that employee's job to the equipment being locked out or tagged out as follows:

(1) *Authorized employee* (use LO/TO to service or maintain equipment) training shall cover details about the type and magnitude of the hazardous energy sources present in the workplace and the methods and means necessary to isolate and control energy sources.

(2) *Affected* or *other employee* (operate or use the machines) training shall cover: recognizing when the control procedure is in place, understanding the purpose of the procedure, and understanding the importance of not attempting to start up or use equipment that has been locked out or tagged out.

(3) *Supervisors* over authorized employees shall be trained as an authorized employee and trained in the procedure for removing lockout/tagout devices in paragraph 8.2.12 above.

b. **New-hire training**. If you are a new employee, you shall attend LO/TO training before doing any tasks that could expose you to energy hazards. Your supervisor shall tell you if you require LO/TO training when you are first assigned to work.

c. **Retraining**. As an authorized employee, you require retraining at least every 2 years or as required in 29 CFR 1910.147(c)(7)(iii).

d. **Certification of training**. Supervisors shall certify employee training records (see chapter 4.1, paragraph 4.1.11) as required by 29 CFR 1910.147(c)(7)(iv).

8.2.16 Periodic audits of JSC's LO/TO program

8.2.16.1 Each organization or contractor is responsible for continually monitoring and periodically auditing (at least annually) its LO/TO and energy control programs. The following requirements apply:

a. The audit shall follow the requirements of 29 CFR 1910.147 (c) (6) and be documented.

b. The Safety and Test Operations Division shall:

(1) Audit JSC's LO/TO program at least annually by inspecting organization and contractor audit documentation to ensure all affected employees understand and are following the program.

(2) Forward any deviations noted on the audit to the responsible organization or contractor for correction.