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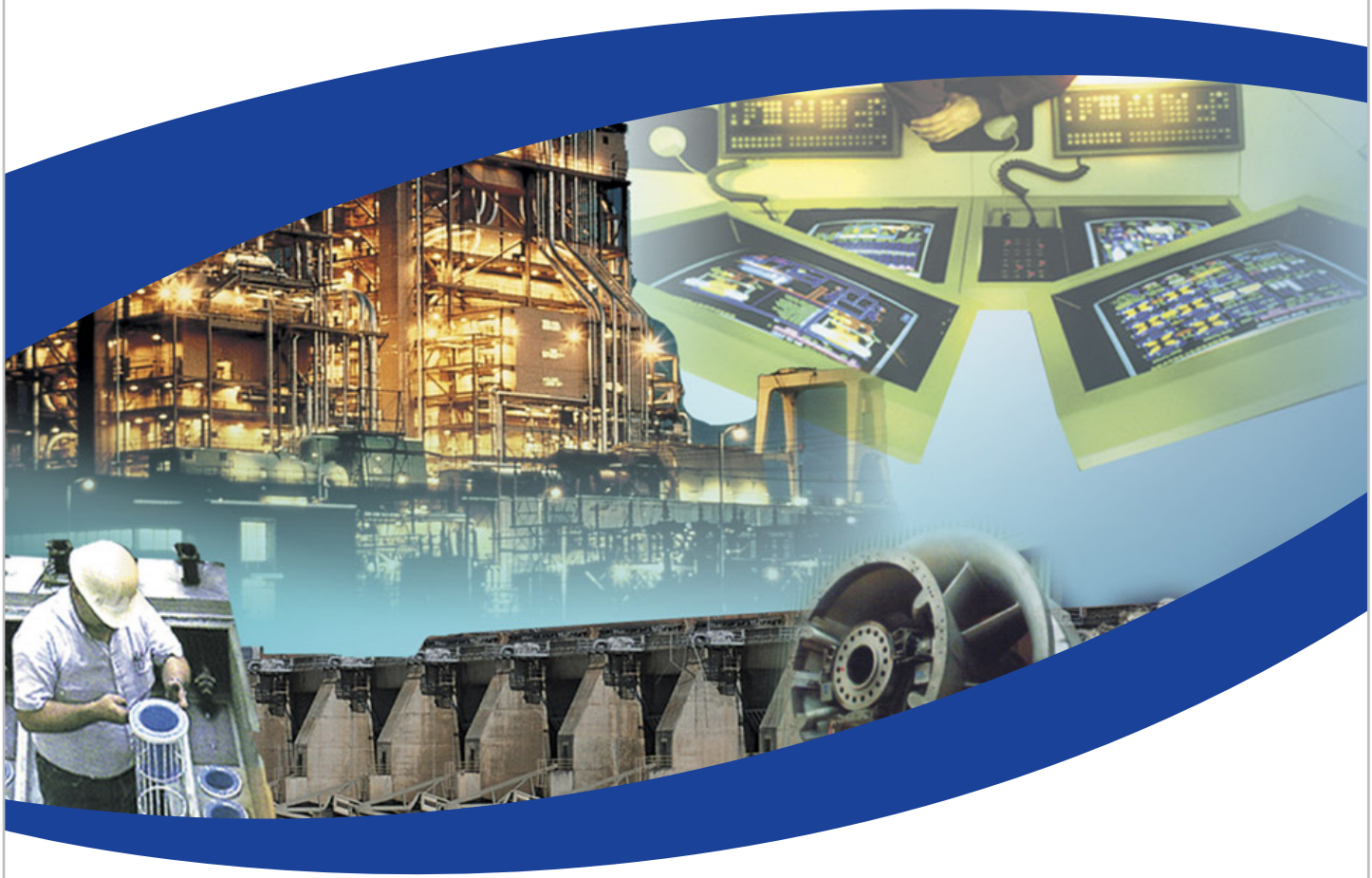
Lockout/Tagout Self-Assessment Guideline

Revision 1, 2018



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Revision 1, 2018

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PRODUCT DESCRIPTION

At electric generating stations, lockout/tagout (LOTO) programs exist to protect personnel from injury and plant equipment from damage. By identifying strengths along with areas for improvement, periodic assessment of a station's program can contribute to an understanding of how the program is meeting those objectives. This report presents a systematic method for self-assessing a plant's LOTO program. Included are a detailed worksheet and examples of how the worksheet and approach have been applied at two different fossil generating stations.

Background

The LOTO process changes the baseline configuration of an electric power plant (the normal operating condition) to a different configuration (a condition that supports hands-on work on equipment in a situation where personnel could otherwise be exposed to hazards) and then restores the configuration back to the normal or operating condition when the work is complete and it is safe to do so. A robust, clearly documented lockout/tagout process, commonly called *LOTO*, is critical for the protection of workers and equipment and for the performance of effective operations and maintenance. The purpose of assessing the LOTO process is to provide a more complete understanding of station performance and identify strengths as well as areas for improvement. By identifying gaps between the station's performance and industry best practices, continuous improvements can be made. The assessment process can also validate that company policies and procedures are understood, that the policies and procedures are being properly implemented through routine practices, and that the procedures are properly aligned and consistent.

Objective

This report updates and supersedes the Electric Power Research Institute (EPRI) report *Lockout/Tagout Self-Assessment* Guideline (EPRI 3002001127), published December 2013. This report describes a self-assessment process specific to LOTO as a means of identifying gaps in a station's LOTO process and the execution of that process. The report illustrates how to perform a programmatic gap analysis to compare plant LOTO procedures to industry best practices as identified in *Clearance and Tagging (Lockout/Tagout) Guideline for Power Plants* (EPRI 3002011179) as well as a performance gap analysis that reviews the actual execution of the plant LOTO program.

Approach

As part of the development of the assessment framework, member utilities participated in EPRI-facilitated assessments of their LOTO programs. Experience gained in these assessments has been used to develop and refine the process described in this report and the self-assessment gap analysis worksheet provided in the appendix.

Results

This report describes how to plan and perform programmatic gap analyses by which the station's LOTO procedures are compared against industry best practices as well as performance gap analyses of the execution of a station's LOTO program. An organized worksheet guides the assessor through the assessment process to identify and evaluate any gaps between industry best practices and station procedures and between station procedures and actual station practices observed. Utilities can then assess their overall performance in order to improve worker safety, reduce occurrences of equipment damage, and achieve more timely completion of work.

Applications, Value, and Use

Even in plants with detailed procedures in place, activities have been observed that were not as safe as they should have been. There is a need across the industry for companies to assess their LOTO processes and identify gaps. Doing so will help the industry develop actions to close those gaps in order to enhance worker safety, protect equipment, and improve their overall programs.

Keywords

Assessment
Clearance
Lockout/tagout (LOTO)
Tagging

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PRIMARY AUDIENCE: Operations personnel, supervisors, and managers

SECONDARY AUDIENCE: Plant managers, site assessment supervisors, engineering supervision

KEY RESEARCH QUESTION

Lockout/tagout (LOTO) programs at electric generating stations exist to protect personnel from injury and plant equipment from damage. Periodic assessment of a station's program can contribute to an understanding of how the program is meeting those objectives by identifying strengths along with areas for improvement.

RESEARCH OVERVIEW

As part of the development of the assessment framework, member utilities participated in EPRI-facilitated assessments of their LOTO programs. Experience gained in these assessments has been used to develop and refine the process described in this report and the self-assessment worksheet provided as a fillable Word[1] document (Appendix A).

KEY FINDINGS

- All programs assessed have been found lacking in several areas of industry standards for LOTO.
- Independent isolation reviews are not always clearly understood; for many of the members assessed, this results in weaknesses in this area.
- Equipment LOTO acceptance by maintenance and other non-operations groups requesting LOTOs have a poor understanding of what a walkdown review acceptance really means.

WHY THIS MATTERS

This report describes how to plan and perform programmatic gap analyses by which the station's LOTO procedures are compared against industry best practices as identified in the EPRI report *Clearance and Tagging (Lockout/Tagout) Guideline for Power Plants* (3002011179) as well as performance gap analyses of the execution of a station's LOTO program. It provides an organized worksheet that guides the assessor through the assessment process to identify and evaluate any gaps between industry best practices and station procedures and between station procedures and actual station practices observed.

[1] Word is a registered trademark of Microsoft Corp.

HOW TO APPLY RESULTS

Develop assessment teams of experienced staff members, both in house and loan-in staff from other stations. The team will review the plant's procedures, checklists, and other guidance documents on LOTO and compare that information to the industry standards in the checklist in this report's appendix and with *Clearance and Tagging (Lockout/Tagout) Guideline for Power Plants* (EPRI 3002011179). Even in plants with detailed procedures in place, activities have been observed that were not as safe as they should have been. There is a need across the industry for companies to assess their LOTO processes and identify any gaps. Doing so will help the industry develop actions to close those gaps in order to enhance worker safety, protect equipment, and improve their overall programs.

LEARNING AND ENGAGEMENT OPPORTUNITIES

- EPRI provides supplemental work to assist members in assessing their LOTO programs and training their own assessment teams.
- Other opportunities include any EPRI Generation member with generating assets, insurance companies with connections to EPRI members in Generation, the U.S. Occupational Safety and Health Administration as a regulatory agency, and international members with a desire to have effective energy control programs.

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GLOSSARY

Definitions for common corrective action terms used throughout this report are provided in this glossary. Usage varies slightly within the industry; these definitions clarify how the terms are used in the report.

- **area for improvement.** Identification of a process, procedure, or task that does not meet station standards or industry best practices. See *gap analysis*.
- **assessment.** The process used by a designated team to evaluate the performance of a particular unit or task and the implementation of policies and procedures related to the assessment target using criteria as the standard.
- **assessment team.** A dedicated team assembled to evaluate a process or the performance of an organization. Members may be station personnel from unrelated organizations or outside participants from other stations and other electric generating companies.
- **best practice.** A criterion that is being effectively and efficiently implemented and is as good as or better than any observed in the industry.
- **criteria.** Specific elements of an objective or an area of operations, such as turnover, communications, LOTOs, and procedures, that are related to that objective or area of operation. Criteria descriptions are based on industry best practices identified in the industry as identified in the Electric Power Research Institute (EPRI) report *Clearance and Tagging (Lockout/Tagout) Guideline for Power Plants* (3002011179) [1].
- **data review/document review.** Pertinent data and documents reviewed by assessment team members to determine facts to be included in the assessment observations.
- **event review.** A review of information, documents, data, and interviews related to a specific event that is included in the scope of an assessment.
- **gap analysis.** Comparison of the station's procedures, processes, and performance to the best practices of the industry and identification of variances that need improvement.
- **industry best practice.** Observed industry performance identified as a model of the standard of achievement for a particular procedure, process, or task.
- **interview.** A question-and-answer session with station personnel, conducted by assessment team members to help them locate facts that are related to the scope of an assessment.
- **observation.** An analytical review of an activity or process for the purpose of assessing the function. Observations are documented and contain facts to support assessment conclusions.

- **Occupational Safety and Health Administration (OSHA) 1910.269.** States that the employer's energy control program shall meet the following requirements:
  - If an energy-isolating device is not capable of being locked out, the employer's program shall use a tagout system.
  - If an energy-isolating device is capable of being locked out, the employer's program shall use lockout, unless the employer can demonstrate that the use of a tagout system will provide full employee protection as follows:
    - When a tagout device is used on an energy-isolating device that is capable of being locked out, the tagout device shall be attached at the same location that the lockout device would have been attached, and the employer shall demonstrate that the tagout program will provide a level of safety equivalent to that obtained by the use of a lockout program.
    - In demonstrating that a level of safety is achieved in the tagout program equivalent to the level of safety obtained by the use of a lockout program, the employer shall demonstrate full compliance with all tagout-related provisions of this standard together with such additional elements as are necessary to provide the equivalent safety available from the use of a lockout device. Additional means to be considered as part of the demonstration of full employee protection shall include the implementation of additional safety measures, such as the removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or the removal of a valve handle to reduce the likelihood of inadvertent energizing.
- **qualifications.** Not only the qualifications of the individual performing a specific task being observed, but also the qualifications of the observer assessing the task.
- **strength.** An area of positive performance that is meeting or exceeding expectations and compares well with other observed industry performance.

CONTENTS

1
GENERAL DISCUSSION

This report describes a method for assessing a lockout/tagout (LOTO) program to determine its effectiveness in ensuring that a station has adequately implemented a complete and integrated program. This report presents guidance, not requirements. Utility management retains the responsibility of selecting the process options in use for their stations; however, industry standardization might be feasible based on a reduction in the number of options allowed. Utility processes could benefit from comparison of a utility's approach with the approach in this report. Electric generating stations are complex industrial facilities where many hazards must be controlled and where maintenance and operations are conducted by many different people with different training and skills. Therefore, safety and efficiency are the overall goals driving the need for this guideline.

The purpose of assessing the LOTO process is to provide a more complete understanding of station performance and to identify strengths along with areas for improvement. By identifying gaps in the station's performance as compared to industry best practices, continuous improvements can be made. Strengths should be reinforced and areas for improvement corrected. The assessment process can also validate that company policies and procedures are understood, that the policies and procedures are being properly implemented through routine practices, and that the procedures are properly aligned and consistent.

In order for assessments to be effective, the company and plant management must be committed to the assessment process. An atmosphere that encourages self-assessment, identification of problems, and continuous improvement must be fostered by managers and supervisors. Given the right tools and encouragement, no one can better identify the problems and implement the fixes that will lead to more efficient operations than those who are doing the work every day. Improving processes is a cost-effective way to increase megawatt production while always keeping safety as a primary area of focus.

Additionally, an assessment must have the support of the station staff in order to get the best results. Personnel must feel free to speak and work as they normally do in order to provide the most representative data. There should not be a perception that management will "shoot the messenger."

In order to get the maximum benefit from self-identification of problems, the plant should have methods to capture and document any problems or potential problems in the plant, provide for the investigation of what happened or could happen and what needs to be done, and then track the execution and effectiveness of corrective actions as the actions are applied to the problem. Some stations call such a program a *corrective action program*. These programs also provide a means of archiving information for future use in identifying trends. Proper implementation of these programs is useful in improving plant efficiency and reliability.

Self-assessments should include a review of trends in LOTO performance, especially if the process leans heavily on the legacy knowledge of seasoned workers. As the station's workforce changes, an easy-to-use assessment of the process will have benefits for people entering the utility's workforce. Often, elements of the LOTO process are actually located in a variety of procedures, computers, and administrative tools. Although the current workforce has become familiar with the cross-functional nature of the LOTO process and is familiar with the elements they most often use, the future workforce will benefit from a process description that summarizes all key elements in one place.

2
ASSESSMENT METHODOLOGY

This report presents a methodology for performing an assessment of a LOTO program, using a two-step process. Although the steps are combined in the appendices, each step can be used as a standalone analysis.

The first step is a programmatic gap analysis of existing station procedures and processes compared against industry best practices, and the second step is a performance-based assessment of the implementation of the station's procedures. The process typically involves several individuals who should be knowledgeable in the LOTO process, working together as a team to evaluate the station's program and identify areas for improvement as well as strengths that can be capitalized on, with both being a means to drive programmatic improvements. Station management should then develop an action plan to address the necessary improvements. In order to get the maximum benefit from self-identification of problems, the plant should have a method to capture and document potential problems and then track the execution and effectiveness of corrective actions as the actions are applied to the problems.

Planning and Preparation

The LOTO process should be assessed in its entirety approximately every two years, but focused assessments can be performed on specific aspects of the program as needed. Management will determine the scope and schedule for an assessment, taking into consideration recent events and near misses, industry events, any recent changes in plant operations and equipment that could impact the LOTO process, and current observations of work. (For information on establishing an observation program, see the Electric Power Research Institute [EPRI] report *Developing an Observation Program for Fossil Electric Generating Stations* [2].)

After management has decided on the assessment scope and schedule, the assessment team should be selected. Team members should be knowledgeable and experienced in all aspects of LOTO and should be familiar with the assessment process, especially in terms of how to conduct observations and interviews. They should be objective and willing to identify potential areas that need improvement. Typically, for a full assessment of LOTO, three individuals would be involved as assessors. A best practice for assessments is to have at least one team member be external to the station, thus bringing a fresh look. Such individuals are likely to have questions about activities and processes that are not familiar to them, and they will not be blinded by "that's the way we've always done it." A team leader should be designated; this person should have supervisory experience, high performance standards, a willingness to push for improvements, and the ability to represent and fully explain the team's position to management. It is helpful if this person has participated in previous assessments.

The team should be briefed by management or the team leader on the purpose and scope of the assessment. Smaller teams or individuals working alone can be used to assess smaller focus areas. Teams should be sized according to the scope of the assessment.

Discovery

The team leader should discuss the assessment worksheet, how each area should be assessed, and assignment of areas to ensure that all areas are adequately covered.

The self-assessment worksheet in Appendix A provides an outline of key criteria to be assessed and associated proven industry best practices to examine station procedures against. The outline is not a checklist, but rather a guide or starting point to be used to ensure that all areas are considered. Additional guidance to aid the assessors on the criteria that should be assessed and how to assess them is included in Section 4, "Assessment Criteria." The self-assessment worksheet guides the assessors through the process of analyzing station procedures against industry best practices and assessing the implementation of the same procedures. It provides designated spaces to document any strengths or identified gaps and potential impact.

The Programmatic Gap Analysis Process

The programmatic gap analysis is an analysis of the station's LOTO procedures compared to the best practices. Using the assessment outline provided in Appendix A, the assessor should compare industry best practices taken from *Clearance and Tagging Guideline for Fossil Electric Generating Stations* (EPRI 1014916) [3] against the plant's LOTO procedures and processes. Although it is not necessary to reference the original document, the page numbers after each task indicate the corresponding page in the EPRI report. The assessor can then measure and analyze gaps, if any, and document them in the comment box provided in the worksheet. Any differences between the best practices listed in the outline and the station's LOTO procedure should be given detailed management review to ensure that the differences are understood and action plans put in place to implement desired changes.

When differences are identified between the station LOTO procedure and the self-assessment worksheet, thorough analysis and consideration should be given to implementing the practices listed in the worksheet. The practices listed in the worksheet are summarized from the EPRI LOTO guideline, which is a collection of industry best practices for complying with the regulations of the U.S. Occupational Safety and Health Administration (OSHA). The OSHA regulations have some flexibility in terms of how they can be met, especially when it is possible to demonstrate positive performance in a specific area.

OSHA regulations are performance-based and not necessarily absolute requirements. Within the regulations and interpretations, many options are allowed, and many exceptions have been granted. Utilities are required to meet the objectives of the regulations by selecting a coherent approach from the many different possible options provided for in the regulations and the interpretations provided by OSHA. The EPRI LOTO guideline does not endorse or implement every conceivable option offered by OSHA, and no utility LOTO programs that have been observed implement everything as listed in the guideline. But all the individual best practices in the EPRI guideline have been implemented by some utility and judged worthy of inclusion in the guideline by EPRI and industry representatives.

The program described in the EPRI LOTO guideline has been designed to be a sound, coherent approach in the aggregate. Users who choose to implement different provisions in their own programs should verify the completeness and coherence of their final program and confirm that their program is effective, especially with regard to elements that are different from ones spelled out in the EPRI guideline.

The Performance Gap Analysis Process

The LOTO performance gap analysis is performed after the procedure analysis. This part of the assessment consists of observing the LOTO procedure implementation and identifying differences or gaps. The observations are repeated on the same function multiple times, preferably by more than one person on the team and on different shifts to determine how work is normally done, not how just one individual or one crew performs. Appendix A provides additional guidance on performing observations.

The number of times a function is observed should be based on performance. If performance is observed to be very good, fewer observations of the activity can be performed, but if poor or questionable performance is observed, more observations might be needed to identify the potential improvement items. It is important to observe several crews performing the same activity because there could be consistent performance within crews but inconsistencies between crews.

For example, to assess how LOTO devices are hung, the assessor would familiarize himself or herself with the station's procedural requirements and expectations for hanging LOTO devices. The hanging of LOTO devices by three or four different individuals, with some being from different crews, would be observed to get an understanding of how LOTO devices are hung. It must be emphasized to the crew that the objective of an assessment is to improve processes and not to evaluate individuals. If one individual is found to be performing a function incorrectly, probably others are also performing that function incorrectly as well.

However, it is important that observations maintain an aspect of randomness in order to capture actual work activities rather than staged procedure use or work activities due to announced LOTO observations. Through interviews and observation, the observer should compare the practices observed with the procedure and the involved component names and numbers with drawings, LOTO devices, and components.

The self-assessment worksheet in Appendix A is the tool provided to compare current performance against practices considered to be industry best practices. The worksheet is subdivided into specific sections for ease of assessing:

- Gap analysis of LOTO procedure section
- Gap analysis of LOTO training section
- Gap analysis of LOTO process and performance section

The LOTO procedure section is for the reviewer to assess the station's procedure performance against the industry standards and determine if gaps exist. The LOTO training section is designed to assess the potential gaps in the training of the various personnel involved in the LOTO processes. The balance of the document adds the gap analysis of the actual practices in implementing the LOTO procedure.

Note: It is not unusual to observe performance issues in the field that are neither relevant to the current assessment nor covered in this report's best practices. However, safety issues need to be addressed immediately. Observers need to be aware that off-normal situations can arise, and they should be able to respond appropriately. There will also be issues that need to be reported to station management and entered into the station's problem reporting system or corrective action program. Any safety concern or potential threat to the safety of the plant staff or the integrity of plant systems should be acted on and reported to station management immediately.

Observation Analysis

Observation analysis is a method for organizing and processing the observation data to draw conclusions that will be supported by facts from one or more observations. The information gathered in the observations will be analyzed for both strengths and areas for improvement. All available team members should participate in the analysis. Prior to starting the analysis, each team member should have received a copy of all observations and should have become familiar with them or be prepared to briefly discuss the key points of the observations that he or she personally observed. This is the information that will be used to fill in the blanks for explaining the gap or no gap sections of the worksheet.

Some observations will be negative and can be used as facts to support a potential improvement item; some will be positive and can support a potential strength. Many others will be neutral, in effect, but may later be used to put an improvement item or strength in perspective.

Typically, team members meet at least once daily to discuss the status of their activities; what they have observed, including departures from expected performance both above and below industry best practices; and areas other team members might want to focus on.

Verification and Validation

The team validates the facts against the best practices for objectives and criteria and sorts the facts by subject area. Validation is very important because any improvement item should be accurately identified to ensure that the right problems are corrected and that strengths can be reinforced.

Potential strengths are areas of positive performance that have been demonstrated by the organization, not just ideas. The benefits of strengths are recognized by the team and should be encouraged and communicated to station personnel so that they can capitalize on these benefits and institutionalize them if possible.

Delivery

When all the facts have been sorted, the team comes to a consensus on each of the areas and completes the relevant portion of Appendix A, "LOTO Self-Assessment Worksheet." If no problem areas exist in a section, a short summary of what was observed should be documented.

An informal debriefing session is typically held with the assessment team and management to review the assessment findings, ensure agreement on the facts, and reach an understanding of the conclusions. Any areas in question might require additional observations by the team.

3
ASSESSMENT OUTLINE

In preparation for the assessment, it is necessary to review specifics on how to conduct observations for a LOTO assessment. Observing one item at a time would not provide a realistic picture of the process, and following the LOTO process from start to finish would be time-consuming. The recommendation is for the assessor to observe LOTO activities in specific settings, such as in the LOTO center or the control room, or by walking around the plant and watching all aspects of work in progress. In particular, the observer would look for LOTO-related activities, such as hanging a LOTO, removing a LOTO, or maintenance requesting a LOTO. However, it is important that observations maintain an aspect of randomness in order to capture actual work activities rather than staged procedure use or work activities due to announced LOTO observations.

The observations should be written as activities occur, capturing what was seen and entering each observation into the worksheet database. Upon completion of the observations, the information from them can be inserted into the worksheet (Appendix A). Any observations that do not fit into the categories of programmatic gaps or performance gaps need to be captured in a third category of "Other Potential Improvements That Should Be Considered by the Station." This can be a text list of items. It will ensure that all aspects of the LOTO process are covered. The observation database should be available to the station manager to provide additional insight.

It is important that the observer not be so focused that items such as the following are missed:

- Personnel working without a LOTO
- No LOTO devices on isolation valves
- Old or illegible LOTO devices
- LOTO devices on the floor
- LOTO devices in the plant not on active LOTOs

The assessment outline should be based on the scope of the assessment as directed by management. The outline for the LOTO assessment criteria may be performed as follows:

1. Through discussions and reviews, look for any previous problems with LOTOs.
2. Discuss with the individuals involved any problems that they have with the process and what they do or do not like about it.
3. Compare component names and numbers between drawings, LOTO devices, and components.

4. Observe whether the components were safely isolated and whether the LOTO devices were hung in the correct sequence—for example, a breaker locked out before the pump isolation valves were closed.
5. Verify that the control operator is aware of related equipment status.
6. Review several old LOTOs for completeness.
7. During walks in the plant and shops, look for any disassembled components with LOTO devices attached.
8. Look at LOTO devices in the plant, and compare the LOTO position with the actual component position. Observe only; do not touch the components.
9. Look at LOTO devices in the plant, and observe whether they ensure that the component position cannot be changed. Observe only; do not touch the components.
10. Verify that the LOTO process is efficient, with a minimum of waiting time for operations or maintenance.
11. Review some planned work orders against LOTO requests to determine if boundaries are proper for the work scope.
12. Review some completed work orders on operating equipment and compare LOTO boundaries with the work scope.

4
ASSESSMENT CRITERIA

Assessment criteria might pertain solely to LOTO, or they might have shared objectives or related activities with other areas, such as a corrective action program or industrial safety. For the purposes of this assessment, the focus for the shared objectives is how effectively plant personnel perform their responsibilities related to LOTO. Refer to the 2008 report *Updated Operations Assessment Guideline* (EPRI 1014200) [4] for details on how best to perform the assessment.

The objectives are further divided into criteria for ease of assessment. It is not necessary to meet all of the criteria—what is more important is that the objective be met. If all the criteria are not met, assess how this affects the objective and whether there is a potential area for improvement. The descriptions of the criteria were developed from observations made at power plants that were considered to be among the best in the industry for that area, identified in an industry reference, or developed as a result of broad industry experience.

Following each group of criteria is a shaded box that provides suggestions for how to assess that group. Depending on the level of performance demonstrated during the observations of the criteria and how well it compares to the criteria description, it may be necessary to do more or less than suggested.

Generally, to assess each criterion, assessors should begin by reviewing the criterion description, related procedures, and any other written guidance or management expectations that are available. Make written observations on areas where the activity differs from the procedure and guidance and/or from the criterion. Included in the written observation should be a reference to management expectations for the criterion.

Policies, Programs, Processes, Procedures, and Practices

Effective policies, programs, processes, procedures, and practices shall be established as follows:

- **Station policies** provide direction and course of action designed to influence and determine decisions or actions. Policies explain what is to be accomplished and who is responsible for implementation and oversight. Policies support plant and corporate direction. Policies are communicated, understood, and followed.
- **Programs** of operations include LOTO-specific initiatives that are designed and intended to provide consistent, sustained results and improvements. Examples of such programs are:
  - Personal safety program
  - Equipment safety program
  - Plant accident prevention
  - LOTO training, to include OSHA and U.S. Department of Energy (DOE) good practices

- **Processes** of operations are work activities that are flowcharted and have inputs and outputs, and these inputs and outputs have measurable attributes. These processes involve people, equipment, input materials, methods, and an environment that works together to produce outputs.
- **Procedures** establish specific instructions and define specific steps and actions that must be performed when LOTO activities are to be performed and must comply with the policies and processes. Procedures are:
  - Valid and correct
  - Current and user-friendly
  - Understood and followed
  - Revised when processes, systems, and equipment are modified
  - Written in such a way as to provide information and instructions to safely operate and maintain the equipment as intended, as well as how to carry out the LOTO process
- **Practices** of operations establish guidelines to achieve designated tasks. Practices are the least formal level for implementing directions for operations.

Policies, Programs, Processes, and Procedures: How to Assess

- If possible, observe several LOTO evolutions to verify how procedures are used.
- Interview the supervisor and those who are responsible for LOTO implementation regarding their use of procedures.
- Review several previously completed LOTO activities to verify satisfactory completion.

LOTOs

The LOTO process is designed to identify sources of energy and hazardous materials that could adversely affect maintenance activities, to isolate all such sources from the work area, and to ensure that the isolation remains effective until the work is completed. The LOTO process is applied whenever workers are performing maintenance on plant equipment or systems where there is any possibility of injury or damage as a result of the release of energy or hazardous materials. For the LOTO process to be effective, it must be understood by all affected personnel, applied uniformly in every job, and respected by every worker and supervisor. The requirements for LOTOs in U.S. industry are identified in OSHA regulations (primarily OSHA 1910.269).

The LOTO procedures apply to all situations requiring special control measures. The procedures address protecting personnel from injuries that might result from unexpected operation or energizing of equipment. They also address preventing the unexpected or inadvertent loss of essential safety systems and operating systems.

The DOE's *Guide to Good Practices for Lockouts and Tagouts* [5] provides the following information on lockouts and tagouts:

Lockout/Tagout Use
Lockout/tagout serves three functions. The first function is to protect personnel from injury. The second function is to protect systems and equipment from damage. The third function of lockout/tagout is part of the overall control of equipment and system status. A properly performed lockout/tagout ensures that the operating staff is aware that the affected equipment cannot be operated. Coordination of lockout/tagout with the operating staff helps ensure that necessary operations and safety functions can be performed without exceeding the approved operating criteria for facility systems or causing unexpected hazardous releases to the environment.

Protecting Personnel from Injury
The primary emphasis of the lockout/tagout program is to protect personnel from injury. Lockout/tagout is required when maintenance is to be performed on equipment. After the equipment has been isolated from all sources of potentially hazardous energy and material, locks (if used) and tags are applied to the isolating devices to ensure that the equipment cannot be operated inadvertently.

Protecting Equipment from Damage
When equipment problems that could destroy or severely damage the equipment are detected, a lockout/tagout is used to remove the equipment from service and prevent its operation until corrective maintenance can be performed. If lockout/tagout is used to protect the equipment, the procedures are identical to those used when the purpose is to prevent personnel injury and first, isolate the equipment from all sources of potentially hazardous energy, then apply locks and tags to prevent accidental or inadvertent operation. An alternative system is used for equipment protection in which the equipment is not physically isolated from all energy sources but rather is tagged to indicate the specific conditions under which operation may be permitted. The use of caution tags is not permitted as a lockout/tagout to protect personnel from energy or hazardous material sources.

Lockout/Tagout Practices
Anyone involved with the lockout/tagout process, including preparing, placing, verifying, or accepting a lockout/tagout, must be aware of the requirements for safely isolating hazardous energy or material sources (e.g., electrical circuits, fluid lines, capacitors, material storage tanks). The following standard practices should be supplemented by specific practices applicable to facility systems.

General Practices
A LOTO must isolate all sources of energy or hazardous materials that may cause personnel injury or equipment damage. For example, isolating a pump motor for bearing maintenance should also include shutting and tagging the pump suction and discharge valves to prevent possible rotation from fluid flow. Only controlled drawings, controlled system schematics, or other controlled documents should be used as references for determining or verifying isolation points. In the absence of controlled drawings, a physical walkdown should be performed by a qualified person to ensure that isolation will be achieved by the planned lockout/tagout. Operation or removal of tagged-out equipment is NEVER permitted. Removal of tagged-out equipment would be impossible unless new isolation boundaries have been established and the tagged-out component is now itself isolated. In that case, any affected lockout/tagout should be modified to reflect the new isolation boundaries. The obsolete tag(s) are removed in accordance with

established procedures before starting maintenance activities. Some control devices "seal in" when actuated and could cause equipment to start when power is restored. Because of this component trait, the practice of verifying lockout/tagout isolation by operating the controls (e.g., pressing the start button) for the affected equipment should not be permitted. Control switches are tagged in a position corresponding to the desired protective state of the equipment (e.g., OFF, neutral, pull-to-lock), even when another device (e.g., circuit breaker, disconnect switch, valve in pneumatic supply line, DCS controls) provides the primary isolation from the energy source.

Electrical Practices
If electrical grounding devices are required, the location and sequence for installation of each device are specified in the lockout/tagout procedure. All electrical grounding devices used in a lockout/tagout are tagged out to ensure that the grounds remain in place until the work is complete, and that they are removed before reenergizing the system. To ensure electrical equipment, breakers, and bus systems are not energized, voltage test should be performed. Request assistance from qualified electricians to perform the test using meters or voltage glow sticks. In addition, attempted starts or breaker cycling test can be considered based on the system conditions (ensure test starting or cycling does not create potential damage if starts and closures actually occur).

Piping Systems Practices
Systems, portions of systems, and components that operate at temperatures or pressures above ambient are vented and, if necessary for the performance of work, drained or cooled. Whenever possible, an atmospheric drain and/or vent between the component to be worked and sources of pressure to the component are tagged in the open position to depressurize the equipment and to accommodate thermal expansion or contraction.

Systems that operate at high temperatures or high pressures are isolated from the work area by two closed valves in series, and a telltale vent or drain valve between the isolation valves should be opened. Systems containing hazardous materials are isolated by two valves in series and the isolated section is purged. When any of these conditions exists and two-valve isolation cannot be provided, specific management approval is obtained before performing work. Exceptions to the two-valve isolation are documented in the lockout/tagout record and in the work package, and the workers should be informed.

Verifying depressurization by breaking flanged connections, loosening valve bonnets, removing instrument tubing, or other similar actions should be avoided unless no other means for verifying depressurization exists. Strict supervisory control and advance planning are required if these methods are used.

Valve Practices
Pneumatically operated valves and solenoid-operated valves may be used as isolation points if the following conditions are met: A pneumatically or solenoid-operated valve that fails open is NOT considered closed for lockout/tagout purposes, unless its power (air) supply is isolated and the valve is forcibly closed with an installed jacking device or gag (i.e., a device designed to block off or obstruct operation of a valve). The valve and its power (air) supply isolation points must be tagged. A pneumatically or solenoid-operated valve that fails closed is NOT considered closed for lockout/tagout purposes unless its power (air) supply is isolated and the valve is visually confirmed to be closed. The valve and its power (air) supply isolation points must be tagged. A pressure operated valve or check valve CANNOT be used as an isolation boundary valve unless it is physically restrained in the required position by a gagging device approved by the facility. A motor operated valve may be used as an isolation boundary point provided

that, after the valve has been positioned as required by the lockout/tagout, its power supply is isolated and tagged. The local control point (e.g., handwheel, manual operator) for a motor or pneumatically operated valve must be locked/tagged when the valve is used as an isolation boundary point. Any remote control points (e.g., control switches, reach rods) should also be tagged.

Caution Tags

The caution tag is used for informational purposes only. The caution tag is used when equipment is operating in an abnormal status or condition, regardless of whether a unit is on line or off line or if there is a need for specific information concerning the operation of a piece of equipment (that is, leaking valve packing, loose operating handle, and so on). Caution tags are not used in place of a danger or LOTO tag, but they may be used in conjunction with these tags as an information source. The purpose is clearly defined on the caution tag and the tag hanger identified. Caution tags are to be removed when the abnormal status or condition has been corrected.

Tagouts: How to Assess

1. Through discussions and reviews, look for any previous problems with tagouts.
2. Observe three tagouts from start to finish. Start with the tagout request, and follow the process until the tagout has been accepted for work to begin. Compare what you observe with the procedure and best practice.
3. Discuss with the individuals involved any problems that they have with the process and what they do or do not like about it.
4. Compare component names and numbers between drawings, tags, and components.
5. Observe whether the components were safely isolated, and whether the tags were hung in the correct sequence—for example, a breaker racked out and tagged before the pump isolation valves were closed.
6. Verify that the control operator is aware of the status of related equipment.
7. Review several old tagouts for completeness.
8. During walks in the plant and shops, look for any disassembled components with tags attached.
9. Look at tags hanging in the plant, and compare the tag position with the component position. Observe only; do not touch the components.
10. Verify that the tagging process is efficient, with a minimum of waiting time for operations or maintenance.
11. Review work management schedules to see if LOTOs are being called for so that backshift can perform LOTOs before needed on the next shift (labor efficiency).

5
SKILLS AND KNOWLEDGE

Station workers are trained and qualified to a high state of readiness to effectively support operation of hardware and processes, such as LOTO.

The training program directly supports and is linked to the station policies and procedures process. Policies and procedures are in place that establish job qualifications and prerequisites, instructor qualifications, and the training program process. The training program does the following:

- Includes the training plan
- Establishes qualification standards
- Identifies instructional materials
- Establishes the record-keeping and documentation process for tracking progress and completion of training

Managers and supervisors are actively involved in determining training program content, establishing performance standards, and implementing the program in accordance with policies. Individuals at all levels of the organization are involved in identifying the training needs, requirements, and processes to ensure consistent conformance and performance of the training activities with the actual activities.

Training and Qualification

Requirements are in place to ensure that only qualified personnel are authorized to conduct various activities in the LOTO process. One method used by many stations is to maintain a database or list of personnel qualified to perform the different functions. The actual control is that the computerized process steps to sign off or complete the associated functions can be performed only by people logged onto the system and automatically verified against the database of authorized personnel for that step in the process.

Levels of Training

The following levels of training should be provided to the various persons involved in the LOTO process (note that each level of training includes the preceding levels):

- **Level 1:** Any person who could come into contact with LOTO process devices should be trained to understand the purpose of the program, how to identify the LOTO device used, and the meaning of the LOTO device used (general employee role).

- **Level 2:** Any person who, in addition to Level 1, will be allowed to work on plant equipment under the LOTO process should be trained on the following:
  - OSHA Qualified Worker training
  - How the station's process affects the worker and their accountabilities within the process, including the following knowledge: the expectation that all work is performed with a work authorization; when a LOTO is used, the work must be within the LOTO boundary; how to identify components and self-check; specific methods and responsibility for sign-on and sign-off; and workers' rights within the LOTO process.
- **Level 3:** Any person who, in addition to Levels 1 and 2, will be allowed to sign onto a LOTO as LOTO holder should be trained on the following:
  - The LOTO Holder's responsibilities to the workers under his or her control
  - The LOTO process to the extent necessary to understand the basis for different types of work authorizations, how and when to modify LOTOs, the relationship of zero-energy checks to the LOTO process, and performance expectations for verifying that the work is isolated
  - The LOTO Holder's responsibilities to other organizations participating in the LOTO process (Operations, Planning, Scheduling, and other crafts)
- **Level 4:** Any person who, in addition to Level 1, will be allowed to plan or schedule work activities that could require a LOTO should be trained on the following:
  - Hazard analysis and how to identify if a LOTO will be required
  - Station expectations for coordinating work that requires a LOTO, including the various types of work authorizations and when to use them
  - The LOTO process to the extent of understanding his or her responsibilities to the other participants in the process
  - How to change LOTO boundaries when needed
  - How to determine suggested LOTO boundaries (if station policy expects planners to provide suggested boundaries)
- **Level 5:** Any person who, in addition to Level 1, will be allowed to hang or verify a LOTO should be trained on the following:
  - Operational knowledge of the systems and components he or she might encounter while hanging tags, including licensed operator training, if applicable
  - The LOTO process to the extent necessary to understand the basis for different types of work authorizations, the consequences of inadequate boundaries, how and when LOTOs could be modified, and performance expectations for verifying that the work is isolated
  - The tag hanger's responsibility for the safety of others
  - Specific performance expectations for hanging LOTO devices, including the station's verification practices

- **Level 6:** Any person who, in addition to Levels 1 and 5, will be allowed to write or verify LOTOs should be trained on the following:
  - The LOTO process in its entirety
  - Broad knowledge of the station's work control process, including specific knowledge of the types of work authorizations and when they should be used
  - The LOTO writer's responsibilities to the other participants in the process
  - How to write and change LOTO boundaries in accordance with the station's LOTO process
  - How to read prints to support writing LOTOs
  - How to understand the threshold for involving other disciplines as necessary for complicated LOTOs, especially those involving complicated circuits
- **Level 7:** Any person who, in addition to Levels 1, 5, and 6, will be allowed to approve LOTOs should be trained on the following:
  - The LOTO process in its entirety, including the basis for the supporting station policies
  - The station's work control process as it affects plant operations, including the basis for the supporting station policies
  - Shift supervisor training
  - Processing deviations, problems, and stop work
  - Monitoring of the program

Training and Qualification: How to Assess

1. Verify the training and qualification documentation for several positions.
2. Determine the level of operator knowledge during observations of rounds, control room activities, turnovers, interviews, and other work activities.
3. Verify that retraining is implemented and documented through interviews with personnel and training staff and documentation review.
4. Verify that a process is implemented to provide information and training on plant changes, new equipment, procedure changes, and industry events.

6
PROBLEM REPORTING AND CORRECTIVE ACTION PROGRAM DATABASE

Inputs into a repository, such as a database, should be from any events or near misses in the plant, the company, or industry. It is also a reliable method of capturing information from assessments and observations that in turn initiate corrective actions to prevent or minimize occurrences or reoccurrences. A work environment that encourages timely reporting of potential problems should be fostered. Employees should be encouraged to report any concern, regardless of whether it is a potential, suspected, or actual problem.

Responsibility for corrective actions should be assigned and tracked to completion. There should be follow-up to evaluate the effectiveness of the corrective actions.

All events, near misses, and corrective actions should be included in this problem reporting database. The database should be accessible and searchable by keyword. The information from the database should be discussed during pre-job briefs for related activities.

7
REFERENCES

Works Cited in This Report

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2. *Developing an Observation Program for Fossil Electric Generating Stations.* EPRI, Palo Alto, CA: 2013. 3002001131.
3. *Clearance and Tagging Guideline for Fossil Electric Generating Stations.* EPRI, Palo Alto, CA: 2008. 1014916.
4. *Updated Operations Assessment Guideline.* EPRI, Palo Alto, CA: 2008. 1014200.
5. *Guide to Good Practices for Lockouts and Tagouts.* DOE-STD-1030-96. U.S. Department of Energy, Washington, D.C.: May 1996. www.doe.gov. pp. 7, 12–15.

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U.S. Department of Labor, Occupational Safety and Health Administration, www.osha.gov.

- OSHA 1910.147, The Control of Hazardous Energy (Lockout/Tagout)
- OSHA 1910.269, Electric Power Generation, Transmission, and Distribution
- OSHA Instruction CPL 2-1.38, Enforcement of the Electric Power Generation, Transmission, and Distribution Standard
- OSHA Instruction CPL 02-00-147, Enforcement of the Electric Power Generation, Transmission, and Distribution Standard

A
LOTO SELF-ASSESSMENT WORKSHEET

N.B.: This worksheet is supplied in this report both as a static PDF (this appendix) and an editable Word document with fillable fields and dropdown menus. To access the Word document, select Attachments (the paperclip icon) from Adobe Acrobat's Navigation Pane.

GAP Analysis of LOTO Procedure

The purpose of this section is to compare the EPRI guideline to the plant's LOTO procedure and to identify gaps. The gaps should be evaluated for potential impact to the process and an action plan developed to address improvement(s) as needed. Therefore, only the procedures are analyzed. This section should be completed prior to starting the performance gap analysis portion of the self-assessment. The "Choose an item" section is to be used to indicate if there is a gap and should include a short description of the gap or how the best practice is met in the text block.

1. The LOTO program should be a company-level program and should be sponsored by a corporate executive.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap

2. LOTO process ownership and authority should be within the station's operations organization, managed on behalf of and with cooperation of the entire affected population.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap

3. The station's LOTO program should be implemented as a requirement.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap

4. A standing LOTO Committee made up of representatives from the affected work groups is used to improve the process and to reduce coordination difficulties.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap

5. Use only a single standard LOTO device on a component (that is, do not use a combination of tag types and/or locks).
   – Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap

6. Caution is used when multiple LOTO centers are created, as changing processes can lead to mistakes. Communication between LOTO centers and individuals should be held to high standards.
   – Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap

7. When a computerized LOTO process is used, authority and responsibility for filling out the various parts of the computerized form should be clearly specified in appropriate procedures, and the software should screen for or prevent bypassed steps.
   – Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap

8. A documented method exists for managing LOTOs when the computer system supporting the process is not available.
   – Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap

9. An interface agreement with the force of a required procedure should be developed to clearly define ownership boundaries between the Transmission System Operator and the station. The boundaries should be precisely described for specific components and can be portrayed in drawings or procedures for both the TSO and the station.
   – Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap

10. Use periodic self-assessments and program inspections. These should include trending and tracking of performance indicators. Performance indicators used should be of the no-fault, graded approach to LOTO events and near misses. These should include review of LOTO process performance trends, include personnel from other plant sites, and include a review of long-hung LOTOs to ensure the LOTO remains legible and necessary.
    - Gap analysis results between EPRI guideline and Station Procedure:

      Choose an item.

GAP Analysis of LOTO Training

The purpose of this section is to compare the EPRI report to the plant's LOTO procedure and training material and to identify gaps. The gaps should be evaluated for potential impact to the process and an action plan developed to address improvement(s) as needed. Therefore, only the procedures are analyzed. This section should be completed prior to starting the performance gap analysis portion of the self-assessment. The self-assessment is conducted by reviewing lesson guides, reviewing training records, and interviewing trainers. In each area, use the "Choose an item" block to note if a gap exists or not. Then use the text block to describe why or why not.

1. ***Station personnel*** – Any person who could come into contact with LOTO devices should be trained to understand the purpose of the program, how to identify the LOTO devices used, and the meaning of the LOTO devices used.
    - Gap analysis results between EPRI guideline and Station Procedure:

      Choose an item.

      Type why gap or no gap
    - Gap analysis results between Station guideline and Station Practices:

      Choose an item.

      Type why gap or no gap

2. ***LOTO Worker*** – Any person who, in addition to item 1 training, will be allowed to work on plant equipment under the LOTO process should be trained on the following:
    - What it means to be an OSHA-qualified worker.
    - Requirements of the LOTO process that affect the worker and his or her accountabilities within the process. This includes, but is not limited to, the following:
        - All work is performed with a work authorization when a LOTO is used.
        - All work must be performed within the LOTO boundary.
        - Components with LOTO devices or test tags cannot be removed from the system or have maintenance performed on them.
        - Proper techniques for identifying components and self-checking.

  - Site-specific methods for signing/locking on and signing/locking off LOTOs, and their associated responsibilities.
  - Workers' rights within the LOTO process.
- Gap analysis results between EPRI guideline and Station Procedure:

  Choose an item.

  Type why gap or no gap
- Gap analysis results between Station guideline and Station Practices:

  Choose an item.

  Type why gap or no gap

3. ***LOTO Holder*** – Any person who, in addition to items 1 and 2 training, will be allowed to sign/lock on as a LOTO Holder should be trained on the following:
   - The LOTO Holder's responsibilities.
   - The LOTO process to the extent necessary to understand the basis for different types of work authorizations, how and when to modify LOTOs, requirements for zero-energy checks in the LOTO process, and expectations for verifying the work area is isolated.
   - The LOTO Holder's responsibilities to other organizations participating in the LOTO process (operations, planning, scheduling, engineering, other crafts, and so forth).
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

4. ***LOTO Device Hanger/Verifier*** – Any person who, in addition to item 1 training, will be allowed to hang or verify a LOTO should be trained on the following:
   - Hazard analysis and how to identify whether a LOTO will be required.
   - Management expectations for coordinating work that requires a LOTO, including the various types of work authorizations and when to use them.
   - Sufficient operational knowledge of the systems and components that they may encounter while hanging LOTO devices to understand their responsibilities related to other participants in the process and the integrated impact that their actions could have on the unit.

- The LOTO process to the extent necessary to understand the basis for different types of work authorizations, the consequences of inadequate boundaries, how to change a boundary, how and when LOTOs can be modified, and performance expectations for verifying that the work area is effectively isolated.
- How to determine when grounds/grounding devices are required, including identifying the proper connection points.
- The LOTO Device Hanger's responsibility for the safety of others.
- Specific performance expectations for hanging LOTO devices, including required verification practices.
- Gap analysis results between EPRI guideline and Station Procedure:

  Choose an item.

  Type why gap or no gap
- Gap analysis results between Station guideline and Station Practices:

  Choose an item.

  Type why gap or no gap

5. ***LOTO Writer/Reviewer*** – Any person who, in addition to items 1 and 4 training, will be allowed to write or review LOTOs should be trained on the following:
   - Sufficient operational knowledge of the systems and components on which they will write/review LOTOs to assess and understand system/component inter-relationships and potential impact on integrated plant risk.
   - The LOTO process in its entirety.
   - Broad knowledge of the work control process, including specific knowledge of the types of work authorizations and when they should be used.
   - Fleet/station/industry operating experience with LOTO-related events, weaknesses, and program failures.
   - The LOTO Writer/Reviewer responsibilities to other participants in the process.
   - Methods/techniques for avoiding knowledge-based errors and accountability for using error-reduction tools.
   - Requirement for the LOTO Writer/Reviewer to perform a complete technical review of the LOTO.
   - How to write and change LOTO boundaries in accordance with the LOTO process requirements.
   - How to read the types of prints and technical documents required to support writing LOTOs.
   - How to verify when grounds/grounding devices are required, including ensuring that the proper connection points are identified.

- Identifying the threshold for involving other disciplines as necessary for complicated LOTOs, especially those involving complicated circuits.
- Gap analysis results between EPRI guideline and Station Procedure:

  Choose an item.

  Type why gap or no gap
- Gap analysis results between Station guideline and Station Practices:

  Choose an item.

  Type why gap or no gap

6. ***LOTO Approver*** – Any person who, in addition to items 1, 4, and 5 training, will be allowed to approve LOTOs should be trained on the following:
   - The LOTO process in its entirety, including the basis for the supporting station policies.
   - The work control process as it affects plant operations (or other issuing authorities), including the basis for the supporting station policies.
   - Sufficient operational knowledge of the systems and components on which they will review/authorize LOTOs to assess and understand system/component inter-relationships and determine if there could be adverse operational consequences or integrated plant risk challenges.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

Gap Analysis of LOTO Process and Performance

Each following section is a short summary description of the best practice listed in the EPRI LOTO guideline. Each section asks if there is a gap between the site LOTO procedure and the EPRI guideline. Use the "Choose an item" to select if a gap exists or not. Enter some detail on how the site procedure meets or does not meet the guideline in the text block provided.

Requesting and Developing a LOTO

1. A request for LOTO is submitted well in advance of the scheduled work. The request includes items such as clear equipment identification, a detailed scope of the work to be performed, duration of the requested LOTO, and special considerations. Station procedures should clearly describe the required elements of a LOTO request and the level of detail needed.

– Gap analysis results between EPRI guideline and Station Procedure:

  Choose an item.

  Type why gap or no gap

– Gap analysis results between Station guideline and Station Practices:

  Choose an item.

  Type why gap or no gap

2. The LOTO Writer develops the LOTO using controlled drawings, equipment walkdowns, the associated work package, and/or conversations with the requestor to identify the specific components needed to isolate energy sources from the equipment to be worked. Specific focus points for the LOTO Writer are:
   – Determines the system or plant conditions necessary to support a work activity.
   – Performs an in-field walkdown of equipment and the work area as needed to understand key attributes of the work, such as the location and elevation of a flanged connection, the orientation of relays, or the types of connections associated with skid-mounted equipment. The walkdown also permits the identification of complicating factors, such as difficulty accessing isolation points or redundant equipment that is out of service.
   – Performs a screening to determine if an additional review or management involvement is warranted if the LOTO is complex or potentially risk-significant.
   – Consults the craft, engineering, or other resources if the level of complexity of the LOTO or the technical nature of the work activity challenges his or her knowledge level about what is required to protect workers.
   – If a standard LOTO is used as a starting point, verifies that the work scope for which it was approved exactly matches the proposed work scope and that no changes have been made to any reference material or the work order since the standard LOTO was approved or last reviewed satisfactorily.
   – If an archived LOTO is used as a starting point, critically questions the previous work scope against the scope for the current work activity, then modifies the archived LOTO as needed to develop the new LOTO.
   – Determines if the LOTO under review will result in tag sharing among LOTOs. If tag sharing will be involved, the LOTO writer ensures that establishing each tag does not create a conflict with an existing LOTO tag/boundary. (Tags-only LOTO.)
   – Consults any LOTO notes that might be available from previous performance of the same/similar work activity, and captures any pertinent information in the new LOTO.
   – To the extent practical, ensures that there will be no conflicts between existing LOTOs and the proposed LOTO, either in required boundaries or plant conditions, at the scheduled execution time of the LOTO.

- Identifies the energy release paths, such as vent/drain valves or grounding devices, required to ensure that stored energy is released from the isolated area and that the work area remains safe.
- Identifies measures (tag-plus) in addition to hanging a LOTO tag that are prudent to prevent a single human error from introducing inadvertent energy into the isolated work area. (Tags-only LOTO.)
- Determines if the LOTO on a piece of equipment could render additional equipment susceptible to damage if operated, such as the LOTO on a cooling water pump that is the sole cooling source for another component.
- Prepares the equipment isolation list, specifying the sequence of applying the LOTO isolating, specifying the position of the energy isolating devices, verifying correct equipment identification and description on each LOTO isolating device, and when possible, identifying zero-energy checks for isolation to safely isolate the requested equipment.
- Gap analysis results between EPRI guideline and Station Procedure:

  Choose an item.

  Type why gap or no gap
- Gap analysis results between Station guideline and Station Practices:

  Choose an item.

  Type why gap or no gap

3. The LOTO Reviewer confirms that correct isolation practices were used and appropriate procedural and administrative requirements are satisfied. Specifically, the LOTO Reviewer scrutinizes the final isolation boundaries, sequence of steps for isolating/de-energizing a system or component, required plant conditions, and accuracy of the LOTO devices prepared. The LOTO reviewer should strive to maintain an independent perspective on the LOTO. The following are specific reviews that the LOTO reviewer should perform:
   - The final LOTO boundary isolation points
   - The required plant conditions versus work scope
   - Any conflicts within this LOTO or with other LOTOs, especially if tag sharing or in-test tags are involved
   - Equipment deficiencies that could impact the safe work area
   - Equipment nomenclature differences, especially where such differences also exist in station documents or databases (equipment labels, databases, and design documents should all agree to minimize the potential for error)
   - The sequence of steps for isolating and de-energizing the system/component
   - Ensuring that appropriate procedural or administrative requirements have been met
   - Accuracy of prepared LOTO devices to match the LOTO list (if not automatically prepared by the computer)

- The following techniques can be used to ensure an adequate technical review:
  - Do not discuss the LOTO with the LOTO Writer until the LOTO Reviewer has developed his or her own idea of the LOTO boundary.
  - Use appropriate references (procedures, drawings, manuals, planning documents, and so on).
  - Separately assess and understand the work scope based on the LOTO request form.
  - Separately assess and understand the hazards.
  - Separately walk down the work area if needed.
  - Mark up prints from a clean copy, especially for LOTOs on complex equipment where no historical/archived LOTO is referenced.
  - Do not read the draft boundary LOTO list until the previous steps are complete.
- Gap analysis results between EPRI guideline and Station Procedure:

  Choose an item.

  Type why gap or no gap
- Gap analysis results between Station guideline and Station Practices:

  Choose an item.

  Type why gap or no gap

Authorize and Hang LOTO

1. The LOTO Approver authorizes the LOTO to be hung after performing an integrated assessment to confirm that the LOTO will protect workers for the defined work scope, then signs to indicate that the LOTO is correct and valid. The LOTO Approver:
   - Confirms that plant conditions are correct for the LOTO
   - Verifies no conflicts with existing LOTOs
   - Initiates any compensatory requirements, such as fire watches
   - Initiates any additional actions needed to document or control plant status changes
   - Ensures that LOTO Device Hangers/Verifiers are prepared for the task and understand the LOTO (pre-job)
   - Directs plant systems to be realigned and LOTO devices to be hung
   - <u>Gap analysis results between EPRI guideline and Station Procedure:</u>

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

2. After the appropriate pre-job briefing, the LOTO is sent out with a qualified LOTO device hanger.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

3. The LOTO Device Hanger performs the following steps after receiving approval to hang the LOTO:
   - Ensures that the station person responsible for a watch station is aware of an impending lineup change that affects the watch station before proceeding.
   - Performs system/component alignment as directed by the LOTO isolation list sequence, including required draining or evacuation.
   - Matches the equipment identification on the LOTO device to be hung with the component label, then hangs the LOTO device on the component. If the LOTO device cannot be affixed directly to the energy-isolating device, the LOTO device shall be located as close to the energy-isolating device as possible, in a position immediately obvious to anyone attempting to operate the energy-isolating device. Specific acceptable locations should be described by station practices for each type of component.
   - Confirms LOTO devices and in-test tags will not be hung concurrently.
   - Installs the LOTO device as required on the component. If installing the LOTO device will prevent the independent LOTO Device Verifier from determining the position of the component as required by station procedures, the LOTO Device Hanger typically performs this step concurrently with another qualified LOTO Device Hanger.
   - Verifies that the appropriate response has occurred after the energy isolation devices have been manipulated and LOTO device attached, such as system is depressurized, system is drained, or MOV indicating lights are extinguished after the associated breaker was opened.
   - Initial or sign the “LOTO hung by” blank on the LOTO isolation list.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

4. If there are discrepancies among the equipment identifications or between the LOTO isolation list sequence and procedure steps to be used, the LOTO Device Hanger stops and notifies the Issuing Authority. The LOTO Device Hanger does not continue until the problem is resolved.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

5. Having been briefed, the person assigned to verify the LOTO devices (LOTO device verifier) performs the following tasks for each component on the LOTO isolation list:
   - Identifies the LOTO'd component by matching the component label, including noun name (when applicable), with the equipment identification information provided on the LOTO isolation list.
   - Verifies that the energy isolation device is in the position required by the LOTO. If the device is not in the required position, the LOTO Device Verifier stops (and does not reposition the device). If the LOTO device prevents the LOTO Device Verifier from determining the position of the energy isolation device, this step should have been performed during the initial LOTO hanging by concurrent verification.
   - Ensures that LOTO and in-test tags are not hung concurrently on the same energy isolation device.
   - Ensures that the required LOTO device is installed as required.
   - If any discrepancies are identified, the LOTO Device Verifier stops and notifies the Issuing Authority to obtain resolution for the problem.
   - Initial or sign the "LOTO verified by" blank on the LOTO isolation list.
   - Notify LOTO issuer when LOTO verification completed.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

Issuing a LOTO

1. When all LOTO devices are verified, the Qualified Operations Person will activate the LOTO by LOTO software, LOTO paperwork, and master lockbox as applicable. The Qualified Operations Person will communicate to the LOTO Requester that the LOTO is ready for LOTO Holders.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap
2. If not a group LOTO, each LOTO Holder who performs a task assigned to the LOTO work scope walks down the LOTO to verify that the LOTO covers the scope of work to be performed and verifies the effectiveness of the specific LOTO isolation points and de-energization methods on which they are relying to prevent the inadvertent release of energy during the work.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap
3. If a group LOTO, the LOTO Holder (crew leader/contract coordinator) walks down the affected area to verify effective isolation of the component(s) to be worked. The LOTO Holder should verify that the LOTO covers the scope of work to be performed and verifies the effectiveness of the specific LOTO isolation points and de-energization methods on which they are relying to prevent the inadvertent release of energy during the work.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

4. Each LOTO Holder should verify de-energization of hazardous energy sources. Zero-energy checks should ensure that stored energy has been released and discharged and that the machine or equipment has been rendered safe. This occurs as follows:
   - Before initial work start.
   - At the beginning of each work shift, unless the LOTO has been locked because the discipline LOTO Holder was continuously signed/locked on to it.
   - After any change to LOTO boundaries or manipulation of components using in-test tags (to the extent necessary to ensure that the LOTO adequately protects them).
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

5. To ensure his/her safety, the LOTO Holder must do a LOTO walkdown of the portion of the LOTO related to the work activity at the following minimum times:
   - Before initial work start
   - At the beginning of each work shift, unless the LOTO has been locked because the discipline LOTO Holder was continuously signed/locked on to it
   - After any change to LOTO boundaries or manipulation of components using in-test tags (to the extent necessary to ensure that the LOTO adequately protects them)
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

6. After walkdown verification, the LOTO Holder accepts the LOTO by LOTO software, LOTO paperwork, and personal lock on master lockbox as applicable.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

7. If LOTO Holder (crew leader/contract coordinator) for a group LOTO, follows the station designated process for group LOTO (lockboxes, master tags, and so on).
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

Starting Work

1. The LOTO Holder is responsible for ensuring that LOTO Workers are briefed on all key elements related to the LOTO that will protect them. The brief should cover the following:
   - The scope of work, components authorized to be worked, LOTO boundary, and basis for safe conduct of work
   - The presence of energy in the work area that was not removed or isolated by the LOTO
   - Whether workers are expected to release energy and the means to release it (breaking a fitting, discharging a capacitor, applying grounds, and so forth)
   - Any special precautions, such as confined space, chemical, or fire impairment actions
   - Protective equipment needed if it is more than generic personal protective equipment (such as electrical flash gear or respirators)
   - The expectation to immediately contact the Issuing Authority if a change to the work scope is identified
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

2. All workers either sign/lock as required as a LOTO Holder or as a LOTO Worker under a group LOTO process (lockboxes, satellite lockboxes, master tags, and so on). All LOTO Workers must be uniquely accounted for on any LOTO protecting them and must maintain positive control over any change that could result in the introduction of energy into the work area.

- If lockout system, LOTO Workers' personal lock must identify the LOTO Worker (lock/tag).
- Gap analysis results between EPRI guideline and Station Procedure:

  Choose an item.

  Type why gap or no gap
- Gap analysis results between Station guideline and Station Practices:

  Choose an item.

  Type why gap or no gap

3. If a change in work scope or another emergent deficiency is identified during the work, the LOTO Holder and/or LOTO Workers immediately place the work in a safe condition and notify the appropriate personnel. The condition is then evaluated, and if a boundary change is necessary, the issuing authority is promptly notified and the LOTO request will be revised as needed to reflect the new work scope, rewritten to reflect a new LOTO boundary and strategy for shifting the isolation points without compromising worker safety.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

Work Completion

1. When work is complete, workers working under a LOTO Holder release the LOTO (remove personal locks, sign off, and so on). (Group LOTO)
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

2. Prior to release of the LOTO when work is complete, the LOTO Holder should verify that:
   - LOTO is no longer required to protect the LOTO Workers. (Group LOTO)
   - All LOTO Workers under the LOTO Holder have released the LOTO. (Group LOTO)

- Workers are clear of the area. (Group LOTO)
- The work area is free of tools, parts, and work debris.
- The integrity of the portion of the system/component associated with their work is correct and intact such that the system/component can be returned to service. If not, any remaining conditions are communicated to the LOTO authority for documentation in the LOTO.
- Gap analysis results between EPRI guideline and Station Procedure:

  Choose an item.

  Type why gap or no gap
- Gap analysis results between Station guideline and Station Practices:

  Choose an item.

  Type why gap or no gap

LOTO Restoration

1. Once all work is complete, qualified plant personnel inspect the affected equipment to verify that work is complete, the work area is clean, personnel are clear of the system, and the system is intact.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

2. The LOTO issuer evaluates results from the LOTO Holder release and plant personnel LOTO walkdown and authorizes the LOTO removal.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

3. The LOTO Writer plans the entire sequence of restoring the plant configuration to normal. The LOTO Writer should consider the following aspects when developing a LOTO restoration sequence:
   - Determining the existing plant conditions and how they compare to the conditions assumed by the "Limits and Precautions" and "Initial Conditions" sections of operating procedures.
   - Ensuring the restoration of each energy-isolating device does not initiate a conflict with other plant tags or another LOTO.
   - Elevation differences might interfere with filling and venting the system.
   - Instrumentation that has been drained might need to be refilled by I&C.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

4. The LOTO Approver concurs with the restoration plan, then authorizes LOTO removal and restoration. Because this constitutes a plant status change, the LOTO Approver initiates additional actions required by the plant status change. These additional considerations can include, but are not limited to, the following:
   - Ensuring that plant conditions support restoring the system/component.
   - Initiating procedures to be used during the restoration evolution.
   - Assigning resources, establishing priorities, and supervising the restoration evolution to the extent necessary to ensure success.
   - Notifying personnel to perform support activities, such as testing, visual leak checks, and minor adjustments that are conditional and based on plant conditions.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

5. The LOTO Approver determines the level of detail of the brief conducted for the purpose of removing the LOTO. The following specific points should be made during the pre-job brief, if relevant:
   - State whether the LOTO removal is to be performed before or during the performance of a procedure used to align the components and system.
   - Identify specific components that are expected to release energy when positioned and evaluate for the need to have a second individual verify the correct component before positioning (two individuals identify the component). This could be desirable if the positioning of a similar misidentified component could cause unwanted consequences.
   - Identify any personal protective equipment to be used, if more than the expectations for general workers.
   - Ensure the person(s) removing the LOTO are aware of information provided for removing LOTO devices and aligning the systems.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

6. Having been briefed, the LOTO device hanger qualified person assigned to remove the LOTO performs the following tasks for each component in the sequence designated on the LOTO restoration list:
   - Identify the component with the LOTO device to be removed by matching the component label with the equipment identification provided on the LOTO restoration list (in accordance with the station's component labeling policy and standard operating procedure).
   - Identify the LOTO device to be removed by matching the LOTO number on the LOTO device with the LOTO number of the LOTO restoration list.
   - Remove the LOTO device from the component.
   - Unless other LOTO devices are hanging on the component, move the component to the position required on the LOTO restoration list.
   - Initial or sign the "positioned by" blank on the LOTO restoration list (unless other LOTO devices are hanging on the component, in which case the control room should be notified).
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap

– Gap analysis results between Station guideline and Station Practices:

Choose an item.

Type why gap or no gap

7. If the LOTO restoration list sequence is not compatible with the sequence of procedural steps that are to be followed, stop and have the LOTO restoration list or procedural step sequence corrected.
   – Gap analysis results between EPRI guideline and Station Procedure:

   Choose an item.

   Type why gap or no gap
   – Gap analysis results between Station guideline and Station Practices:

   Choose an item.

   Type why gap or no gap

8. When all LOTO devices are removed per the preceding, report completion of the evolution to supervision and return the LOTO restoration list and all LOTO devices that have been removed to the LOTO Approver or designee.
   – Gap analysis results between EPRI guideline and Station Procedure:

   Choose an item.

   Type why gap or no gap
   – Gap analysis results between Station guideline and Station Practices:

   Choose an item.

   Type why gap or no gap

9. The LOTO Approver verifies that all applicable criteria are met and declares the system or component ready for service. At this point, plant status is in the normal configuration for the existing plant conditions and may be operated at the discretion of operations.
   – Gap analysis results between EPRI guideline and Station Procedure:

   Choose an item.

   Type why gap or no gap
   – Gap analysis results between Station guideline and Station Practices:

   Choose an item.

   Type why gap or no gap

Boundary Change

1. Boundary modifications are not performed while LOTO Workers are signed/locked on a LOTO.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap
2. Boundary modifications are verified by LOTO Holders before LOTO Workers are signed/locked on a LOTO.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

Grounds

1. Personnel installing or removing ground(s) sign/lock on the LOTO for protection while installing or removing ground(s).
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap
2. All grounds installed for worker protection, including personal grounds, are tracked/LOTO'd as part of the LOTO unless the LOTO Writer determines that extenuating conditions preclude applying a LOTO device.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap

– Gap analysis results between Station guideline and Station Practices:

Choose an item.

Type why gap or no gap

3. Grounding devices can be installed only after the equipment is electrically isolated and are applied only by qualified personnel with specialized training in grounding and how to install grounding devices properly.

– Gap analysis results between EPRI guideline and Station Procedure:

Choose an item.

Type why gap or no gap

– Gap analysis results between Station guideline and Station Practices:

Choose an item.

Type why gap or no gap

External Energy Injection

1. When external energy injection (EEI) is needed during a LOTO (meggering, rotational bump of equipment, and so on), the LOTO procedure should provide direction to follow with regard to EEI.

– Gap analysis results between EPRI guideline and Station Procedure:

Choose an item.

Type why gap or no gap

– Gap analysis results between Station guideline and Station Practices:

Choose an item.

Type why gap or no gap

2. All LOTO Workers and LOTO Holders should release the LOTO.

– Gap analysis results between EPRI guideline and Station Procedure:

Choose an item.

Type why gap or no gap

– Gap analysis results between Station guideline and Station Practices:

Choose an item.

Type why gap or no gap

3. LOTO devices identified for EEI are configured.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

4. All workers performing the EEI activity should sign/lock on the LOTO.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

5. The LOTO is "locked out," preventing others from signing/locking on during EEI.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

6. Energize and proceed with testing or positioning.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

7. All workers performing the EEI activity should release the LOTO.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

8. De-energize all systems, and reapply LOTO devices as required.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

9. LOTO Workers and LOTO Holders can again sign/lock on the LOTO.
   - Gap analysis results between EPRI guideline and Station Procedure:

     Choose an item.

     Type why gap or no gap
   - Gap analysis results between Station guideline and Station Practices:

     Choose an item.

     Type why gap or no gap

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