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DOE-STD-1030-96
May 1996
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DOE-STD-1030-92

DOE STANDARD

GUIDE TO GOOD PRACTICES FOR LOCKOUTS AND TAGOUTS

U.S. Department of Energy
Washington, D.C. 20585

AREA SAFT

FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, "Conduct of Operations Requirements for DOE Facilities."

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CONTENTS

ACRONYMS

CFR	Code of Federal Regulations
OSHA	Occupational Safety and Health Administration

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DEFINITIONS

Affected Person	Person whose job requires operation or use of equipment on which maintenance is being performed under lockout/-tagout, or whose job requires work in an area in which such maintenance is being performed.
Authorized Person	Person qualified through system knowledge and lockout/-tagout training, and authorized by the facility to install lockout/tagout on machines or equipment in accordance with facility procedures.
Capable of Being Locked Out	An energy isolating device is capable of being locked out if it has a hasp or other means of attachment to which, or through which, a lock can be affixed, or it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy isolating device or permanently alter its energy control capability.
Caution Tags	Tags used to indicate some precaution or item of information that must be known prior to operating a component or system. Caution tags may be used on functional components or systems. Caution tags are NOT to be used for energy isolation (i.e., do not use caution tags where it is appropriate to use lockout/-tagout).
Centrally Controlled Lockout/Tagout	A lockout/tagout in a facility having a central organization that is responsible for operation of the facility or process and is separate from maintenance organizations. In such facilities, all lockouts/tagouts are authorized by the operations supervisor and all lockout/-tagout activities are coordinated by operations personnel. Compare "Individual-Controlled Lockout/Tagout."

Contractor	A person, consultant, partnership, or corporation providing assistance in the management, operation, testing, inspection, or servicing of equipment at a DOE facility.
Controlled Document / Controlled Drawing	A document or drawing whose content is maintained uniform among all copies by an administrative control system.
Energy Source	Any source that could cause harm to personnel or equipment by generating or transferring electrical energy or potential (voltage); hydraulic, pneumatic, gas, or steam pressure; vacuum; high temperature; cryogenic temperature; potentially reactive chemicals; or stored mechanical energy.
Energy-Isolating Device	A mechanical device that prevents the transmission or release of energy. Examples include: a circuit breaker, a disconnect switch, a flow control valve, a slide gate, a blind flange, a block, and any similar device used to block or isolate energy. Push buttons, selector switches, or other control-circuit-type devices are not considered energy isolating devices.
Hazardous Substance or Material	Any solid, liquid, or gaseous material that is toxic, explosive, flammable, corrosive, or otherwise physically or biologically threatening to health. Oil is excluded from this definition.
Individual-Controlled Lockout/Tagout	A lockout/tagout in a facility wherein individual operators are responsible for operating and maintaining individual machines or processes. In such facilities, lockout/tagout is performed by each individual requiring protection. Compare "Centrally Controlled Lockout/Tagout."

Installation of Lockout/Tagout	The process of positioning energy-isolating devices, attaching locking devices (if applicable), and attaching tagout devices.
Lockout	The placement of a lockout device on an energy-isolating device, thereby preventing the energy-isolating device and the equipment being controlled from being operated until the lockout device is removed.
Lockout Devices	Devices that use a positive means, such as a combination or key lock (key locks are preferred), to hold an energy-isolating device in the safe position and prevent the energizing of equipment. Hasps, chains, and other devices may be treated as lockout devices when used in conjunction with locks.
Lockout/Tagout	A general term for all methods of ensuring the protection of personnel and equipment by installing tagout devices, with or without lockout devices.
Lockout/Tagout Holder	A qualified individual who is authorized to work, or to supervise work, under a centrally-controlled lockout/-tagout. A lockout/tagout holder is the same as "the authorized employee who is responsible for (that is, being protected by) the lockout or tagout device" or "the employee in charge of the clearance" as designated by OSHA.
Maintenance	Any activity involving work on the equipment to improve or retain its capability to function in the system, including maintenance or service, inspection, testing, and calibration.
Release of Lockout/Tagout	Formal termination of the need for protection under a lockout/tagout, by the protected individual.

Removal of Lockout/Tagout	Physical removal of the tags and locks associated with a lockout/tagout and, if not prevented by another active lockout/tagout, restoring the equipment to operable status.
Responsible Supervisor or Manager	The individual having authority and responsibility for operational control of a facility, process, experiment, or other project.
Tagout	The placement of tagout devices on energy-isolating devices to inform personnel that the energy-isolating device and the equipment being controlled MUST NOT be operated.
Tagout Device	A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled MUST NOT be operated or removed. Tagout devices are installed with all lockout devices, and on all boundary points that isolate equipment from sources of energy. Tagout devices are also installed on components used to verify or enhance the safety of a lockout/tagout, such as opened valves for venting and draining, installed grounds, or monitoring instrumentation.

GUIDE TO GOOD PRACTICES FOR LOCKOUT AND TAGOUT

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, Lockouts and Tagouts, Chapter IX of Department of Energy (DOE) Order 5480.19, "Conduct of Operations Requirements for DOE Facilities." The practices in this guide should be considered when planning or reviewing lockout and tagout programs. Employers at DOE facilities are advised to adopt procedures that meet the intent of 29 CFR (Code of Federal Regulations), Parts 1910 and 1926 (OSHA) and DOE Order 5480.19.

DOE Order 5480.19 and this Guide to Good Practices provide a set of guidelines and good practices for lockout/tagout from an operational standpoint. However, employers should be aware that there are further details in other sources (e.g., OSHA) which deal more specifically to lockout/tagout requirements from a personal safety standpoint. Employers should refer to these other sources for additional insights to requirements and good practices for the implementation of lockout and tagout programs at their facilities. If conflicts arise between OSHA and DOE Order 5480.19 or this Guide, OSHA shall take precedence.

Public Law 91-596, dated December 29, 1970, established OSHA, which had as its main purpose to ensure "so far as possible every working man and woman in the Nation safe and healthful working conditions." As part of this effort in the late 1980s, OSHA reviewed materials from many different sources to gather information on accidents that were caused by failure to properly lockout and tagout hazardous energy sources. As a result of the reviews, OSHA began to establish standards dealing with lockout/tagout of hazardous energy sources.

The first standard became effective in January 1990. Standard 29 CFR 1910.147, "The control of hazardous energy (lockout/tagout)," deals with servicing and maintenance of machinery and equipment. This standard was followed in December 1990 by 29 CFR 1910.333, "Safety-Related Work Practices," which addresses exposure to electrical hazards from work on, near, or with conductors. In May 1994, 29 CFR 1910.269, "Electric power generation, transmission, and distribution," became effective and established locking and tagging procedures for the deenergization of electric energy sources used for purposes of generation, transmission, and distribution, as well as equivalent installations of industrial

establishments. In addition, 29 CFR 1926.417, "Lockout and Tagging of circuits," was established to cover construction activities.

The primary purpose of all four of these lockout/tagout programs is to protect employees from exposure to potential hazardous energy sources. In fact, OSHA estimates that proper implementation of these standards will prevent approximately 261 deaths annually and will reduce the average injury and lost work days associated with lockout/tagout injuries by 85 percent annually.

"Lockout and Tagout" is an element of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the need for a formal lockout and tagout program to promote safe and efficient operations.

2. OBJECTIVE

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

A lockout/tagout program is implemented to provide protection to personnel and equipment, and to aid in the control of equipment and system status.

Criteria:

1. Locks and tags are used when controls must be established to protect personnel, equipment, or the environment.

2. The facility lockout/tagout program is implemented through physical and administrative controls on sources of energy and hazardous materials.

3. Protective materials and hardware are provided to control sources of energy and hazardous material.

4. Procedures are developed and used to control and document the application of lockouts/ tagouts.

5. Lockout/tagout procedures provide instruction for all aspects of energy control including notifications, equipment shutdown, isolation, application of locks and tags, verification, release, removal, and restoration to operational status.

6. Requirements are specified for temporary or partial removal of a lockout/tagout for testing or equipment positioning.

7. Periodic inspection and review of lockout/tagout implementation are performed.

8. All personnel receive appropriate training in the safe application, use, and removal of lockouts/tagouts.

9. The lockout/tagout program specifies actions that must be taken when other than facility personnel (e.g., vendors, subcontractors, etc.) perform work on equipment.

10. The lockout/tagout program identifies any special requirements for maintenance

performed under a group lockout/tagout.

11. The lockout/tagout program identifies the requirements for transfer of lockout/tagout at shift change.

12. Caution tags are controlled similarly to tagout devices but are not used for energy isolation.

3. DISCUSSION

A program for lockout and/or tagout (hereafter referred to as lockout/tagout) is of primary importance for ensuring worker safety in DOE facilities. The overall program for safety at DOE facilities is described in guidelines published by the Department of Energy, Office of Environment, Safety, and Health. Lockout/tagout is an essential part of this overall safety program.

A lockout/tagout program is designed to identify sources of energy and hazardous materials that could adversely affect maintenance activities, isolate all such sources from the work area, and ensure that the isolation remains effective until the work is completed. Lockout/tagout should be applied whenever workers are performing maintenance on facility equipment or systems where there is any possibility of injury or damage as a result of release of energy or hazardous materials.

If a facility's lockout/tagout program is to be effective, it must be understood by all affected personnel; it must be applied uniformly in every job; and it must be respected by every worker and supervisor. The requirements for lockout/tagout in U.S. industry are identified in OSHA regulations.

The lockout/tagout procedures in many DOE facilities, like the procedures used in electric utility power plants, must apply to situations requiring special control measures. In these facilities, measures to protect the individual worker must be integrated with the operation of larger safety systems designed to protect the public, the environment, and the facility. The procedures used in these facilities address protecting personnel from injuries resulting from unexpected operation or energizing of equipment. They also address preventing the unexpected or inadvertent loss of essential safety systems and operating facility systems.

Operation of equipment in these facilities is usually performed by an operations organization. Qualifications for operations personnel are distinct from the qualifications of maintenance or other service personnel. The specialized knowledge operators must possess regarding system functions and interactions mandates that only qualified operators may manipulate facility controls for any purpose, including lockout/tagout.

Within this Guide to Good Practices, two methods of lockout/tagout implementation are discussed. For facilities or situations where the application of lockout/tagout is limited and has no effect on the overall facility safety or environmental systems, the method is called an individual-controlled lockout/tagout. For facilities where the application of a lockout/tagout

is far-reaching and may alter an integrated process, the method is called centrally controlled lockout/tagout. For example, centralized operations control (similar to electric utilities) or situations requiring integration of lockout/tagout with other functions would use a centrally controlled lockout/tagout. This guide identifies many lockout/tagout practices that apply to both methods. It also identifies many additional or alternative practices that apply to only one method. DOE facilities may have operating characteristics addressed by either method. As part of the implementation of a lockout/ tagout program, each facility must determine which guidelines are most applicable to the facility's own function and organization. The goal of the lockout/tagout program is the same for all DOE facilities: the control of potentially hazardous energy sources and hazardous materials to ensure safety.

4. GOOD PRACTICES

4.1 Lockout/Tagout Use

Lockout/tagout in a DOE facility may serve three functions. The first function, defined by both OSHA and DOE Order 5480.19, is to protect personnel from injury. The second function closely related to that, 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.

Both functions are necessary for the overall safe operation of DOE facilities, in accordance with guidelines published by the Department of Energy, Office of Environment, Safety, and Health. Some considerations affecting the use of lockout/tagout are identified in the following sections.

4.1.1 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, unless the criteria listed in Section 4.1.4 of this document are met to qualify for exception to the lockout/tagout program. 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.

4.1.2 Protecting Equipment from Damage

When equipment problems that could destroy or severely damage the equipment are detected, a lockout/tagout may be 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 – first, isolate the

equipment from all sources of potentially hazardous energy, then apply locks and tags to prevent accidental or inadvertent operation.

In some facilities an alternative system is used for equipment protection. In this system, 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. This system uses caution tags, which are discussed in Section 4.11. The use of caution tags is not permitted as a lockout/tagout to protect personnel from energy or hazardous material sources.

4.1.3 Other Uses of Lockout/Tagout

In some situations, it may be necessary to prevent inadvertent operation of a functional system. The following example illustrates this:

> Fresh nuclear fuel for a particular reactor must be kept dry (free from water) until it is ready to be loaded into the reactor. This is necessary to prevent the possibility of an inadvertent criticality. When fuel is received in the facility, it must be transported through an area where a fire-protection sprinkler system is installed. During the time nuclear fuel is present in the area, it may be appropriate to isolate, lock, and tag the fire-protection sprinkler system to prevent its operation.

In this case, the lockout/tagout is not related to any maintenance activity, but the situation requires that the system be inoperable for safety reasons. Locking out valves on storage tanks to prevent environmental impact during maintenance may also be an appropriate use of lockout/tagout.

4.1.4 Exceptions to Lockout/Tagout Requirements

OSHA does not require lockout/tagout for activities that are performed as part of normal operations, such as minor tool changes and adjustments, as long as effective alternate protective measures are used. Lockout/tagout is also not applicable to hot tap operations involving work on pressurized transmission and distribution pipelines for gas, steam, water, or petroleum products; however hot taps should be used only when continuity of service is essential, and procedures and equipment that provide proven effective protection for personnel are used.

Equipment that presents no danger to personnel or other equipment during maintenance does not require lockout/tagout. For example, electrical equipment whose maximum voltage is less than 30 volts will not normally require lockout/-tagout if there will be no increased exposure to electrical burns or to explosion due to electric arcs. Equipment that can be deenergized by unplugging it from its energy source does not require lockout/tagout, if the unplugged power cord is under the exclusive control of the person performing the maintenance. Lockout/tagout is required for all other equipment.

OSHA requirements identify specific situations where the use of a written procedure for lockout/tagout is not necessary. An authorized individual can perform lockout/ tagout without a written procedure if ALL the following criteria are met:

- The machine or equipment has no potential for stored or residual energy or reaccumulation of stored energy that could endanger personnel after shutdown

- The machine or equipment has a single energy source that can be readily identified and isolated

- The isolation and locking/tagging of that energy source will completely deenergize and deactivate the machine or equipment

- The machine or equipment is isolated from that energy source and locked out during maintenance

- A single lockout device will achieve a locked out condition

- The lockout device is under the exclusive control of the authorized personnel performing maintenance

- The maintenance does not create hazards to other personnel

- There have been no accidents involving unexpected activation or reenergizing of the machine or equipment during previous maintenance.

4.2 Lockout/Tagout Implementation

Before implementing a lockout/tagout program, it is necessary to identify the method of equipment control used within the facility. There are two approaches to equipment control, individual-controlled and centrally controlled.

4.2.1 Individual-Controlled Lockout/Tagout

In some DOE facilities, individual workers operate equipment for the purpose of producing, assembling, testing, or packaging components or products. The equipment used may include milling machines, lathes, presses, test benches, and other machines. Each worker may be responsible for operation and routine maintenance of an individual piece of equipment.

For these workers, protection from hazardous energy sources simply means preventing the power from being inadvertently or accidentally turned on while they are performing the maintenance. The simplest and most effective method for controlling the hazardous energy is the individual-controlled lockout/tagout.

Under an individual-controlled lockout/tagout, the individual worker is responsible for taking all necessary actions to ensure personal safety and the safety of others during the maintenance. To aid the worker, OSHA and DOE Order 5480.19 require the following:

- Locks will be used whenever possible to secure energy or hazardous material isolating devices. New equipment and major equipment modifications will be designed to permit the use of locks. Tags should be used to identify the person who placed the lock and the purpose of the lock. If locks cannot be used, installation of tagout devices is required.

- Management should identify activities that require lockout/tagout. For each activity requiring lockout/tagout, criteria should be provided to identify the locations for locks and tags.

- Only designated personnel should have access to keys for keylocks that are integral to control devices. If the worker deactivates equipment by removing the key from the control switch, it is essential to ensure that no additional keys are available to unauthorized personnel. Additionally, the control switch should be tagged.

- Every isolation from an energy or hazardous material source must be verified. Specific techniques for verification should be established by facility procedures. The initial verification should include a review of pertinent controlled drawings or manuals, and a hands-on physical check of the equipment. The drawings should be used to help identify the sometimes obscure sources of power or pressure (e.g., control power, indication or interlock circuits, sensing lines) that may be present in equipment even though the main (and obvious) sources have been isolated. If a physical check is not possible because of hazards in the area or an existing lockout/-tagout, other verification, such as observation of a reliable position indicator, is required. Periodic checks should be performed to ensure that isolating components remain in the proper position and that locking devices remain properly attached.

- If it is necessary to unlock an isolating device or place it in a position other than the prescribed position during maintenance, specific authorization should be obtained and documented. Before the change is made, persons who will perform maintenance while the deviation is in effect must clearly understand the change in protection level and any additional restrictions necessary to ensure safety.

4.2.2 Centrally Controlled Lockout/Tagout

In contrast to the facilities described in Section 4.2.1, other DOE facilities have a central organization that is responsible for operation of the facility or process, or interrelated systems that are not necessarily under a single individual's control. The facility may contain highly complex specialized equipment, such as a reactor or a particle accelerator, or it may contain equipment spread over a large area, such as electrical distribution systems. In facilities like these, certain process and specialized safety functions may be required to ensure the safety of personnel, equipment, and the environment, even though maintenance is being performed on other parts of the system.

In these facilities, lockout/tagout is more clearly a part of the overall program for control of equipment and system status, and therefore must involve operations personnel and supervision in the approval and implementation process. Maintenance personnel are not normally trained in the requirements for safe operation of the process systems, therefore maintenance personnel are not normally authorized to operate facility equipment, except within the requirements of specific maintenance procedures.

Lockout/tagout in centrally controlled facilities requires effective coordination between operations and the personnel performing maintenance to ensure that appropriate safety functions are maintained and that a safe work environment is provided. Coordination is also required when a lockout/tagout in one facility could affect systems or site utilities in another facility. Therefore, operations managers should define system and process boundaries.

In some cases, operations may define equipment that can be turned over to maintenance for all work-related activities, including lockout/tagout control. In these cases maintenance must comply with all lockout/tagout requirements, including documentation and restoring the equipment to operable condition. Whether the lockout/tagout is performed by operations or maintenance personnel, the process for approval and centralized control should be the same.

Many of the requirements for a centrally controlled lockout/tagout are similar to those for an individual-controlled lockout/tagout. Requirements of both programs are described in the following sections.

4.2.3 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.

4.2.3.1 General Practices

A lockout/tagout must isolate <u>all</u> 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) should be 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 should be 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) provides the primary isolation from the energy source.

4.2.3.2 Electrical Practices

If electrical grounding devices are required, the location and sequence for installation of each device should be specified in the lockout/tagout procedure.

All electrical grounding devices used in a lockout/tagout should be tagged out to ensure that the grounds remain in place until the work is

complete, and that they are removed before reenergizing the system.

4.2.3.3 Piping Systems Practices

Systems, portions of systems, and components that operate at temperatures or pressures above ambient should be 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 should be tagged in the open position to depressurize the equipment and to accommodate thermal expansion or contraction.

Systems that operate at high temperatures (e.g., greater than 200°F for a water system) or high pressures (e.g., greater than 500 psig), should be 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 should be isolated by two valves in series and the isolated section should be purged. When any of these conditions exists and two-valve isolation cannot be provided, specific management approval should be obtained before performing work. Exceptions to the two-valve isolation should be 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.

4.2.3.4 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

4.2.3.5 Practices for Injecting Energy Potentials Into Systems and Components for Testing

Lockouts/tagouts that are established to isolate a component, portion of a piping system, or electrical circuit for the purpose of injecting an energy potential for testing (e.g., hydrostatic test, local leak-rate test, electrical insulation test, etc.) within the lockout/tagout boundary require special consideration.

The lockout/tagout should be prepared in accordance with an approved written procedure that specifically addresses the conduct of the test.

The initial lockout/tagout boundaries should be established to protect test personnel and test equipment while test equipment is being connected to the system or component. Other work within the area isolated for

testing should be suspended.

After the test equipment is installed, an isolation boundary must be established to confine the testing activity and to protect equipment and personnel outside the boundary while testing is in progress. The initial lockout/tagout boundary may be used for this purpose but must be carefully evaluated to ensure adequate protection for equipment and components outside the isolation points.

4.3 Protective Materials and Hardware

Both DOE Order 5480.19 and OSHA include specific requirements for isolation devices, locking devices, and tags. This section offers some explanation related to those requirements.

All locking devices and other protective materials must be standardized and issued by the employer (facility). These requirements are important for two reasons. First, it would be impossible to maintain control and accountability if each worker used locks or other devices that were not standardized or did not offer adequate protection. Second, it is essential that locking devices and tags be readily identifiable and not used for any other purpose.

Locking devices and tags must be standardized either in color, shape, or size. For example, if a facility has decided to use commercial 1-inch padlocks with a red plastic band for lockouts, every lock used on a lockout will be immediately recognizable by those characteristics. Similar 1-inch locks with red plastic bands would not be permitted in any other use, such as securing a locker. Tags require a standard print and lettering format, in addition to standard color, shape, or size.

Locking devices and tags must be durable enough to withstand exposure to the environment where they are installed, for as long as they are expected to be there. This means that the tag must not deteriorate and the message must remain legible. Tags placed in areas where acids or caustics are used or stored may require clear plastic covers or lamination to meet this requirement.

Locking devices must be substantial so they cannot be removed or bypassed while workers are depending on them for protection.

Tagout devices, including their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal. Tagout device attachment means shall be of a non-reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds and shall have the general design and basic characteristics of being at least equivalent to a one-piece, all-environment-tolerant nylon cable tie.

All locking devices and tags used in individual-controlled lockouts/tagouts must identify the person applying them and the organization. This requirement can be met by always tagging each lockout device, and always identifying the individual and organization on each tag. In centrally controlled lockouts/tagouts, the tag should be uniquely identified (numbered), should identify the component and the required position, and should identify the persons placing and verifying the tag.

Tagout devices must clearly warn that operation is not permitted (for example, "Danger, Do Not Operate"). These tagout devices should never be used on equipment that is energized or in-service.

4.4 Procedures for Lockout/Tagout

Facilities are required to use administrative procedures to ensure uniformity in applying their lockout/tagout program. In addition, each lockout/tagout, unless exempted in accordance with Section 4.1.4 of this guide, requires a specific written technical procedure in which the isolation points and other instructions for installing and removing tags are identified. The technical procedures containing lockout/tagout instructions can be developed in any one of the following three ways:

- Maintenance procedures may identify the isolation and tag locations required for a job or for a piece of equipment. In centrally controlled facilities, development of these procedures should involve operations personnel to ensure that the protection is adequate and that other systems or equipment are not inadvertently affected.

- Operating procedures may be prepared and approved in advance for isolation of specific systems or equipment.

- Lockout/tagout instructions may be prepared and approved by the responsible supervisor or manager to meet a specific work requirement.

A generic procedure for similar types or like pieces of equipment can be used as a technical procedure.

4.4.1 Requirements for Lockout/Tagout Procedures

Each of the technical lockout/tagout procedures should:

- Identify the intended use of the procedure and any limitations or restrictions controlling its use.

- Specify the procedural steps necessary to isolate the work area from all sources of energy or hazardous materials. The procedure should identify the locations for all tags, the order of operation and tagging, and the final position of tagged components.

- Provide specific instructions for placing and removing locks and tags, and for documenting the placement and removal of each lock and tag. If the work is expected to continue beyond a single shift, instructions should also be provided for transfer of "ownership" or protection.
- Provide clear instructions for verifying the effectiveness of the lockout/-tagout. The verification should be performed by qualified personnel who were not involved in isolating the work area or installing the locks and tags. *DOE Guide to Good Practices for Independent Verification* can provide useful guidelines for carrying out an independent verification of a lockout/-tagout.

4.4.2 Documentation of Lockout/Tagout

Each lockout/tagout should be documented based upon facility risk and operational requirements. Documentation for a simple individual-controlled lockout/tagout may consist of a record on the completed tag. A lockout/tagout that involves multiple energy-isolating devices, or that will be used by several individuals or work groups (including centrally controlled lockout/tagout) should document the following activities as they apply: authorization, placement of locks and tags, verification of effectiveness, acceptance by individual workers or work group representatives, release by workers at the completion of the job, authorization for and removal of locks and tags, and restoration to operable condition.

The sample Lockout/Tagout Record Sheet in Appendix A provides one approach to documenting a lockout/tagout.

Facilities also may use a standardized form, such as the sample Lockout/Tagout Record Sheet, when it is necessary to prepare and approve lockout/tagout instructions to meet a specific work requirement. When completed, the form should provide the necessary procedural steps for isolation, specific instructions for placing and removing locks and tags, and instructions for verifying the effectiveness of the protection.

4.5 Installing, Verifying, and Removing Lockout/Tagout

Certain elements of a lockout/tagout should be performed in sequence to ensure that the lockout/tagout provides the desired level of safety. Understanding these elements will help facilities define the specific steps that will be required in the installation, verification, and removal of facility lockouts/tagouts. The operating principles that form the basis for these elements are discussed below.

4.5.1 Installation of Lockout/Tagout

Lockout/tagout should not be installed unless authorization has been obtained from the supervisor responsible for operation and status of the equipment. In addition, the following guidelines should be observed.

- Only personnel who are qualified and authorized should be permitted to isolate equipment or install locks and tags. This is necessary to ensure that the operator responsible for the equipment or process is aware of its status and is able to verify all requirements for personnel and equipment safety. It also helps ensure that adequate protection is provided to the worker, even when the worker is not familiar with system operation.

  In facilities using individual-controlled lockout/tagout, a qualified operator should assist anyone needing protection (e.g., vendor) who is unfamiliar with the isolation procedure. When the lockout/tagout is installed, it should be placed under the control of the person requiring the protection.

- All personnel authorized to isolate equipment or install locks and tags should

know, through training and qualification, the type and magnitude of hazards involved in work on the equipment or system. They should understand what methods will be used to control those hazards, and they should know how to verify that the protection is adequate.

- The machine or equipment should be shut down using normal operating procedures. This produces an orderly shutdown and avoids the possibility of added hazards or equipment damage that might result from simply disconnecting the power or using some other unusual shutdown method.

- Equipment isolation devices must be physically located and operated in such a way as to isolate the equipment from the energy source.

  - Protection should not be based upon the presumed remote actuation of a circuit breaker or valve. As an additional protection, it may be possible to rack out a circuit breaker or remove a component (such as a fuse or a piping spool piece) to isolate the equipment from an energy source.

  - If a component is already tagged (from another lockout/tagout) it must NOT be operated or removed. Its position should be verified by all other appropriate means, e.g., observation of system parameters, valve position indicators, etc.

  - Personnel should verify the expected physical results of positioning each component. If undesirable conditions are encountered, e.g., inability to depressurize a piping system because of leakage through an isolation valve, the responsible supervisor or manager should be contacted for resolution.

- Tags and locks should be attached to all isolation devices to clearly indicate that operation is prohibited. In some large centrally controlled facilities, including most commercial power plants, tags alone have been found to be sufficient for protection. This is because of the training that all persons receive and the strict procedures that govern operation of equipment in these facilities.

  - If tags are used as the sole protection, the facility must demonstrate that the tagout procedures afford the same protection as lockout.

- In facilities using individual-controlled lockout/tagout, and in facilities where the training and familiarity with procedures of all personnel in the area cannot be determined, locks should be used along with tags to physically prevent unauthorized operation of isolation devices.

- When locks are used, each individual performing work (each lockout/-tagout holder in centrally controlled facility) should lock and tag each applicable isolation device, group lockout device, group lockbox, or comparable mechanism.

- In centrally controlled lockouts/tagouts, where many individuals or work groups may require protection from the same lockout/tagout, the number of individual locks on isolation devices could become excessive. The number of individual locks can be reduced and safety can be preserved by a "group lockout" system such as the one described in Section 4.5.3.

- Potentially hazardous stored or residual energy must be relieved, disconnected, restrained, or otherwise rendered safe. If it is possible for stored energy to reaccumulate, a means should be provided so workers can continue to verify that a safe level exists until completion of the work. This verification may be provided by opening a valve for draining or venting, breaking a flanged connection, installing grounding devices, or by other similar means. All such methods of verification should also be tagged to ensure that they remain effective during the work and that they are restored to operating condition when the lockout/tagout is removed.

- The isolating and deenergizing of the equipment and the proper installation of locks and tags should be verified by a qualified person. In addition, the adequacy of the protection should be verified by the individual(s) or work group representative(s) who will be working under the lockout/tagout. Verification should include checking that electrical systems show no voltage present (and are grounded if applicable), fluid and pneumatic systems are depressurized and vented (or drained if applicable), and all isolation devices are properly positioned, inoperable, and appropriately tagged.

- If facility procedures require independent verification of the system, it should be performed in accordance with *DOE Guide to Good Practices for Independent Verification*. If the sample Lockout/Tagout Record Sheet

(Appendix A) is used, the requirement for independent verification should be identified on Line [4].

4.5.2 Release and Removal of Lockout/Tagout

Like installation, release and removal of lockouts/tagouts have the potential to significantly affect personnel and facility safety. Release refers mainly to centrally controlled lockouts/tagouts. It ends the protection and permits the operations organization to change or remove the boundary isolations. If a form such as the sample Lockout/Tagout Record Sheet (Appendix A) is used, release occurs when an individual or work group representative signs in Block [10] of the form, removes any applicable individual/work-group locks (e.g., from a group lockbox), and turns over keys for other affected locking devices (e.g., integral-lock control switches).

Removal of a lockout/ tagout restores the energy availability to the equipment and returns the equipment to an operable condition, unless other current lockouts/tagouts affect the same equipment. Placing components in an operable condition when the lockout/tagout is removed does not mean placing them in operation. For example, removing a lockout/tagout would restore a circuit breaker to an operable condition, but would not close it; removal would restore the operability of a motor-operated valve, but would not open the valve. Approved operating procedures should be used for all operations, including equipment and system startup and post-maintenance testing.

In centrally controlled facilities, the following additional steps should be performed to ensure a safe release and removal of a lockout/tagout.

- Prior to releasing a lockout/tagout, the individual or work group representative should check that the machine or equipment is operationally intact. It would not be safe to remove the lockout/tagout if further work must be performed to make the equipment operational.

- The individual or representative should check to see that all nonessential items (e.g., tools, trash, etc.) have been removed from the work area. Returning to the area to retrieve tools or materials after the lockout/tagout has been released may be unsafe, and the area may be unsafe for operations personnel if housekeeping is not completed.

Only after all affected individuals and work group representatives have released a lockout/tagout can the operations organization remove the tags (and locks, if used) and place the equipment in an operable condition. The sequence for removal of tags and the final position of tagged components should be specified in the lockout/tagout procedure. As part of the restoration, the area should be checked to ensure that:

- The equipment is operationally intact, including all required guards and interlocks.

- Components within the lockout/tagout boundary are repositioned, if required, to permit safe operations

- Components that could cause automatic operation of a circuit breaker or a motor- or air-operated valve when control power or pressure is restored are in a position such that automatic operation will NOT occur during removal of the lockout/tagout.

Prior to removal of a lockout/tagout, the person responsible for operation should inform all affected personnel that the lockout/tagout is being removed and that the equipment will be operational.

The responsible individual, supervisor or manager should account for all tags prior to declaring the equipment operable and closing out the lockout/tagout. One effective method is to have all tags returned to be individually verified and destroyed or marked to prevent reuse. In some cases, such as tagouts that are applied in contamination areas, it may not be practical to personally verify and destroy the removed tags. Under such circumstances, alternative methods of verification should be developed.

In facilities using individual-controlled lockout/tagout, the person who installed a lock and tag should be the one to remove it. Each facility must develop specific procedures to be followed for lockout/tagout removal when the individual is unavailable, (e.g., has departed at the end of the shift). The appropriate supervisor/manager should assume responsibility for verifying that the individual is not available, authorizing the removal, and ensuring that the individual and all other affected personnel are informed prior to resuming work at the facility.

4.5.3 Group Lockout/Tagout

When maintenance is performed by a crew, craft, department, or other group, it is often advantageous to use a "group" lockout/tagout procedure. Such a procedure must afford personnel a level of protection equivalent to that provided by installation of personal lockout/tagout devices. The centrally controlled lockout/tagout described in this Guide meets that requirement when the following actions are performed:

- An authorized person (a member of the operations organization in centrally controlled facilities) locks and tags each isolation device.

- The keys from all isolation device locks are placed inside a lockable box. This box is then also locked and tagged.

- Each individual or work group representative requiring protection adds an individual lock and tag to the lock box.

No keys to isolation devices can be obtained until all individuals and work groups have released the lockout/tagout and removed their locks and tags from the lock box.

- After all individuals and work group representatives have removed their locks and tags from the lock box, the authorized person (or a person authorized by the responsible supervisor or manager in centrally controlled facilities) may remove the final lock and tag from the lock box. This makes the keys available for removing the remainder of the lockout/tagout.

4.6 Temporary or Partial Removal

As a general rule, temporary or partial removal of a lockout/tagout is discouraged, except when required as part of an approved work package, e.g., to stroke a motor-operated valve, to check phase rotation on a motor, or to test equipment functionality. It is important that a temporary or partial removal of a lockout/tagout is not regarded as an opportunity to take shortcuts. The same series of checks and precautions is required whether one tag is being removed or the entire lockout/tagout. All lockout/tagout holders must release the lockout/-tagout before any tags are removed or any changes are made in the isolation boundaries.

After the activity that required temporary or partial removal of the lockout/tagout is completed, the lockout/tagout will either be reapplied or completely removed. If the lockout/tagout is to be reapplied, the equipment must be shut down, deenergized, verified, and locked/tagged just as it was for the initial application. If a record like the sample Lockout/Tagout Record Sheet (Appendix A) is being used, the new tags should be added to the list in Block [12] of that sheet. If the lockout/tagout is to be completely removed, it must be done in accordance with the normal procedure for release, removal, and restoration.

4.7 Shift or Personnel Changes

Ensuring personnel safety and continued work boundary isolation during shift or personnel changes requires special attention. All facilities should establish procedures for the orderly transfer of responsibility and protection under a lockout/tagout.

4.7.1 Facilities Using Individual-Controlled Lockout/Tagout

Facilities using individual-controlled lockout/tagout may be able to use the following method: The off-going and oncoming persons together review and verify the lockout/tagout. At each energy-isolating device, oncoming persons attach their own new tag and off-going persons remove their tag. All keys for applicable locking devices are turned over to the oncoming person. This transfers "ownership" of the lockout/tagout without releasing control over the energy-isolating devices.

4.7.2 Facilities Using Centrally Controlled Lockout/Tagout

Facilities using centrally controlled lockout/tagout should ensure that control of the lockout/tagout is maintained during shift changes. If a new work crew is taking over the work, or if outside vendor personnel are involved in the work, each individual or work group representative should release their lockout/-tagout(s) at the end of the shift for turnover to the oncoming personnel. At the beginning of each shift, each individual or work group representative should verify the adequacy of lockout/tagout protection and receive new authorization from the responsible supervisor or manager before beginning work.

If a form like the sample Lockout/Tagout Record Sheet (Appendix A) is used, the release at the end of a shift should be recorded in Block [10] of the sheet. At the beginning of the next shift, each individual or work group representative should be entered on a new line in Blocks [7] and [8]. Authorization for work to begin should be recorded in Block [9] for each period of work. Sheets should be added as required to record additional entries.

4.8 Periodic Inspection

Facility procedures should outline periodic review and inspection responsibilities for lockout/tagout. Documentation for each review/inspection should include the date and time of the inspection, the name/signature of the person conducting the inspection, any deficiencies noted, and corrective action(s) taken.

Facility operators should inspect for correct placement of tagout devices (and locks, if used) and correct position of tagged equipment as part of their normal rounds. Operators should notify the responsible supervisor or manager if deficiencies are noted.

Each shift, lockout/tagout holders should inspect the work boundary isolation devices to verify that tagout devices (and locks, if used) are properly installed. At facilities where ALARA concerns would limit such inspections, operations management should establish an inspection frequency that is consistent with dosage control considerations. Lockout/tagout holders should inform affected personnel and the responsible supervisor or manager if deficiencies are noted.

Supervisors should inspect work boundary isolation devices to verify that tagout devices are properly completed and installed to warn against operation, locks (if used) are properly installed to prevent inadvertent operation, and devices are properly positioned to provide the required protection. They should interview personnel installing, removing, and working under lockouts/tagouts to determine their knowledge of responsibilities. They should review the documentation for current and removed lockouts/tagouts to ensure that the documentation meets all requirements and accurately reflects the current status. Supervisors should document each inspection, including the date, person(s) performing the inspection, equipment and procedures involved, and personnel participating in the inspection. They should initiate corrective action for any deficiencies.

Managers should inspect facilities or areas under their control at least annually for overall

compliance with facility lockout/tagout requirements. Facilities having a high level of lockout/tagout activity or a history of problems involving lockout/tagout should be inspected more frequently. Managers should document their inspections, including any deficiencies found and corrective actions initiated.

4.9 Outside Contractors

Whenever outside contractors or other outside servicing personnel are engaged in work covered by the lockout/tagout program, there may be differences in interpretation and application. The facility supervisor and the contractor should discuss the protection requirements for the job. All lockout/tagout protective measures should be applied in accordance with facility procedures. The contractor should ensure that the procedures are understood by all subordinate contractor personnel.

4.10 Training and Communication

A lockout/tagout program cannot provide consistent worker and equipment safety if all personnel do not understand and comply with its requirements. All employees may potentially be affected by the lockout/tagout program, whether through their own work activities or the work of others. Therefore, facilities should ensure that each employee receives an appropriate level of training on the purpose and function of lockout/tagout. OSHA requires all affected personnel to be trained on the contents of the lockout/tagout program and the requirements to implement it effectively. The training should include:

- Lockout/tagout program
  - Recognition of lockout/tagout
  - Purpose of lockout/tagout procedures
  - Use of lockout/tagout procedures
- Lockout/tagout compliance
  - Locks and tags not to be bypassed, ignored, or otherwise defeated

  - Locks and tags not to be removed without proper authority

- Tag limitations

  - Tags are warning devices only and do not provide physical restraint against operation

  - Effectiveness depends on compliance by all personnel

Personnel authorized to isolate equipment and install locks and tags, and persons designated as lockout/tagout holders in centrally-controlled facilities, should receive additional training in the areas listed below.

- Hazardous material and energy sources

  - Recognition of sources applicable to the facility

  - Magnitude and type of energy or materials involved

  - Methods and means to isolate and control

- Lock limitations

  - Necessary facility operation may be hindered by locks

  - Locks and chains could contribute to seismic loading of small instrument line valves

Facilities should evaluate the need for additional training following changes in job assignments, machines, or processes.

4.11 Caution Tags

Caution tags SHALL NOT be used for protection of personnel performing maintenance or for energy isolation, but they may, at the facility's option, be administered by a common tagging procedure.

Use of caution tags should be restricted to situations in which a component or system is functional, but some precaution or other item of information is needed prior to its operation. For example:

> A piece of equipment has both an automatic and a manual mode of operation. A problem develops in the automatic control, making that mode of operation unreliable, but the equipment is still functional. A caution tag would be appropriate to warn an operator of the limited operational capability and the need to monitor the equipment in the manual operating mode.

Caution tags should NOT be used in the place of more appropriate action, such as a temporary or permanent procedure change, placing an operator aid, use of the work control system, or corrective maintenance. The instructions contained in a caution tag should not conflict with established facility procedures or technical safety requirements.
If caution tags are used in a facility, the program should include the following elements:

- The use of caution tags should be controlled and documented.
  - Situations requiring special operator or maintenance precautions should be brought to the attention of the responsible supervisor or manager.
  - The appropriate supervisor or manager should determine the need for each caution tag and authorize its placement.
  - Caution tags should be placed so that they are readily apparent to an individual prior to operation of the tagged device, but they should not obscure indications or interfere with switches or other control devices.
  - A facility log should document all caution tags issued in the facility, including their status and additional amplifying information.
  - All caution tags should be reviewed periodically to verify their continued need and applicability.
  - Caution tags remaining active for long periods (e.g., longer than three months, or other facility guideline) should be brought to the attention of the responsible supervisor or manager for action to resolve the problem.

- Caution tags should be easily identifiable and unique in appearance compared to other tags used at the facility. Caution tags should contain the following information:

  - Caution tag number
  - Component identification number and name
  - Effective date
  - Precautions and amplifying instructions
  - Signature and organization of the person authorizing the caution tag.

APPENDIX A
(SAMPLE) LOCKOUT/TAGOUT RECORD SHEET

Intentionally Blank

(SAMPLE) LOCKOUT/TAGOUT RECORD SHEET

[1] Lockout/Tagout Number _____ - _____ - _____
Facility - Year-Number

[2] Component/System:

[3] Requested By:

[4] Independent Verification Required at Lockout/Tagout Yes No

[5] Safety-Related Testing Required Yes No
Specify testing conducted:

[6] Lock/Tag Preparation (Block [12]) completed; Placement of Locks/Tags Authorized

_____
(Operations Supervisor)

[7] Issued For	**[8]** Accepted (Lockout/Tagout Holder)		**[9]** Work Authorized (Responsible Supervisor)		**[10]** Release Lockout/Tagout (Lockout/Tagout Holder)	
Activity Identification	Name	Date/ Time	Name	Date/ Time	Name	Date/ Time

Blocks [7], [8], [9], & [10] continued on additional sheets? ❑ Yes

[11] Restoration (Block [14]) Completed / Operability Checks Satisfactory

Specify testing performed:

_____
(Responsible Supervisor or Manager)

Intentionally Blank

Completion of the (Sample) Lockout/Tagout Record Sheet

Lines [1], [2], and [3] request administrative information to identify the lockout/tagout, the equipment affected, and the name of the requester.

Line [4] requires determination of any independent verification requirement at the time the lockout/tagout is applied. Independent verification may be required on some systems, particularly safety systems, following installation of a lockout/tagout to ensure that required safety functions have not been inadvertently affected. Additional information concerning independent verification requirements can be found in *DOE Guide to Good Practices for Independent Verification*.

Line [5] requires identification of safety-related testing requirements, in accordance with facility safety standards.

Line [6] confirms the proper listing of tagout points (Block [12]) and preparation of tags, and documents approval by the responsible supervisor or manager to begin installing the lockout/tagout.

Block [7] provides space to identify the work activity(ies) requiring protection under this lockout/tagout. Activities may be identified by their work control document number, procedure number, etc.

Block [8] provides space for appropriate lockout/tagout holders (individuals or representatives of work groups) to document their acceptance of the lockout/tagout as adequate protection for their intended work.

Block [9] provides space for the responsible supervisor or manager to document that the lockout/tagout has been properly installed and that work is authorized to begin for each individual, work group, or shift.

Block [10] provides space for these individuals or work group representatives to document their release of the lockout/tagout at the end of the job (or shift).

Block [11] provides for the responsible supervisor or manager to document the closure of the lockout/tagout after it has been released by all users (Block [10]) and has been removed and restored to operational condition (Block [14]). If post-maintenance testing is required to prove operability, it should be identified in Block [11].

Blocks [12], [13], and [14] document the preparation, placement, and removal of each individual tag. Block [12] provides space to list components that will form isolation boundaries around or verification points within the work area, the required position of each component, and the sequence in which the tags should be placed. The authorized persons who prepare the list and tags and who verify the accuracy and adequacy of the protection should be identified in the spaces labeled "Prepared by" and "Verified by." Block [13] documents the positioning of components and the placement and verification

of each tag. Block [14] documents the required position of each component to restore it to an operable condition, sequence for restoration, authorization for removal of each tag, tag removal and restoration of each component to operable condition, and verification.

Block [15], the remarks section, provides space for amplification on any action required or condition observed during placement, verification, or removal of tags (and locks, if used). For example, if two-valve isolation cannot be achieved in a hazardous system, or if verification cannot be performed because of high radiation, a statement in the remarks section should document the affected component(s), the reason, and the appropriate supervisory approval. Block [15] should also be used to identify (by signature, initials, and position) the personnel performing specific lockout/tagout actions, such as installing tags, verifying installation, removing tags, verifying removal, or adding tags to an existing lockout/tagout record.

DOE-STD-1030-96

CONCLUDING MATERIAL

Review activities:
DOE-DP
DOE-EH
DOE-EM
DOE-ER
DOE-NE
DOE-NS
DOE-PAPO

Preparing activity:
EH-31
Project Number:
SAFT-0056