

		SOP0008 Rev. 3 <i>Facilities Level 3 Procedure</i>
Stage: Approved	Effective Date: 10/01/15	Lock-out/Tag-out (LOTO) Operating Procedure

1.0 PURPOSE

This procedure establishes the detailed process for performing Lock-out/Tag-outs (LOTOS) not covered in PUB-3000, and is provided as a supplement to PUB-3000. Personnel authorized to carry out LOTOs are required to be trained in and familiar with the LOTO policies and procedures in PUB-3000. SOP0008 (previously OPER-045) does not supersede the requirements given in PUB-3000, but serves to provide additional details.

2.0 SCOPE

This procedure applies to all Facilities Operations & Facilities Engineering Departments LOTO Authorized Persons and subcontractors working for the Facilities Operations Department who require a LOTO to perform contracted work.

This procedure only addresses how to control hazardous energy. Consult your work authorization or SME for information to control other hazards present at the work location.

3.0 DEFINITIONS

3.1 All definitions shall be per PUB-3000, Chapter 8 & 18. Any information provided in this section is supplementary to the definitions found in PUB-3000.

3.2 Hazardous Energy Thresholds:

It is often necessary to involve technical experts (industrial safety, Industrial hygiene, engineering, etc.) to assist in the analysis of energy forms to determine appropriate controls. This section provides guidance for evaluating common hazardous energy sources that Facilities Crafts may perform services or maintenance work on.



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Energy Form	LOTO Not Required	LOTO Required
Electrical Energy	See PUB-3000, Chapter 8, LBNL Electrical Safety Manual, Section 8.2.3 & 8.2.4	See PUB-3000, Chapter 8, LBNL Electrical Safety Manual, Section 8.2.5 & and other sections referenced in the section.
Thermal, Hot	Liquids or gases $\leq 125F$ Surfaces $< 140F$ (Surfaces are defined as having no leakage of liquid or gas outside of the pipe, containment, vessels, etc) Equivalent Pipe Diameter ≤ 6 inches	Liquids or gases $\geq 125F$ Surfaces $\geq 140F$ Equivalent Pipe Diameter > 6 inches
Thermal, Cold	Liquids and surfaces $> 27F$	Liquids and surfaces $\leq 27F$
Mechanical Motion, Rotational	Fan Diameter ≤ 20 inches Fan Diameter between 20 and 24 inches installed with common suction plenum, backdraft damper linkages must be visible outside of the air stream to confirm that the backdraft damper is functioning correctly	Fan Diameter > 24 inches
Hydraulic Pressure	Water System Pressure < 150 psig and ≤ 6 inches pipe diameter Water Systems include HPCW, CHW, HHW, LCW, TRW, Sanitary Sewer, Storm Drain and Fire Sprinkler Water	Water System Pressure ≥ 150 psig or > 6 inches pipe diameter Exception Fire Sprinkler Systems at East Canyon Area that operate near 175 psig
Pneumatic Pressure	Compress Air Pressure ≤ 30 psig	Compressed Air Pressure > 30 psig Natural Gas: All Pressure

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3.3 Multiple Shifts: If the work is transferred to a different crew and/or a different shift (e.g. changing assigned workers, going from day to swing/owl shift).

4.0 ROLES, RESPONSIBILITIES, AND QUALIFICATIONS

4.1 All roles and responsibility descriptions are per PUB-3000, Chapter 8 & 18. ***The LOTO Roles and Responsibilities by Position and System*** found in section 7.1 delineates which Facilities persons are authorized by Facilities Management to perform in the roles described in PUB-3000. Those roles include the **LOTO Qualified Person**, the **Person In Charge**, the **LOTO Responsible Individual**, and the **LOTO Approver**. All craft workers are expected to be **LOTO Authorized Persons**. The individuals performing all the roles listed previously must be current with all required training to perform in these roles.

4.2 Facilities Management reserves the right to create individual based exceptions to the roles shown in ***The LOTO Roles and Responsibilities by Position and System***. Individual exceptions can take the form of reduced responsibility (e.g. in response to performance issues) or increased responsibility (e.g. individuals acting in a different role). Exceptions must be approved by Facilities Management and documented appropriately. Workers must be current with all required training associated with any given role they are performing.

4.3 Electrical Safety Officer: See PUB 3000, Chapter 8, [Work Process C](#), section 8 for all duties of the ESO. Additionally, the ESO will provide answers for questions regarding content in this procedure, specific LOTO procedures and assist in reviewing LOTO Permit applications.

5.0 REFERENCES (LINKED DOCUMENTS)

5.1 Linked Facilities Documents

5.1.1 COR0001, Work Instruction for Supervisor(s) Conducting Job Briefings

5.1.2 SOP-0012, Planned Utility Shutdown Coordination

5.1.3 SOP-0015, Customer Communications for Maintenance Work Orders

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5.2 Linked LBNL Document(s)

5.2.1 PUB-3000, Chapters 8 & 18

5.3 External Source Requirement Document(s)

5.3.1 NFPA 70E: Standard for Electrical Safety in the Workplace

6.0 PROCEDURE

6.1 Preventive Maintenance

6.1.1 Facilities Work Planning and Control (WPC) generates a preventive maintenance work order. WPC plans, schedules, and assigns the work to the appropriate craft lead per established work instructions.

6.1.2 The Lead Craft Worker reviews the work order.

6.1.2.1 If the equipment to be serviced is cord-and-plug, the requirements in PUB-3000, Chapter 18, [Work Process C](#) are followed.

6.1.2.2 If the equipment to be serviced meets the conditions listed in PUB-3000, Chapter 18, [Work Process D](#) section 2, then the simple LOTO steps described in PUB-3000, Chapter 18, [Work Process D](#) section 5 are followed.

6.1.2.3 If the equipment to be serviced requires a complex LOTO, the Lead must determine whether the work can be completed without the use of subcontractors, multiple shifts, group LOTO, temporary partial restoration, or tagout only.

- a) If the preventive maintenance work cannot be completed without the use of subcontractors, multiple shifts, group LOTO, temporary partial restoration, or tagout only, proceed to section 6.2.3.

6.1.3 If the Lead Craft Worker determines that the nature of the work falls outside the scope described in all subsections of 6.1.2, then an approved written LOTO procedure and a designated Person In Charge accountable for the safe execution of the LOTO is required.

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- 6.1.3.1** The Lead Craft Worker will check the database of equipment specific operating procedures located at G:\Operations_N_Maintenance\LOTO Procedures\Equipment specific LOTO procedures by building.
- a) If the equipment specific operating procedure is not in the library, then the Lead Craft Worker will develop a new equipment specific operating procedure for the equipment.
- 6.1.3.2** The Lead Craft Worker will review and edit the equipment specific operating procedure so that it only reflects the steps necessary to execute a successful LOTO on the equipment being serviced.
- 6.1.3.3** The Lead Craft Worker will initial or sign as the reviewer and forward the final LOTO procedure to an authorized LOTO Approver.
- 6.1.3.4** The LOTO Approver will review the written LOTO procedure for accuracy and completeness.
- a) If the LOTO procedure is inadequate, the LOTO Approver will return the procedure to the Lead Craft Worker for revision.
- b) If the LOTO procedure is adequate, the LOTO Approver will document approval by signing the written LOTO procedure. The LOTO Approver will then return the approved written LOTO procedure to the Lead Craft Worker.
- 6.1.3.5** The draft electronic copy of the now approved LOTO procedure should be “saved as” in the library of approved LOTO procedures located at G:\Operations_N_Maintenance\LOTO Procedures\Approved LOTO procedures.

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6.1.3.6 The Lead Craft Worker will assign a LOTO Qualified Person or Qualified Electrical Person to execute the work, as appropriate, and designate a Person In Charge for the safe execution of the lockout.

For preventive maintenance work, the Qualified Person or Qualified Electrical Person and the Person In Charge will typically be the same person. Hereafter, these roles will be referred to as the Assigned Craft Worker.

6.1.3.7 The Assigned Craft Worker will execute the LOTO and the work associated with the job.

a) If the LOTO procedure requires revision or is otherwise inadequate, **PAUSE WORK** and immediately contact the Lead Craft Worker.

6.1.3.8 The Assigned Craft Worker will provide the successful LOTO procedure to the Facilities Administration Group. The Administration Group will check to see if the LOTO procedure is in the Maximo database.

a) If the LOTO procedure does not match the LOTO procedure in the system (or if none exists), the Administrative personnel will enter the successful LOTO procedure into the Maximo database safety module.

b) If the LOTO procedure does match the LOTO procedure in the system, the Administrative personnel will make no changes to the information in Maximo.

c) The Administration Group will maintain a change log of the LOTO updates and reviews.

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6.2 Corrective Maintenance and Project Support

- 6.2.1** Corrective maintenance and project support can take many forms and is not as predictable as preventive maintenance work. Troubleshooting may be required, or the work may be planned in a similar fashion to preventive maintenance. Subcontractors, multiple shifts, temporary partial restoration, or the need for tagout only may be required depending on the scope of the work.
- 6.2.2** WPC, The Lead Craft Worker, and/or the Assigned Craft Worker will determine the need for LOTO based on the determined scope of work.
- 6.2.2.1** The individual(s) involved in scoping the work will follow the steps provided in sections 6.1.2.1 – 6.1.2.3.
- 6.2.3** If the work requires the use of subcontractors, multiple shifts, group LOTO, temporary partial restoration, or tagout only, an LOTO RI will be assigned by the MRO Supervisor. The LOTO RI is also the Person In Charge of the LOTO.
- 6.2.3.1** If the work requires Group LOTO, the LOTO RI will follow the requirements in PUB-3000, Chapter 18, [Work Process G](#).
- 6.2.3.2** If the work requires Tagout only, the LOTO RI will follow the requirements in PUB-3000, Chapter 18, [Work Process H](#).
- 6.2.3.3** If the work requires subcontractors in addition to in-house crafts, the LOTO RI will follow the requirements in PUB-3000, Chapter 18, [Work Process I](#).
- 6.2.3.4** If the work will be completed over multiple shifts, the LOTO RI will follow the requirements in PUB-3000, Chapter 18, [Work Process J](#).
- 6.2.3.5** If the work will be completed using temporary partial restoration, the LOTO RI will follow the requirements in PUB-3000, Chapter 18, [Work Process K](#).

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- 6.2.4 The LOTO RI will write the LOTO procedure needed to execute the work.
- 6.2.5 If subcontractors are involved in the work, the LOTO RI will apply for a LOTO permit in the EHS database at <https://lbnl.quickbase.com>. The written procedure developed in 6.2.4 is entered into the EHS database as part of the LOTO permitting process.
- 6.2.6 Following EHS review, the LOTO Approver will approve the permit in the EHS database.
- 6.2.7 The LOTO RI (and others, as applicable) will execute the LOTO and the work associated with the job.
 - 6.2.7.1 If the LOTO procedure requires revision or is otherwise inadequate, **PAUSE WORK** and immediately contact the Lead Craft Worker.

6.3 Facilities General LOTO Guidance

- 6.3.1 PUB-3000 contains the approved LBNL LOTO Program Policy information and procedures. Personnel authorized to carry out LOTO must be familiar with and act in accordance with PUB-3000. Individuals must be current with all applicable LOTO trainings to be authorized to participate in LOTO's.
- 6.3.2 All LOTO authorized employees participating in the LOTO must apply a red Lock and Tag.
- 6.3.3 Use LOTO prior to and during equipment servicing, maintenance or modification if unexpected release of energy could injure personnel.
- 6.3.4 Authorized personnel have the right to impose LOTO whenever they judge it necessary.
- 6.3.5 The Assigned Craft shall complete a graded, risk-based pre-LOTO assessment to determine if the LOTO creates any safety or negative operational impacts. Identified safety risk and operational impacts must be appropriately mitigated prior to implementation of the LOTO.

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- 6.3.6** The Assigned Craft, LOTO RI, Facilities WPC and/or Zone Management will notify stakeholders of any operational impact caused by the LOTO. This process is described in further detail in SOP-0015, *Customer Communications for Maintenance Work Orders*.
- 6.3.7** A LOTO shall remain in place until the work is complete and all hazards have been made safe.
- 6.3.8** Use only LBNL red approved locks with a single key in the lock user's possession. Red tape on a lock is no longer allowed.
- 6.3.9** Use only LBNL approved tags.
- 6.3.10** Locks and tags shall remain in place until the lock owner's work is safe and complete. If it is required for the worker to leave the work site, consult the LOTO RI to determine lock removal guidelines.
- 6.3.11** At least one approved LOTO shall remain in place until the work effort is complete and the system or equipment is safe with all covers, barriers, and shielding in place including all necessary parts, components and fasteners. Should all LOTO's be removed before all work is complete the verification step must be repeated.
- 6.3.12** The MRO or Engineering LOTO RI will determine if they will apply an administrative or LOTO lock prior to the subcontractor LOTO application.
- 6.3.13** LOTO RI for MRO managed work
1. LOTO RI will assist in gathering all information for the control of related applicable hazardous energy. This includes a risk-based pre-LOTO assessment of safety and negative operational impacts of the LOTO.
 2. Fully define the scope of the project and LOTO effort including all affected equipment in the work order. The work order shall contain Risk Assessment as defined in SOP-0012, *Planned Utility Shutdown Coordination*.
 3. MRO Qualified Persons or a Utility Coordinator should help assess and define on a risk-based, graded approach the safety and operational impacts of the LOTO.
 4. Request LOTO Permit as described in 6.2.5.

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5. Conduct all pre-job and LOTO briefs.
 - a. Explain identified hazardous energy control points and where those control points are located.
 - b. Each LOTO authorized worker must review and understand the LOTO effort and agree that it is safe and sufficient prior to implementation, and that all negative operational impacts that could result from the LOTO have been identified and mitigated as appropriate.
 - c. Answer questions and address any issues that the project has about the identified hazardous energy controls and the LBNL LOTO program.
6. Ensure compliant subcontractor Locks and Tags so that:
 - a. Each authorized worker may witness the absence of voltage.
 - b. All authorized workers shall be protected by a compliant lock and tag properly filled out.
 - c. All authorized workers shall be protected by LOTO 100% of the time.
 - d. The MRO First Lock and tag shall not be removed without LBNL RI approval.
 - i. Special Condition LOTO Lock Removal is defined in PUB-3000, Chapter 18 [Work Process O](#). Consult the ESO for the removal of administrative locks.
7. When the LOTO Safe Zone is modified or the job requires work to be performed near or around the hazard zone or any changes occur causing a modification to the Hazard Zone, all authorized persons shall be briefed before beginning or restart work.
8. Each authorized worker must remove his/her own lock and tag.
9. LOTO RI removes Locks and Tags after determination that it is safe to do so and the provisions of PUB 3000 and/or a LOTO permit are followed.
10. The LOTO RI is responsible for all post-LOTO testing and validation of completeness of work (leak detection, electrical voltage testing, phase rotation, water and/or gas flow, equipment start up etc.)

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7.0 ATTACHMENT(S)

7.1 LOTO Roles and Responsibilities by Position and System

LOTO Roles and Responsibilities by Position and System								
<p>1) The Facilities roles listed with an "QP" under a specific LOTO type are considered LOTO Qualified Persons.</p> <p>2) In the case of a complex LOTO, the Person in Charge is accountable for the safe execution of the lockout. The Facilities roles listed with a "PIC" under a specific LOTO type are authorized by Line Management to serve as the Person in Charge for that complex LOTO type.</p> <p>3) The Facilities roles listed with a "RI" under a specific LOTO type are authorized by Line Management to serve as the LOTO Responsible Individual.</p> <p>4) In the case of a complex LOTO, the LOTO Approver is designated by the division to approve LOTO procedures. The Facilities roles listed with a "LA" under a specific LOTO type are authorized by Line Management to serve as LOTO Approvers for that complex LOTO type. LOTO Approvers must also be authorized as Responsible Individuals.</p> <p><i>The individual performing as a Qualified Person, a Person in Charge, a LOTO Responsible Individual, or a LOTO Approver must be current with all required training requirements associated with the role they are performing.</i></p> <p><i>All crafts personnel are expected to be LOTO Authorized Persons. LOTO Authorized Persons must be current with the training required to be a LOTO Authorized Person.</i></p>								
	Electrical LOTO's			Other Required LOTO's				
	Utility Source Type: 50-300 VAC, 50-60 Hz power, provided there is no arc flash hazard (QEW 1 Level work)	Utility Source Type: 50-750 VAC, 50-60 Hz power, with or without arc flash hazard (QEW 2 Level work)	Utility Source Type: > 750 VAC Utility 60 Hz (QEW 3 Level work)	Energy Form: Thermal, Hot Utility Source Type: Liquids or gases ≥ 125F or Surfaces ≥ 140F or Equivalent Pipe Diameter > 6	Energy Form: Thermal, Cold Utility Source Type: Liquids or gases ≤ 27F	Energy Form: Mechanical Motion, Rotational Utility Source Type: Fan diameter > 24 inches	Energy Form: Hydraulic Pressure Utility Source Type: Water System Pressure ≥ 200 psig or > 6 inches pipe diameter	Energy Form: Pneumatic Pressure Utility Source Type: Compressed Air Pressure > 30 psig or Natural Gas: All pressure
Laborer								
Lead Laborer								
Rigger								
Lead Rigger								
Carpenter								
Carpenter/Roofer								
Lead Carpenter								
Plant Maintenance Tech				QP, PIC	QP, PIC	QP, PIC	QP, PIC	QP, PIC
Lead Plant Maintenance Tech				QP, PIC, RI	QP, PIC, RI	QP, PIC, RI	QP, PIC, RI	QP, PIC, RI
Electrician	QP, PIC, RI	QP, PIC						
Lead Electrician	QP, PIC, RI	QP, PIC, RI						
Electrician - Fire Alarm	QP, PIC, RI							
Lead Electrician - Fire Alarm	QP, PIC, RI							
Electrician - High Voltage	QP, PIC, RI	QP, PIC	QP, PIC, RI					
Lead Electrician - High Voltage	QP, PIC, RI	QP, PIC, RI	QP, PIC, RI					
Plumber/Pipefitter				QP, PIC	QP, PIC	QP, PIC	QP, PIC	QP, PIC
Lead Plumber/Pipefitter				QP, PIC, RI	QP, PIC, RI	QP, PIC, RI	QP, PIC, RI	QP, PIC, RI
HVAC Mech	QP, PIC, RI	QP, PIC		QP, PIC, RI	QP, PIC, RI	QP, PIC, RI	QP, PIC, RI	QP, PIC, RI
Lead HVAC Mech	QP, PIC, RI	QP, PIC, RI		QP, PIC, RI	QP, PIC, RI	QP, PIC, RI	QP, PIC, RI	QP, PIC, RI
Painter								
Lead Painter								
Lighting Technician	QP, PIC, RI	QP, PIC						
Lead Lighting Technician	QP, PIC, RI	QP, PIC, RI						
Electrical Engineer	QP, PIC, RI, LA	QP, PIC, RI, LA						
Electrical Engineer - High Voltage	QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA					
Mechanical Engineer				QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA
Civil/Structural Engineer								
Controls Engineer	QP, PIC, RI			QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA
Utility Coordinator				QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA
MRO Supervisor Mechanical				QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA
MRO Supervisor QEW 2	QP, PIC, RI, LA	QP, PIC, RI, LA						
MRO Supervisor QEW 3	QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA					
Electrical Safety Officer	QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA	QP, PIC, RI, LA

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7.2 Checklist for LOTO Briefings

SUMMARY

A formal LOTO briefing is the process of verbally communicating the detailed specifics of the LOTO to all LOTO participants. This includes the Qualified Persons supporting the LOTO (as applicable) and the LOTO Authorized Persons who will be adding their personal LOTO locks once the LOTO is established.

The LOTO briefing is a critical part of the LOTO process. All LOTO Authorized Persons must obtain a LOTO briefing from the Responsible Individual prior to applying personal LOTO locks.

The LOTO briefing is performed before and after any change/modification to the LOTO including temporary partial restoration.

Task Description	Completed By (Initials)	Date Completed
Describe the complete scope of the LOTO effort		
Detailed description of the scope of work Hazardous Energies Mitigations		
Detailed description of the LOTO Safe Zone LOTO boundaries LOTO Hardware		
Overview of expected conditions		
Permits LOTO Requirements Other Requirements		
Required or suggested work practices		
Special tools and/or PPE		
Manpower requirements		
Area and work effort hazards		
Coordination with other crafts		
Notification of key effected individuals		
“Hold or pause points”		
“Stop Work” issues		
Contact phone numbers (if needed)		

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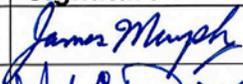
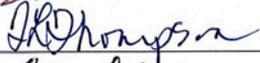
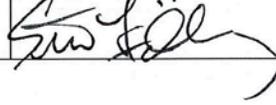
Document History

Rev	Effective Date	Procedure Owner or Contact Name	Summary of Changes
03	Current	Mike Dong	Addition of sections 6.1, 6.2, and 7.1. Updates of sections 3, 4, 5, and 6.3.

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Approvals

The signatures below document the approval of the Standard Operating Procedure for Lock-out/Tag-out (LOTO) Operating Procedure effective 10/01/15.

Reviewer/Approver/Author	Title	Name	Signature	Date
Author	Electrical Safety Officer	Jim Murphy		9/29/15
Reviewer	Chief Plant Engineer	Mike Dong		9/30/2015
Reviewer	Electrical Superintendent	Bill Mattson		9/30/15
Reviewer	Maximo System Administrator	Tammy Thompson		9/30/15
Approver	Facilities Operations Department Head	Steve Lindberg		9/30/15