Lawrence Berkeley National Laboratory
Multi Division LOTO Program
Self-Assessment Report

Accelerator Technology and Applied Physics
Nuclear Sciences
Computing Sciences Area
Information Technology
Advanced Light Source/ALS-U Physics
Environment, Health and Safety

September 2023

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I. EXECUTIVE SUMMARY

Multiple divisions participated in a division self-assessment of LOTO practices within each of the divisions. The assessment focused on implementation and management of complex LOTO procedures including WPC activities, employee training and applicable division-specific processes. LOTO needs vary by division, and each participating division has organized their operations to ensure proper LOTO implementation. There were no findings identified with this self-assessment. Division specific results are provided in the appendices. While some divisions are not currently performing complex LOTOs, most have done so in the past or anticipate this type of work in the future. Each division has WPC activities authorizing LOTO work and LOTO-trained staff. Most divisions have QEW-trained staff or staff training to become QEWs, and multiple divisions rely on Engineering and/or Facilities QEWs to perform or assist with LOTO.

Several divisions identified opportunities for improvement through this assessment and identified improvements or corrective actions they will take moving forward. These are found in the appendices. Observations and potential improvements applicable to the institution as a whole were also identified and provided in the Results section below.

II. INTRODUCTION

This division self-assessment was performed to understand how well divisions are implementing lockout tagout requirements as defined in ES&H Manual, Chapter 18, Lockout Tagout.

The following definitions apply to this report:

- (F) Finding - A term that is interchangeable with “Issue”. A term that refers to a programmatic or performance deficiency and/or a regulatory, policy or procedural noncompliance generally identified in a formal assessment or audit.
- (O) Observation - An ineffective practice or condition that is compliant with a regulation or requirement, but, if left unaddressed, could lead to a noncompliance.
- (R) Recommendation - These are inputs from the assessment team for improvements that can be gained in process, performance, or efficiency for meeting a requirement or improving performance. These may also be known as opportunities for improvement, or OFIs.

- (NP) Noteworthy Practice - Practices or conditions that are recognized for their excellence and should be considered for lab-wide application.

III. CRITERIA

The assessment compared performance against requirements in ES&H Manual, Chapter 18, LOTO and any division specific procedures.

IV. ASSESSMENT SCOPE

The scope of this assessment included 1) preparation and planning for work that requires lockout/tagout (LOTO) to control hazardous energy, 2) development, documentation, approval and management of LOTO procedures, 3) the implementation or execution of the LOTO procedure, and 4) annual inspection of LOTO procedures.

V. ASSESSMENT METHODOLOGY

The assessment included interviews with staff involved in the LOTO process, such as LOTO Authorized Persons, Qualified Electrical Workers, LOTO Responsible Individuals, LOTO Persons-In-Charge, LOTO Approvers, and LOTO Evaluators.

The assessment included observations of LOTO work including pre-job briefings and work practices where it was possible given work performed during the course of the assessment. Finally, the assessment included a review of applicable programmatic documents, recent LOTO records, field inspection checklists and results, LOTO procedures and procedure inspection records.

VI. ASSESSMENT RESULTS

There were no findings during this assessment. There were observations and recommendations for improvement. Division-specific observations, recommendations and corrective actions are listed in the appendices. Observations applicable to the institution as a whole and potential improvements along with general observations and recommendations for potential actions applicable to divisions are listed here.

General Division-Specific Observations/Recommendations:

- Develop division-specific LOTO programs/processes if not already developed.
- Consolidate LOTO procedures within Quickbase for each division that decides to use Quickbase for this purpose.
- Consider the use of a tracking system (Smartsheet, Google Sheet, Olog, etc.) to track LOTO implementation and procedure inspections if Quickbase is not serving this purpose.

- Complex LOTO procedures may be performed infrequently. It is recommended that these procedures become inactive when not in use and therefore are subject to a more formal review and approval before they are used again.
- Ensure Job Safety Plans are completed as part of a complex LOTO procedure involving electrical hazards.

Institutionally-Focused Observations/Recommendations:

- Consider enhancing the LOTO procedure form by adding a section for emergency response.
- LOTO procedures are stored in a variety of locations. Encourage consolidation within Quickbase and create a tracking system to document where divisions not using Quickbase are storing their LOTO procedures.
- Quickbase is used by most divisions to document LOTO procedures, but this database has some performance issues. For example, some LOTO procedures are stored in certain Quickbase applications that do not sync with the Complex LOTO Procedure application, and the functionality for documenting LOTO procedure inspections can be confusing. Organize a focus group to review Quickbase and provide recommendations for improved management of LOTO procedures and the LOTO procedure inspections.
- Job Safety Plans (JSPs) are not consistently completed as required, and use of the online JSP form is not consistent. Continue to promote the need for and expectations for JSPs. Consider metrics that monitor the use of JSPs.
- Oversight and QEW support for vendor work varies by division. Review the SJHA process when electrical and LOTO work is involved. Consider enhancements to ensure vendors are working to LBNL standards and adequate vendor oversight and QEW support is available.
- Develop online resources that demonstrate quality pre-job briefings.
- The lack of preventative maintenance on facility infrastructure (Breaker Panels) by the Lab has led to an increased reliance on administrative controls and PPE to protect workers. The Lab should prioritize preventative maintenance on the building breaker panels to eliminate or reduce the level of hazard.

VII. CONCLUSION

These collective division self-assessments confirmed that LOTO is being implemented in each division, with some opportunities for improvement. Overall, feedback from interviewees indicates that the LOTO and electrical safety programs have improved over the last few years and are considered solid programs. Staff have appropriate training and work is authorized through WPC activities. LOTO procedures are developed, implemented and managed by each division. Institutional QEW support is available given the current workload at LBNL. LBNL's safety culture has also continued

to mature and contributes to the success of these programs. Through this assessment, most divisions identified ways to improve their division-level LOTO programs, and there continue to be opportunities to improve the LOTO program at the institutional level.

APPENDIX A1—ATAP Results

<u>ATAP's Assessment</u>

ATAP's assessment focused on Complex LOTO Procedures. The assessment had three parts (1) interviews with people who participate in the ATAP LOTO program, (2) an assessment of ATAP's Complex LOTO Procedures, and (3) ATAP's responses to the assessment's Lines of Inquiry. This report reflects the status of our LOTO Program in August 2023.

1. <u>Interviews</u>

ATAP conducted 10 interviews during May-June 2023 with people who participate in the ATAP LOTO Program. Interviewees were selected based on their completion of training courses EHS0370 LOTO for Authorized Persons, EHS0372 LOTO Awareness for Line Managers, or QEW/QEW-R certification. Some people have multiple roles. There were 6 LOTO Line Managers, 5 LOTO Authorized Persons, and 3 QEW/QEW-Rs. The ATAP and Physics Division Safety Coordinators conducted most of the interviews together. Interview Forms appropriate to each role were used to guide the conversations. Following is a summary of what we learned from the interviews. The recommendations from interviewees were particularly valuable – everyone contributed good ideas.

How ATAP Prepares for and Performs Complex LOTOs

People are aware of LOTO requirements through WPC Activities, the Electrical Safety Manual, talking to safety people, and training.

Hazards are assessed when writing the WPC Activity and LOTO procedures. The researchers consult with the Division Safety Coordinator, the EHS Subject Matter Experts, and Engineering Division staff as needed. Procedures are reviewed and approved before initial use and when changes occur.

Most people do not need to perform LOTO very often. Some procedures are only used when equipment requires repairs.

Most ATAP people who perform LOTO work in small groups. They are in close communication and talk daily about changes to the experiment and the procedures they will be using. Most often, there is one person who performs the LOTO. If there is more than one person involved, they get together and go through the procedures. Briefings are usually in the form of discussions within the work group. They review the

associated WPC and procedure and talk about what they plan to do. They talk about what they plan to achieve during the day, who they need to notify, and how to end the LOTO. Some groups are not using a formal briefing sign-in sheet. Signing in and out is a challenge when they need to perform the same procedure several times in a day.

One group (BELLA) is starting to write Job Safety Plans. Other groups have heard of JSPs in their training but they need additional coaching to feel comfortable writing them and to form the habit of developing JSPs every time they do electrical work.

LOTO Line Managers ensure that people's training is up-to-date. If the training expires, they are not allowed to perform LOTO. They ensure the staff understands the hazards and the approach and are comfortable with performing the work.

What is Working Well

The overall EHS electrical safety program, QEW education, annual renewals, and general improvements in following the rules are reflected in the improved accident record. There have been huge improvements to safety culture (especially in Facilities). People will ask questions now. They have moved from resistance to awareness. We are expecting increased focus and scrutiny on electrical safety and LOTO in response to the SLAC incident.

Interviewees recognize the value of the LOTO program because of the resulting low rate of incidents and injuries.

Having written procedures facilitates communication and prevents distractions.

Interviewees gave favorable comments about the LOTO training courses: The refresher training is good and is needed. LOTO Line Managers found the LOTO classes were useful in helping them communicate with the people working on electronics.It makes people think about safety. People can apply what they learned in the courses to safety outside the Lab also, like controlling electrical plugs and identifying multiple power sources.

Challenges and Recommendations for Improvement Identified from Interviews

Getting access to the training has been challenging. The class registration information isn't always up to date.

The refresher training could be made more relevant and interesting by including Lessons Learned from recent incidents and personal testimonials.

QEW training was initially geared toward Facilities work. It should be adjusted to emphasize R&D work and focus on the types of equipment used in research.

There were some significant rule changes that were not obvious that people found out about during their LOTO procedure reviews. It would be better to be notified when there are rule changes.

QEWs and QEW-Rs need additional coaching to feel competent in writing Job Safety Plans and develop the habit of writing them.

EHS is moving toward doing QEW recertifications every 3 years. We need to do more field evaluations in the off-years. Division ESOs are working with EHS to train evaluators and develop checklists to have consistent evaluations.

LBNL needs more electrical technicians and at least one more electrical supervisor. Research groups are continuing to grow and need more support. Use guidelines from EHS in hiring. There is a greater variety of work here than most places, so candidates need diverse experiences. A person who has related hobbies is a good sign of interest in the work.

Electrical equipment inspection: LBNL will need 8-10 people trained to be able to inspect equipment during periods of peak demand.

Contractor/vendor oversight: This is a top priority, to make sure the rules are followed. The SJHA could trigger a QEW support request when electrical work or the need for LOTO is identified.

Sometimes people get confused about when to use administrative locks and when to use LOTO locks, and what the different locks mean.The LOTO Line Managers need to discuss with their people and ensure they know what to do.

The basic electrical safety course is important to everyone. Everyone should know what LOTO is and when it applies, and be able to make corrections if it is not being done correctly.

It is challenging to log on and off a procedure each time you do LOTO, when you are doing the same procedure multiple times in a day. They would prefer on-line records to paper.

It would be good if there was a way to track execution of the steps of the procedure on-line through the database. It would be nice to merge the LOTO and WPC databases.

There are too many LOTO procedures that are nearly identical. The most challenging part is identifying the right WPC Activity and LOTO procedure. Consolidate WPC Activities and LOTO procedures to the extent allowed. People should be able to find the right WPC/LOTO within 3 clicks. We don't want people to not follow the procedures because they are too hard to find. The BELLA Center has created a Smartsheet to make it easier.

Administration is the most challenging part - getting the procedures done with limited support staff. There is concern about the difficulty of getting renewals done. Researchers would like EHS to take an active role in the process.

Look for ways to modify equipment so that LOTO is not needed.

Recommended: checklists, pocket guides, badge clip-on cards, phone alarm reminders to remove your lock at the end of the day.

It would be nice to be able to add video clips to the procedures to demonstrate how to implement them. Technical proficiency is important and they have had some personnel turnover.

The LOTO procedure alone does not capture all the risks. People need to be aware of all the hazards described in the WPC Activity. Training and OJT are also important.

Evaluate and identify a new LOTO Subject Matter Expert in EHS, to replace the person who has moved to a new position.

1. Assessment of ATAP's Complex LOTO Procedures

ATAP reviewed the status of **81** Complex LOTO Procedures:

33 procedures are **Active** and have been reviewed and approved within the last year.

24 procedures are **Inactive** and are not anticipated to be used in FY23. The corresponding WPC Activities are being revised as needed to indicate that LOTO is not authorized unless the procedures are reviewed and inspected/approved prior to use.

22 procedures are **in the process of being reviewed/inspected/approved** and may be approved before the end of FY23. If the review and inspection/approval is not completed on schedule, the procedures will be made Inactive and the corresponding WPC Activities will be revised as needed to indicate that LOTO is not authorized unless the procedures are reviewed and approved prior to use.

2 procedures are **new**, are in the process of being written, and have not yet been reviewed, inspected, approved, or used.

Status of ATAP Complex LOTO Procedures (August 2023)

CLP#	WPC#	Description	Status	Action
CLP-28	N/A	HV-cage in bldg 88 room 71	Inactive	
CLP-62	AA-0029	60 Strand Cabling Machine in Bldg. 77A Rm. 103	Approved 2/17/23	**Update QuickBase**
CLP-64	N/A	NDCX-II Compression Pulser #4 Tank Access	Inactive	
CLP-81	AA-0021	Superconductin g Magnet	on hold pending equipt modification	**Update procedure, review/inspect**
CLP-87	N/A	Spectra Physics GCR Laser System	Inactive	**Update QuickBase**
CLP-88	N/A	High Voltage Capillary	Inactive	**Update QuickBase**

		Discharge Pulser System		
CLP-89	N/A	BELLA Center Ekspla Power Supply PS5054 Type 3&5	Expired	**Write WPC, Update procedure, review/inspect**
CLP-94	AA-0016	NDCX-II Injector	Approved 3/7/23	**Update QuickBase**
CLP-96	AA-0021	Magnet Test Facility	on hold pending equipt modification	**Update procedure, review/inspect**
CLP-101	N/A	NDCX-II Kaeser Air System	Inactive	
CLP-113	AA-0113	BELLA Center GAIA #12 Laser Head	**Expired**	**Review/inspect**
CLP-121	AA-0051	STS-50 Source, Floating rack, and Vacuum chamber	**Approved 4/18/23**	**Update QuickBase**
CLP-122	AA-0051	STS-50 Vacuum chamber	**Approved 4/18/23**	**Update QuickBase**
CLP-124	N/A	Chamber 2 system	**Inactive**	**write new procedure after installation in 58A**
CLP-125	AA-0099	Chamber 1 system	**Inactive**	**write new procedure after installation in 58A**
CLP-126	AA-0100	BELLA Center SAGA #1 Laser	**Reviewed/ Inspected**	**Complete review /**

		Head	**3/8/23**	**inspection & approval**
CLP-128	N/A	VHF-Gun RF Amplifier	**Inactive**	**Update QuickBase**
CLP-130	N/A	250V 200A DC Power Supply Work	**Inactive**	
CLP-133	Not referenced	NDCX-II FEPS/Final Focus	**Approved 3/7/23**	**Update QuickBase**
CLP-134	AA-0099	Chamber 4 system	**Inactive**	**write new procedure after installation in 58A**
CLP-137	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-138	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-139	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-140	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-141	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-142	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-143	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-144	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-145	AA-0016	NDCX-II	**Approved**	**Update**

		Solenoid Pulser	**3/7/23**	**QuickBase**
CLP-146	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-147	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-148	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-149	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-150	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-151	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-152	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-153	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-154	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-155	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-156	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-157	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-158	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-159	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**

CLP-160	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-161	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-162	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-163	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-164	AA-0016	NDCX-II Solenoid Pulser	**Approved 3/7/23**	**Update QuickBase**
CLP-222	**N/A**	High Voltage Capillary Discharge Solid State Pulser System	**Inactive**	**Update QuickBase**
CLP-223	**N/A**	High Voltage Magnet Switchyard	**Inactive**	**Update Quickbase**
CLP-224	**N/A**	High Voltage Magnet Power Supply	**Inactive**	
CLP-225	**N/A**	EMPH Power Supply	**Inactive**	**Update Quickbase**
CLP-226	**N/A**	**Chamber 3 system LOTO - Pulsed Arc Configuration Maintenance**	**Inactive**	**write new procedure after installation in 58A**
CLP-237	**N/A**	**BELLA - High-Current Gas Jet Valve Chamber**	**Inactive**	**Update Quickbase**

CLP-239	**AA-0006**	Low Energy DD Neutron Generator	**Inactive, WPC has been updated**	
CLP-242	**N/A**	Pelletron Tank Maintenance and Servicing	**Inactive**	
CLP-244	**N/A**	Pelletron Ion Source and Process Gas Maintenance and Servicing	**Inactive**	
CLP-253	**N/A**	Chamber 3 system LOTO - Magnetron Sputtering Configuration Maintenance	**Inactive**	**write new procedure after installation in 58A**
CLP-254	AA-0134	BELLA Center GAIA #1 Laser Head		**Complete the review/ inspection / approval**
CLP-255	AA-0134	BELLA Center GAIA #2 Laser Head	**Approved 2/2/23**	
CLP-256	AA-0134	BELLA Center GAIA #3 Laser Head		**Complete the review/ inspection / approval**
CLP-257	AA-0134	BELLA Center GAIA #4 Laser Head		**Complete the review/ inspection / approval**
CLP-258	AA-0134	BELLA Center		**Complete the**

		GAIA #5 Laser Head		**review/ inspection / approval**
CLP-259	AA-0134	BELLA Center GAIA #6 Laser Head		**Complete the review/ inspection / approval**
CLP-260	AA-0134	BELLA Center GAIA #7 Laser Head		**Complete the review/ inspection / approval**
CLP-261	AA-0134	BELLA Center GAIA #8 Laser Head		**Complete the review/ inspection / approval**
CLP-262	AA-0134	BELLA Center GAIA #9 Laser Head		**Complete the review/ inspection / approval**
CLP-263	AA-0134	BELLA Center GAIA #10 Laser Head		**Complete the review/ inspection / approval**
CLP-264	AA-0134	BELLA Center GAIA #11 Laser Head		**Complete the review/ inspection / approval**
CLP-265	AA-0134	5Hz GAIA #2 Laser Head (L-cave 146L)		**Complete the review/ inspection / approval**
CLP-266	AA-0134	5Hz GAIA #1 Laser Head (71-148)		**Complete the review/ inspection /**

				approval
CLP-267	**AA-0100**	BELLA Center SAGA #2 Laser Head	**Reviewed 3/8/23**	**Complete the review/ inspection / approval**
CLP-268	**AA-0100**	BELLA Center SAGA #3 Laser Head	**Reviewed 3/8/23**	**Complete the review/ inspection / approval**
CLP-269	**AA-0136**	**71-253C Spectra Physics GCR 150 Laser System**	**Inactive**	**Close WPC, Update QuickBase**
CLP-275	**N/A**	Chamber 1 system LOTO	**Inactive**	**write new procedure after installation in 58A**
CLP-279	**AA-0029**	60 Strand Cabling Machine in Bldg. 77A Rm. 103	**Approved 2/17/23**	**Update QuickBase**
CLP-282	**N/A**	NDCX-II Lockout L3 and downstairs charging supplies for Blumlein 1	**Inactive**	
CLP-289	**N/A**	Chamber 2 system (no bias) LOTO	**Inactive**	**write new procedure after installation in 58A**
CLP-290	**N/A**	CLIQ maintenance	**Inactive**	**Update QuickBase**

CLP-386		BELLA Center EKSPLA Power Supply PS5054 Type 5-62428222AA LOTO Procedure	**On hold (new)**	**finish writing procedure & WPC**
CLP-387		BELLA Center EKSPLA Power Supply PS5054 Type 5-62536526AA LOTO Procedure	**On hold (new)**	**finish writing procedure & WPC**

Challenges and Recommendations from the Assessment of ATAP's LOTO Procedures

Many ATAP Complex LOTO Procedures are used infrequently. It may be better to keep them in Inactive status, to be reviewed and approved before use, to ensure that the procedures are updated to reflect current conditions before use.

The QuickBase database serves as an important tool for developing and storing ATAP's Complex LOTO procedures; however, we found several issues that limit its effectiveness for tracking review and approval status. The database was developed prior to current requirements and is not meeting our needs for communicating the current status of LOTO Procedures. The QuickBase and Work Planning and Control Activity Manager databases are not directly linked and do not share information. The roles described in the database do not match the roles defined in EHS Manual Chapter 18. QuickBase editing is limited by role, so that the Division Safety Coordinator cannot directly update the status of procedures. The recordkeeping system for procedure review comments and corrective actions is confusing as there are several places where they might be found, and a new system is still in the process of being developed.

The Complex LOTO Procedure template in QuickBase does not contain a section for emergency response planning. It is recommended that the template be enhanced by including this section.

At this time, it is recommended that ATAP:
– Continue to use QuickBase to develop and store LOTO procedures;
– Use separate documents, shared with our LOTO Inspector/Approver(s), to track the status of procedures and pending corrective actions.

ATAP should continue to monitor and evaluate the adequacy of staffing to implement our LOTO program as changes occur. Currently, the LBNL Deputy Electrical Safety Officer position is open. When filled, this person may act as a back-up LOTO Inspector / Approver for ATAP. The EHS Division needs a full-time LOTO Subject Matter Expert.

1. Summary : ATAP's Responses to Lines of Inquiry

1. Is ATAP's LOTO Procedure Program up-to-date, documented, and approved by Division management? ATAP's LOTO Procedure Program has been updated and documented in Section 2.13 of the FY23 ATAP Integrated Safety Management Plan. Division management review and approval is anticipated before the end of FY23..

2. Have each of ATAP's WPC Activities requiring LOTO been reviewed and updated as needed to reflect changes in Chapter 18?

- **Does the Division have a process to document OJT in WPC Activities?**

WPC Activity reviews and updates are an ongoing process as research processes and personnel roles and responsibilities change. ATAP encourages Activity Leads to use the OJT recordkeeping feature in Activity Manager, but we also allow the flexibility of keeping the records in other ways, such as research notebooks or the BELLA training spreadsheet.

3. For ATAP, have roles and responsibilities for the LOTO process been assigned to appropriate personnel, and have personnel been trained in their roles and responsibilities?

- **Is OJT documented for everyone serving as a LOTO Person in Charge?** There is no definition of LOTO Person in Charge in EHS Manual Chapter 18 (although it is described in Roles and Responsibilities) and there is no separate WPC Hazard or training course for this role, so it is difficult to track. Where the person who establishes the LOTO is the Activity Lead, they receive OJT from the LOTO procedure reviewer/approver during the review process. An electrical work field observation program is just starting and has not been implemented in ATAP yet.
- **Do LOTO participants understand how to access the LOTO procedures and are they aware of the process to follow when 1) procedures need to be edited and 2) new procedures need to be created?** Everyone we interviewed knew how to access their procedures, and how to obtain assistance in writing and editing procedures.
- **Are staff who are only performing limited LOTO authorized and trained to perform the work?** No one is allowed to perform LOTO without current training. It is more common that people take for more training than is required by their role.

4. Have each of ATAP's LOTO Procedures that will be used during FY23 been inspected and approved within 1 year? 33 procedures are **Active** and have been reviewed, inspected and approved within the last year. If other procedures are found to be needed, LOTO will not be authorized until the procedures are reviewed, inspected and approved.

Have the inspections and approvals been properly documented? The QuickBase database has not been an effective tool for accurately documenting review, inspection, and approval status. The ATAP Division Safety Coordinator and our LOTO Inspector/Approver are working with the LOTO Subject Matter Expert to try to update the status information in QuickBase. Meanwhile, ATAP has created a spreadsheet to track status.

- **What is the typical process to review a LOTO procedure for accuracy?** There is a collaborative process between the members of the research team (including matrixed Engineering support) and the Inspector/Approver.. Procedure reviews typically begin with the person(s) most knowledgeable of the equipment and processes looking at the written procedures. The inspection includes a review of the accuracy and adequacy of the procedure by an Electrical Safety Officer, as well as a demonstration by a person qualified and authorized to perform the procedure to show that the procedure is understood and is being performed properly.
- **Who performs these reviews?** The Engineering Division Electrical Safety Officer has been performing the inspections for ATAP.
- **How often are discrepancies found between the steps in the documented LOTO procedure and the steps required to actually perform the work?** In most cases the steps are correct, but there are often suggestions for clarification of wording or labels, or additional photos to ensure that anyone who might need to use the procedure in the future would understand it.
- **What is the process when discrepancies are noticed in a LOTO procedure?** There are ongoing discussions between the procedure developer and the reviewer and inspector/approver. The inspector/approver does not approve the procedure until it is revised to their satisfaction. A consistent process for implementing written documentation of LOTO review/inspection findings and recommendations is still under development.

5. What is the process for preparing to execute a LOTO?

- **Are pre-job briefs provided? What is included in the pre-job briefing?** Yes, when more than one person is performing or affected by a LOTO, there is usually a group discussion of the procedure, hazards, controls, and impacts.
- **How are Job Safety Plans including shock and arc flash risk assessment and review of emergency response plans performed before a LOTO?** While Job Safety Plans(JSPs) are now being mentioned in the LOTO training, the practice has not been fully implemented in research divisions. Electrical workers need more on-the-job

coaching and mentoring on how and when to write JSPs. **Do the LOTO procedures contain this information?** ATAP uses the LOTO procedure template in QuickBase. It does contain shock and arc flash risk information. It does not contain emergency response plans and procedures. The WPC Activities contain some emergency response information, but the quality varies. It is recommended that an emergency response section be added to the Complex LOTO Procedure template to ensure that information specific to the hazards controlled by the LOTO are included.

- **How are controls identified and communicated in the work control documents?** The need to perform LOTO and the training requirements are communicated through the WPC Activities. The controls specific to each LOTO are described in the Complex LOTO Procedures.

APPENDIX A2—NSD Results

<u>NSD's Assessment</u>

NSD's assessment focused on Complex LOTO Procedures that are performed at Building 088 (B088). The division has only one Complex LOTO that is authorized outside of B088 and there is just one person authorized to perform that LOTO procedure.

B088 NSD relies mainly on matrixed staff from the Engineering Division and Facilities Division to perform LOTOs at B088. B088 has numerous complex LOTO procedures for accelerator systems, power supplies, and utilities. Currently most electrical and mechanical LOTOs at B088 are controlled through the B088 EM Shop.

The assessment had three parts (1) interviews with people who participate in the B088 NSD LOTO program, (2) an assessment of B088 NSD's Complex LOTO Procedures, and (3) B088 NSD's responses to the assessment's Lines of Inquiry. This report reflects the status of the B088 LOTO Program in August 2023.

<u>Interviews</u>

7 interviews were conducted during the review with personnel who participate in the B088 NSD LOTO Program. Interviewees were selected based on their role (RI, Line Manager, Program Owner, Approver, QEW, etc.) in the program. Most personnel have multiple roles. Following is a summary of what was learned from the interviews.

How B088 NSD Prepares for and Performs Complex LOTOs

People are aware of LOTO requirements through WPC Activities, the Electrical Safety Manual, Pub 3000 Ch. 18, talking to safety people, and training.

Hazards are assessed and the Job Safety Plan (JSP) is completed, by a QEW, when writing the LOTO procedures. Completed JSPs are kept with the LOTO procedure. Procedures are reviewed and approved before initial use and when changes occur.

Equipment is walked down and drawings are reviewed during the development of a LOTO procedure.

Rather than having equipment owners or various personnel write LOTO procedures, B088 has an assigned QEW LOTO procedure preparer identified that writes or updates all of the B088 LOTO procedures.

Most procedures are used infrequently, usually only when equipment requires repair or inspection.

With input from the LBNL Electrical Safety Officer, B088 NSD updated their LOTO procedure template during FY23 and as procedures come due all are being converted to the new template.

Procedures are signed by 2 reviewers (EM Coordinator, Electrical Engineer), the equipment owner (if applicable), and the B088 Facility Director.

Most B088 NSD people who perform LOTO work in a small group. This group along with the rest of the B088 Operations team meet daily for a morning briefing and during the meeting they discuss what LOTOs need to be performed and who will be the Responsible Individual (RI). Reminders are given about pre-job briefings, signing in / out, and removal of locks.

LOTO documentation is scanned, uploaded, and saved into the B088 google drive. Hard copy is kept in the B088 EM shop until archived by the EM Coordinator.

Pre-Job briefings are given by the RI and cover scope of work, energy sources, what ZVVs have been done, any work restrictions, or specific equipment conditions or boundaries. Answer any questions.

What is Working Well

The overall electrical safety at LBNL and the LOTO program were mentioned by the majority of interviewees. General improvements to the LOTO documentation over the last year were also mentioned.

Need to trust the process

Implementation of LOTOs is working well. Procedures can be updated and approved in 1 to 2 days on average.

QEW training as part of the overall process.

EHS field assessments.

Interviewees recognize the value of the LOTO program by keeping them safe.

The lab's current commitment to providing resources and continuing to update the program.

Challenges and Recommendations for Improvement Identified from Interviews

Getting access to the training has been challenging.

Some interviewees are worried that with the low accident/injury numbers the lab will start pulling resources away from the program.

There were some significant changes made to Pub 3000 Ch. 18 that some personnel did not know about and could not recall receiving notification of the changes. Communications from EHS should be improved.

Would like to see on the LOTO procedures a more detailed explanation on how the LOTO makes you safe.

Pre-Job briefings could be improved, they vary by the person giving them.

LOTO procedure complexity should match the work complexity – Graded approach

There should be more or better OJT on equipment before someone is authorized to perform the LOTO.

The proficiency of each worker is a challenge. Better OJT on a system level would help.

It is challenging to remember to sign out.

It is a challenge to apply the process to very old or custom equipment where there are no drawings.

Quantity of annual reviews required for a facility with limited personnel.

It was noted that this process has become much more involved when dealing with facility equipment (Breaker Panels) that have not been maintained. This drives the use of admin and PPE controls rather than eliminating or reducing the potential hazard by maintaining the equipment.

<u>Assessment of B088 NSD's Complex LOTO Procedures</u>

The status of **86** B088 NSD Complex LOTO Procedures were reviewed:

29 procedures are **Active** and have been reviewed and approved within the last year.

The remaining procedures are listed as **Expired**, **Draft, or In Review** and most are not anticipated to be used in FY23.

Challenges and Recommendations from the Assessment of NSD's LOTO Procedures

Many NSD Complex LOTO Procedures are used infrequently and therefore require a complete review (hazard analysis, JSP, walk down) every time they are needed.

B088 NSD uses a QuickBase platform for writing the LOTO procedures and their status is tracked on a Smartsheet that can be viewed on the B088 Cyclotron website. Hazard analysis and the signed LOTO procedures are linked on the Smartsheet. This makes it quick and easy to find the status and print a copy of a LOTO procedure, but it also requires someone to maintain and update the sheet.

B088 NSD is looking to hire an Electrical Safety Officer. Currently, the LBNL Deputy Electrical Safety Officer position is open and the EHS Division needs a full-time LOTO Subject Matter Expert.

Responses to Lines of Inquiry

1. Is B088 NSD's LOTO Procedure Program up-to-date, documented, and approved by Division management?

Procedure 88-OPS-PRO-017, along with its attachments, is the B088 NSD LOTO Program Procedure. It was last reviewed and approved on March 23, 2020. It is on a 3 year cycle so it was due to be reviewed again in March, 2023. The procedure does not reflect the current information in Pub 3000 Ch. 18 or Rev2 of the LBNL Electrical Safety Manual. This is identified as a corrective action.

2. Have each of B088 NSD's WPC Activities requiring LOTO been reviewed and updated as needed to reflect changes in Chapter 18?

WPC Activity reviews and updates are an ongoing process. The majority of LOTOs at B088 are performed under NS-0059 which is due for renewal in September, 2023.

Does the Division have a process to document OJT in WPC Activities?

NSD does not have a standard process to document OJT. It is left up to the groups and Activity Leads to decide how best to document their OJT. Groups have been encouraged to upload and track their OJT in the WPC activities.

3. For B088 NSD, have roles and responsibilities for the LOTO process been assigned to appropriate personnel, and have personnel been trained in their roles and responsibilities?

Yes, the roles and responsibilities have been assigned to the appropriate personnel at B088 and beside a few challenges maintaining the QEW training, personnel have been and remain current in their training.

- **Is OJT documented for everyone serving as a LOTO Person in Charge?**
 There is no WPC Hazard or training course for this role and with the listed Roles and Responsibilities in Pub 3000 Ch. 18 all of the interviewees agreed that it would be very difficult to document OJT.

- **Do LOTO participants understand how to access the LOTO procedures and are they aware of the process to follow when 1) procedures need to be edited and 2) new procedures need to be created?** Everyone interviewed knew how to access the B088 NSD procedures, and where to obtain assistance with writing and editing procedures.

- **Are staff who are only performing limited LOTO authorized and trained to perform the work?** Yes, staff performing limited LOTO are trained and authorized.

4. Have each of B088 NSD's LOTO Procedures that will be used during FY23 been inspected and approved within 1 year? **29** procedures are **Active** and have been reviewed and approved within the last year. In the past, there were times when B088 NSD used the one-time exception to allow use of a LOTO procedure overdue for renewal.

Have the inspections and approvals been properly documented? The Smartsheet appears to be an effective tool for accurately documenting the approval status. Inspections have not been done per Pub 3000 Ch.18. This is identified as a corrective action.

- **What is the typical process to review a LOTO procedure for accuracy?** Procedure reviews typically begin with the assigned B088 NSD LOTO procedure preparer looking at the current written procedure and the completed Hazard Analysis. The review will include pulling and reviewing drawings, walking the equipment down to verify labels, isolation points, ZVV locations, and the order of the steps. Once any required updates are completed, the procedure is sent for review and approval by the EM Coordinator and Electrical Engineer. Note – the preparer usually walks changes down with the approvers.

- **Who performs these reviews?** The assigned B088 NSD LOTO procedure preparer performs the reviews.

- **How often are discrepancies found between the steps in the documented LOTO procedure and the steps required to actually perform**

the work? In most cases the steps are correct, but there have been a few times when there has been a need to clarify a label or ZVV point in the steps.

- **What is the process when discrepancies are noticed in a LOTO procedure?** If the discrepancy is noted in the field and it is a minor change a one-time single line change is made and approved by the Electrical Engineer. If it is found during the review, the procedure is updated and verified before it is sent for approval.

5. What is the process for preparing to execute a LOTO?

Are pre-job briefs provided? What is included in the pre-job briefing? Yes, Pre-Job briefings are given by the RI and cover scope of work, energy sources, what ZVVs have been done, any work restrictions, or specific equipment conditions or boundaries. Answer any questions.

- **How are Job Safety Plans including shock and arc flash risk assessment and review of emergency response plans performed before a LOTO?** Hazards are assessed and the Job Safety Plan (JSP) is completed, by a QEW, when writing the LOTO procedures. There is no review of emergency response plans performed.

- **Do the LOTO procedures contain this information?** The template used by B088 NSD does contain the hazard assessment and JSP information. It does not contain emergency response plans and procedures.

- **How are controls identified and communicated in the work control documents?** Through the WPC Activity.

Summary of Corrective Actions for NSD

1. Procedure 88-OPS-PRO-017 must be updated to meet the current requirements of Pub 3000 Ch. 18 and Rev2 of the LBNL Electrical Safety Manual.
2. NSD must perform LOTO Inspections as required in Pub 3000 Ch.18.

APPENDIX A3—Computing Sciences Area Results

Summary of Findings

Overall the Computing Sciences Area (CSA) is good standing when it comes to their LOTO program. All complex LOTO work is managed and overseen by the QEW IIs in NERSC. This includes work performed by CSA staff within the NERSC and Scientific Networking Divisions as well as subcontractors. Only QEWs are authorized to initiate LOTOs and everyone else is authorized in the Cord/Plug and Limited LOTO roles (ie. they can initiate LOTO on cord and plug equipment only and can lock on to complex LOTO equipment after it has been de-energized by a QEW). All LOTO related WPC activities are updated, approved, and active.

The requirement for divisions to document their LOTO Procedure Program is relatively new, coming into effect at the end of calendar year 2022. The CS Area has not yet documented their program but upon discussion with division management it has been decided that CSA will document their Division LOTO Procedures Program within their Division ISM Plan, as opposed to creating and maintaining a separate document. This action item is listed in the corrective actions of this report and will be completed in FY24.

A number of LOTO procedures are stored on Google Drive instead of QuickBase. These procedures were created by the previous DSC, Betsy MacGowan and originally stored on her personal Google drive. When Betsy retired the current DSC, Sarah McGinn, migrated her files to a shared drive and in organizing that shared drive the LOTO procedures were discovered. These procedures need to be reviewed and added to the QuickBase database if they are still needed. This action item is listed in the corrective actions of this report and will be completed in FY24.

Observations

Emergency maintenance performed in NERSC on April 25. Work was led by QEW II, Ernie Jew. The onsite affiliates of subcontractor HPE are expected to serve as QEW standbys in these cases, but the individual they sent to serve as Ernie's standby had not completed their training and was not authorized. This gap was identified upfront and Eric Lucas of NERSC stepped in to serve as the standby. Eric is in the process of being authorized to serve as a QEW 1. Upon review it was discovered that Eric had completed his training to serve as a QEW standby, but was not authorized on a corresponding activity in WPC. At the end of 2022, the WPC activities for the Building Infrastructure Group (BIG) within NERSC were reorganized in order to better align with the individual needs of each team member. This new structure promoted better understanding of the work authorizations for both the person performing the work, their supervisor, and the activity leads. As part of these changes, a new activity (NE-0037)

was created for Eric to authorize him as a QEW I and a separate activity (NE-0044) was created for members of BIG who perform non-QEW electrical work, including serving as a QEW standby. Eric is still in the process of obtaining this new certification, but once completed, NE-0037 will authorize his QEW 1 work, including authorization to serve as a QEW standby for the QEW IIs on the team. Obtaining QEW certification takes time and Eric should have been added to NE-0044 to authorize the work he's continuing to perform in the meantime, as a non-QEW. Eric has been performing this work for years at NERSC and prior to the WPC re-organization he was authorized for non-QEW electrical work on WPC activity # NE-0002. This gap was identified and corrected during the course of this self assessment and Eric is now temporarily authorized in WPC under NE-0044 until he makes the transition to a QEW I.

The complex LOTO procedures for the supercomputer cabinets for Cori, Perlmutter and beyond are posted inside each cabinet door along with a sign-in sheet. These procedures are rarely used outside of the initial install and the decommissioning of each system, so the NERSC QEWs have been using the sign-in sheets and LOTO Procedures, along with the SJHA process, when work is performed, instead of writing a LOTO permit for each procedure. In the rare instance where these procedures are used outside of install and decommissioning, the complex LOTO procedure will be used in conjunction with the sign-in sheet, the same as would be done for complex LOTO work not involving a subcontractor. This subcontractor work will also be authorized via SJHA. This process was discussed with the LBNL LOTO Program Manager, Katherine Johnson, who has granted us an exception to writing a LOTO Permit when NERSC and HPE staff perform work outside of installs and decommissioning. This process will be formally documented in the LOTO Program within our ISM Plan.

It was observed that an older version of the sign-in sheet, provided to the NERSC QEWs by the previous DSC, was still in use. The sign-in sheets on the Perlmutter cabinets will be updated during the course of this self assessment. The sign-in sheets on the Cori cabinets will not be replaced because Cori will be decommissioned in July 2023.

It was also observed that the LOTO Permits are stored in QuickBase, but they are stored in an application that doesn't sync to the Complex LOTO Procedure application. I was a QuickBase System Administrator at a previous company and will look into the possibility of syncing the two applications for ease of recordkeeping.

Subcontractors

Although subcontractors are not in scope of this self assessment, in discussion with the EHS LOTO Program Manager it was determined that the HPE subcontractors who are also affiliates of LBNL can take EHS0388 instead of EHS0379 for their complex LOTO work. Therefore, during the course of this self assessment, EHS0388 was added to their WPC activity (NE-0029) and waived for those who do not participate in LOTO work. This allows us to track their training expirations in BLT instead of manually via the SJHA. These workers are still authorized under an SJHA as well.

Suggestions from Interviewees

- Evaluate what can be done to improve the learning curve for the LOTO process/policy
- Ch18 is very thorough when it comes to covering electrical related LOTO hazards, but is lacking when it comes to non-electrical LOTO hazards.
- Incorporate a more hands-on style of learning, not just classroom style to adjust to the different learning styles people have.
- Tailor the information to the different audiences and varying levels of experience

Opportunities for Improvement

Restructure the documents in the LOTO folder from former DSC Betsy MacGowan.

Give overview of Limited Authorized Role to those in NERSC - A2A topic

Give Ben access to QuickBase

Confirm if Jeff and/or Ernie need to be added to EH-0460: LOTO Procedure Approvers and Evaluators

Does Limited LOTO really apply to ESnet staff? Or should we remove and just have them take simple LOTO for Cord and Plug?

  Sarah to retake EHS0388 and EHS0389 to compare

Get the updated Complex LOTO sign-in sheet from Katherine and store it on CS Safety SharedDrive.

  Replace old sheets from Perlmutter cabinets

Confirm if HPE affiliates (Terence Brewer, Kevin Henry) will still take EHS0379 as part of SJHA 2448 or if we will add EHS0388 to their WPC activity and waive for everyone else who doesn't participate in LOTO

Determine if QuickBase can be streamlined to be more efficient

  Sync LOTO Permit application to Complex LOTO Procedure application?

Formalize process for Annual LOTO Certification Form - where is the form? Who submits it to EHS?

CSA ISM Plan Additions

Define Ernie and Jeff’s roles; including mention of EH-0460
Define role for limited LOTO authorized person in NERSC & ESnet
Define role for subcontractors
Outline process for Annual LOTO Certification Form - where is the form? Who submits it to EHS?
HPE subcontractors take EHS0379 annually instead of every 3 years as per Lab policy. This change was put in place due a high number of LOTO violations observed by HPE staff in 2022 and may be revisited at a later date by NERSC management. HPE subcontractors who as also badged affiliates have the option to take EHS0388 via their WPC activity instead of EHS0379.
Add note that the complex LOTO procedures for the supercomputer cabinets for Perlmutter and beyond are posted inside each cabinet door along with a sign-in sheet. These procedures are rarely used outside of the initial install and the decommissioning of each system; therefore the LBNL LOTO Program Manager has granted us an exception to writing a LOTO Permit when NERSC and HPE staff perform work outside of installs and decommissioning. In the rare instance where these procedures are used outside of install and decommissioning, the complex LOTO procedure will be used in conjunction with the sign-in sheet, the same as would be done for complex LOTO work not involving a subcontractor. This subcontractor work will also be authorized via SJHA.

Verbal approval given by Katherine on 5/23. Sarah to request email approval for formal documentation.

Add note that most of the supercomputer Complex LOTO Procedures will not be inspected annually because they are only used every few years when new systems are installed and old systems are decommissioned.

Supporting documentation is located here: [CS Area Safety > CSA Self Assessments > FY 2023]

APPENDIX A4—IT Division Results

Summary of Findings

Overall the IT Division is good standing when it comes to their LOTO program. In early FY23 their LOTO-related WPC activities, all housed within the Computing Infrastructure Group, were restructured. Only one member of IT works as an Authorized Person and a Responsible Individual (RI), so a separate activity was created for his work. The rest of the Computing Infrastructure Group only performs LOTO work as Limited LOTO Authorized Persons, so their WPC activity was updated to remove EHS0370 for Authorized Persons and replaced with EHS0388 Limited LOTO. When I conducted the interviews as part of this self assessment one of the interviewees informed me that they had been making the request to remove EHS0370 for years but it had not been granted until FY23. The team participates in limited LOTO work based on project needs and it is not uncommon for them to go months without joining a LOTO. LOTO work involving the RI is limited to complex LOTO work performed by vendors. The RI leads the LOTO and the vendors execute the work. All LOTO related WPC activities are updated, approved, and active.

The requirement for divisions to document their LOTO Procedure Program is relatively new, coming into effect at the end of calendar year 2022. The IT Division has not yet documented their program but upon discussion with division management it has been decided that IT will document their Division LOTO Procedures Program within their Division ISM Plan, as opposed to creating and maintaining a separate document. This action item is listed in the corrective actions of this report and will be completed in FY24.

There are a total of seven complex LOTO procedures owned by the IT Division. Two of these procedures were inherited from the Scientific Networking Division in the Computing Sciences Area and are maintained in the LBNL QuickBase Database, which is owned by EHS. Two additional IT owned procedures are also in QuickBase. However, the other three procedures are retained on the personal Google Drive of the division’s RI and current versions are also stored as hardcopies. To maintain consistency and reduce the risk that anything will be lost when the RI retires, all procedures will be transferred to QuickBase. This action item is also listed in the corrective actions of this report and will be completed in FY24.

Summary of Procedures stored in QuickBase during the course of this self assessment:

- CLP-6
- CLP-236
- CLP-238
- CLP-281

CLP-6 and CLP-236 are obsolete and have been succeeded by CLP-280 and CLP-281. CLP-6 and CLP-236 need to be archived or removed. This action item is listed in the corrective actions of this report and will be completed in FY24.

Opportunities for Improvement

- Confirm with Katherine if Mike is the LOTO procedure approver for IT or does EHS provide final approval once he and the vendor create the procedure?
- Confirm with Katherine if sign-in sheet is necessary for Mike's LOTO (only 3 people present and no one else is in the room when work is performed)
- Confirm with Katherine if Mike's LOTO procedures can remain in binders or need to be posted
- Confirm with Katherine if the annual PM done in IT using LOTO procedures can also serve as the annual procedure review. Is any additional documentation of the review required or is simply using the procedure once a year enough?
- CLP-6 and CLP-236 need to be archived or removed

ITD ISM Plan Additions

- Define role for limited LOTO authorized person within the division
- Define role for subcontractors within the division
- Define Mike's RI role
- Outline process for Annual LOTO Certification Form - where is the form? Who submits it to EHS?

Supporting documentation is located here: IT Division Safety > IT Division Self Assessments > SA FY23

Doc ID: 8584e2495d435t59dfa48420273ef55e4879a9353e6d

APPENDIX A5—ALS Results

ALS Assessment Summary

This assessment was performed in conjunction with ALS-U since the organizations are tightly integrated and have many of the same staff performing work for both divisions. Work observations, interviews and document reviews were conducted during July and August, 2023 to determine the overall status of our LOTO Program.

The ALS relies mainly on the Engineering Division and Facilities Division to perform LOTO through our Electronics Maintenance (EM), Electronics Installation (EI) and Electrician (EL) matrixed staff. The division has numerous complex LOTO procedures for accelerator systems, utilities and equipment such as beamline hutches. In most cases, electrical and mechanical LOTOs are controlled through our EM Shop as documented in our Lockout Tagout Supplemental Procedure for ALS, AL-09-01. We discovered inconsistencies with this procedure for LOTOs performed by Facilities Crafts and ALS Beamline Scientists, which will be addressed through corrective actions developed as a result of this self assessment.

Most LOTOs are coordinated through our EM Shop, which operates 24/7. The EM Shop staff function as the LOTO Responsible Individual and will establish LOTO and verify zero energy before other LOTO Authorized individuals apply their LOTO to work on the systems. The EM Shop enters each LOTO into the Online LOTO Log (Olog), so that we have an accessible log of the status of all LOTOs in the facility. When LOTOs are not coordinated through the EM Shop, as is the case with Facilities and scientific staff, the LOTOs are not regularly entered into the Olog and they are not tracked centrally at the ALS. This will be addressed through corrective actions developed as a result of this self assessment.

Lines of Inquiry

1. Is ALS's LOTO Procedure Program up-to-date, documented, and approved by Division management?

    Procedure AL-09-01, along with its appendices, is the ALS LOTO Supplemental Procedure. It is current, having last been reviewed and approved on July 21, 2021. It is on a 3 year cycle so will be reviewed again in July, 2024. However, during the course of this self assessment, several areas were identified for revision to reflect current operating practices and to address all groups performing LOTO at ALS.

2. Have ALS's WPC Activities requiring LOTO been reviewed and updated as needed to reflect changes in Pub-3000, Chapter 18? Does the Division have a process to document OJT in WPC Activities?

    The ALS identified 13 WPC Activities that require LOTO. All are Active in the WPC System and include the latest updates from Chapter 18. We will be evaluating the practice of Beamline Scientists performing LOTO on their hutches and equipment without going through the EM Shop, which would then only involve LOTO Authorized Person controls instead of LOTO Responsible Individual controls.

OJT documentation is not consistently documented through the WPC Activities. This is an area that will be addressed during next year's OJT Multi-Division Self Assessment.

3. Have roles and responsibilities for the LOTO process been assigned to appropriate personnel, and have personnel been trained in their roles and responsibilities?

ALS has a dedicated Electrical Safety Officer and an EM Shop where most LOTOs are initiated, which works well. Other staff involved with LOTO have the "LOTO Authorized Person" or "Limited LOTO Authorized Person" roles to join existing LOTOs established by the EM Shop. The ALS maintains an Authorized Persons List (AL-02-01) that specifies the training and qualifications necessary to work on various systems, including LOTO of those systems. Appendices to this procedure are maintained by group leads and identify the names of staff members authorized to work on each system, along with roles and responsibilities. These roles include group lead (person in charge), procedure training coordinators, and authorized staff. Through interviews and work observations, we determined that better clarification between LOTO Responsible Individual (RI) and LOTO Authorized Person is needed after the recent updates to Pub-3000, Chapter 18.

4. Have Complex LOTO Procedures that will be used during FY23 been inspected and approved within 1 year? Have the inspections and approvals been properly documented?

This is an area for improvement. ALS has recently established a module in our online Accelerator Safety Configuration Control (ASCC) system that tracks the status of LOTO procedure inspections, but it has not been implemented yet. We are working with the Engineering Division to begin documenting the inspections through the ASCC module.

5. What is the process for preparing to execute a LOTO?

Facilities LOTO: Electricians performing LOTO at the ALS do not go through the Facilities Hazardous Energy Control group, which is standard practice for all other electrical LOTOs. Through interviews and work observations, it was determined that Electricians were not following some steps in the ALS LOTO Supplemental Procedure, such as having a complex LOTO procedure and updating the Olog with LOTO status. They are also not routinely filling out the online Job Safety Plans or completing paper copies in some cases. Documents that were requested for review for this assessment could not be located. This will be addressed through corrective actions developed as a result of this self assessment.

Engineering LOTO: The EMs are filling out paper Job Safety Plans (JSP) for LOTO in most cases, but are planning to start using the online JSP developed by the EHS Electrical Safety Department. Several LOTOs were observed during this assessment, and pre-job briefings were completed and documented before authorized persons applied their locks to group LOTO. Entering the LOTO information onto the Olog is also

a best practice for configuration control, especially during our long maintenance shutdowns. Staff interviewed had great insight on areas for improvement, which will improve our overall LOTO performance.

Other observations

Areas for Improvement

Facilities Division LOTO

One group LOTO was initiated by Facilities Electricians for a project involving several groups at ALS. A Group LOTO tag was hung on the breaker, but there was no LOTO procedure, the zero voltage verification (ZVV) was not performed and there was no LOTO briefing or other communication with groups that needed to join the LOTO. The Electricians returned the next day to perform ZVV, but work had already progressed which resulted in an Engineering Division ORPS. After discussions with the Lead ALS Electrician and EM Shop, we determined that Facilities Electricians and other Craft workers should be following our LOTO procedure, AL 09-01, including use of the Olog to communicate LOTO status. Issues with the way the LOTO was established were communicated to Facilities for resolution.

Previous ALS matrixed facility Electricians used the ALS Web Job Order system, which itemizes all trades and work involved. The current ALS Electrician workflow uses the Facilities Work Request Center to create a separate document. Then relies on a third work instruction document to marry the parallel work instructions. This effectively breaks the former system of communicating work tasks in a single document. Additionally, all LOTOs performed by Facilities are planned through their Hazardous Energy Control group, except for when they are working at ALS.

Beamline Scientist LOTO

Two LOTOs on beamline hutches were reviewed during this assessment. The LOTOs were performed by scientific staff matrixed from other divisions to the ALS to operate beamlines. One LOTO was entered into the Olog as required by the procedure, although it was a delayed entry. The other was not entered into the Olog. Since these are complex LOTOs and involve power supplies, the EM Shop could initiate these LOTOs and serve as RI to improve coordination and alleviate the need for scientists to take the RI training.

EM supervisors and managers would like to see better documentation for complex LOTOs of power supplies and magnets. They would like a template, possibly as an appendix to AL 09-01, to help with writing the LOTO procedures.

Interviews revealed the challenge of establishing Limited Approach Boundaries within our tunnels, given the tight working spaces and the number of workers and tasks that

are scheduled during maintenance shutdowns. The use of temporary barricades will be discussed further as an option instead of barrier tape.

Best Practices

Mechanical LOTO for the Mechanical Technicians at the ALS is coordinated through the EM Shop, who serve as the RI and perform the briefing and entry on the Olog. This arrangement appears to be working well for staff and the process is well understood.

EMs performing LOTO have a good understanding of the hazards and controls associated with the work. The briefings were clear, documentation was complete and all steps of the LOTO were followed.

Having the LOTO Olog to document the status of all LOTOs within the facility is a best practice that will be improved once all groups performing LOTO use it.

Areas for Improvement

1. Work with Facilities Division to establish a defined process for crafts performing LOTO, utilizing the ALS work planning processes that have been working well.

2. Begin implementation of the ASCC LOTO Procedure Inspection module.

3. Work with Facilities and Engineering Divisions to use the electronic Job Safety Plan (JSP) for all electrical work at the ALS, so that the hazard analysis is uniformly documented and retrievable.

4. Revise the ALS LOTO Supplemental Procedure, AL 09-01, to reflect changes in Chapter 18 of Pub-3000 and to provide additional clarity on requirements and a template for complex LOTO procedures.

5. Revise the Beamline Mini-Hutch Procedures (Appendices to BL 08-24) to clarify roles, responsibilities and controls, including LOTO Authorized Person and LOTO Responsible Individual.

6. Develop uniform standards for documentation of LOTOs in Olog.

APPENDIX A6—Physics Results

Physics Assessment Summary

Physics currently does not have any complex LOTO Procedures. The two complex LOTO procedures in Physics (CLP-166 and CLP-235) are inactive. They were associated with the LAr Test Stand for the LZ experiment which is now installed at SURF in South Dakota. The third complex LOTO is associated with the DI water plant disconnect (CLP-341) which was created during the resurfacing of the DI Water secondary containment. This job was completed and it is no longer necessary to perform this complex LOTO procedure.

Currently, all equipment in Physics is cord and plug therefore, does not require complex LOTO procedures. As a result, this assessment was focused on those required to take LOTO training and QEW1 certified individuals. Engineering QEW support team was also interviewed since they have provided QEW support in the past.

In addition, as part of this assessment the roles and responsibilities of the Lockout/Tagout program as outlined in Chapter 18 of the LBNL EH&S Manual were reviewed and evaluated. The Physics Division no longer has a Division Electrical Safety Officer.

For the Physics Division the following applies:
LOTO Approver – since such a role does not exist in Physics, Physics leverages resources from Engineering or the EH&S Electrical Safety Group.
LOTO Coordinator - Currently Physics is not performing work requiring complex LOTO procedures therefore, this role is not filled in Physics. The Electrical Safety Group would fill this role if necessary.
LOTO person in charge -This would be the QEW establishing LOTO.
LOTO Affected person - This does not need to be identified, it's just the person affected if LOTO needs to take place (PI for the lab or someone working in the area of LOTO).
LOTO Procedure Evaluator - Engineering or Electrical Safety Group.
LOTO Reviewer – Electrical Safety Group to review a new LOTO Procedure before final approval.

Interviews

Physics conducted 4 interviews during May 2023 with people who participated in the Physics LOTO Program. Interviewees were selected based on their completion of training courses EHS0370 LOTO for Authorized Persons, EHS0372 LOTO Awareness

for Line Managers, or QEW/QEW-R certification. One person in Physics is a QEW1 and one Line Manager is currently going through the QEW1 training.
The Engineering Division QEW program supervisor was also interviewed since we have relied on QEW support from this group. The Engineering QEW support for Physics was also interviewed. This individual supported Physics QEW needs prior to Physics having a qualified QEW1 individual.

Physics and ATAP Division Safety Coordinators conducted the interviews together. Therefore, Physics used the same questions as ATAP. ATAP Interview Forms appropriate to each role were used to guide the conversations. Following is a summary of what we learned from the interviews.

What is Working Well

Interviewees gave favorable comments about the LOTO training courses.

Physics QEW1 staff uses the risk assessment checklist found in the Electrical Safety Manual to identify the class of work, sources of power, presence of capacitors, etc.

The Line Manager going through the QEW1 training expressed that the training is very good but it requires a significant amount of time which might not be practical for everyone. The individual’s motivation for becoming a QEW1 had to do with the ability to do some tasks considered “electrical work”, such as shortening cords on new equipment. This individual is also responsible for managing technicians and wants to understand the requirements.

Challenges and Recommendations for Improvement Identified from Interviews

Challenges:
The top challenge identified in Physics is LOTO process vendor qualification, particularly vendors working on the Microsystems Lab (MSL) equipment. Some of the vendors might not conduct electrical work with the same electrical safety rigor as LBNL as reflected by the following quote: “A vendor made a mess out of a machine he had been working on. The vendor’s work did not seem to be up to LBNL standards”.

In the past, Physics relied on Engineering QEWs to oversee vendors performing electrical work on this equipment. We now have a QEW1 qualified individual in Physics to provide oversight up to their level of qualification 300 VAC maximum and no arc flash hazard.

The Engineering QEW support group is still active and has a QEW2, who can support oversight for items above the 300 VAC threshold.

However, the leader of the Engineering QEW support group expressed that there is a shortage of qualified staff and they are hiring and training new staff. They have been struggling to keep up with the demand for support.

Recommendations:

- Provide more QEW support for vendor oversight. A QEW “rover” would be helpful.
- Schedule vendor work and assign oversight in advance.
- The SJHA could trigger a QEW support request when electrical work or the need for LOTO is identified.
- Use cord-and-plug equipment where possible to avoid the need for complex LOTO.

Another recommendation to improve the LOTO process in general is to ensure that new people (especially people coming from Universities) are included in our Safety Culture. They need to know that it is OK to ask questions or ask for help.

APPENDIX A7—ALS-U Results

ALS-U SUMMARY

ALS-U does not have any complex LOTO procedures, therefore is not currently required to meet the requirements of Pub. 3000, Chapter 18, Appendix A. With that said, we used this opportunity to think of what is going to be required in the near future as dark time approaches. In addition, we worked closely with the ALS Division on their self assessment since their noteworthy practices, issues, as well as observations will involve the same work groups as well as the same equipment/areas.

Lines of Inquiry

Interviews with individuals were not conducted within ALS-U. ALS-U relies on the ALS EM's and EI's as well as the Facilities Electricians if LOTO needs to be established. Although physical interviews were not conducted with anyone, the following lines of inquiry were used to assessment future LOTO needs:

1. Is each Division's LOTO Procedure Program up-to-date, documented, and approved by Division management?

    It was identified that ALS-U does not have a LOTO operating program in place. ALS-U does not have any complex LOTO procedures, so a program is not required. A program is seen as a noteworthy practice in case of future work. A meeting with a small group of ALS-U matrixed employees was conducted on August 16th. The employees in this meeting agreed to be a part of a LOTO Working Group and answer questions and review documentation involving the implementation of a division LOTO operating program.

2. Have each Division's WPC Activities requiring LOTO been reviewed and updated as needed to reflect changes in Chapter 18? Does the Division have a process to document OJT in WPC Activities

    There are three ALS-U specific activities (AG) that require the use of simple LOTO and joining an existing LOTO already established. These activities have been reviewed and are current.

AG-0004	02.05.08.01.01 Kickers R&D - Fast kicker installation
AG-0010	Magnet Testing in ALS-U Magnetic Measurement Facility
AG-0020	FLEXON NEG Coating System

It was identified that some ALS activities performed by ALS-U matrixed employees could benefit from removing or waiving the requirement of LOTO Responsible Individual training. The tasks associated with this role are not performed often enough by the individual for them to be proficient enough in the skills necessary to be an RI. The tasks might be better performed by ALS EM's or Facilities Electricians.

The ALS-U division does not currently have the need to document OJT for LOTO, but ALS-U will be participating in next year's Multi Division Self Assessment on documentation of OJT.

3. For each Division, have roles and responsibilities for the LOTO process been assigned to appropriate personnel, and have personnel been trained in their roles and responsibilities?

Roles within the LOTO Process and individuals within the Division performing these roles are listed below:

- LOTO Authorized Person: ALS-U does have several people who have taken EHS370 LOTO Authorized Persons. This will benefit the division in the future.
- LOTO Responsible Individual: Although this is listed as a requirement on some activities, it has been waived from most, if not all, of the employees listed. This role is currently being performed by Facilities Electricians as well as ALS EM's.
- LOTO Person in Charge / Qualified Workers: Jacqueline Bell and Kevin Bender are work leads for a group of ALS-U matrixed individuals who are in the process of going through the QEW training. These individuals have been assigned to ALS activities.
- Limited LOTO Authorized Person: This would be a majority of ALS-U employees who need to apply LOTO to LOTO's already established.
- LOTO Procedure Approver/Evaluator: These roles need to be determined and will be documented in the division LOTO Operating Program when it's written.

- Is OJT documented for everyone serving as a LOTO Person in Charge?

  All current ALS-U activities that require LOTO involve simple LOTO. A Person in Charge is not required for these activities. A process for documented OJT will be written into the ALS-U operating program.

- Do LOTO participants understand how to access the LOTO procedures and are they aware of the process to follow when 1) procedures need to be edited and 2) new procedures need to be created?

This will be addressed in the ALS-U LOTO operating program.

- Are staff who are only performing limited LOTO authorized and trained to perform the work?

  Yes

4. Have each Division's Complex LOTO Procedures that will be used during FY23 been inspected and approved within 1 year? Have the inspections and approvals been properly documented?

   This will be addressed in the ALS-U LOTO operating program.

5. What is the process for preparing to execute a LOTO?

   This was addressed in the ALS LOTO Self Assessment since ALS-U LOTO work starts with ALS EM's and Facilities Qualified Electrical Workers. Looking forward, this will be addressed in the ALS-U operating program for work performed during dark time.

VII. CONCLUSION

This assessment was a beneficial planning tool to determine the correct information that should be included in the ALS-U LOTO Operating Program. It identified the types of planning that still needs to be performed as we head closer to dark time.   With this information, the newly established LOTO Working Group can get a better understanding of the division's needs when planning and performing complex LOTO work.

Appendix B Lines of Inquiry, Interview Questions, Systems/Documents/Records Reviews and Job Observations
Attachment 1
Lines of Inquiry

1. Is each Division's LOTO Procedure Program up-to-date, documented, and approved by Division management?
2. Have each Division's WPC Activities requiring LOTO been reviewed and updated as needed to reflect changes in Chapter 18?
    - Does the Division have a process to document OJT in WPC Activities
3. For each Division, have roles and responsibilities for the LOTO process been assigned to appropriate personnel, and have personnel been trained in their roles and responsibilities?
    - Is OJT documented for everyone serving as a LOTO Person in Charge?
    - Do LOTO participants understand how to access the LOTO procedures and are they aware of the process to follow when 1) procedures need to be edited and 2) new procedures need to be created?
    - Are staff who are only performing limited LOTO authorized and trained to perform the work?
4. Have each Division's Complex LOTO Procedures that will be used during FY23 been inspected and approved within 1 year? Have the inspections and approvals been properly documented?
    - What is the typical process to review a LOTO procedure for accuracy?
    - Who performs these reviews?
    - How often are discrepancies found between the steps in the documented LOTO procedure and the steps required to actually perform the work?
    - What is the process when discrepancies are noticed in a LOTO procedure?
5. What is the process for preparing to execute a LOTO?
    - Are pre-job briefs provided? What is included in the pre-job briefing?
    - How are Job Safety Plans including shock and arc flash risk assessment and review of emergency response plans performed before a LOTO? Do the LOTO procedures contain this information?
    - How are controls identified and communicated in the work control documents?

Attachment 2
Interview Questions

LOTO Authorized Person / LOTO Responsible Individual

Initial Planning:

- Have you performed a LOTO since March 2022?
- How is the need for LOTO identified?
- Who is responsible for determining if LOTO is needed?
- What makes it hard to determine if LOTO is needed?
- Who is responsible for performing risk assessments?
- How is a LOTO procedure initially developed? Who is involved in this process?
- How are people participating in the LOTO execution engaged and involved in the work planning?
- How well does the process work?
- How could the process be improved?

Pre-Job Briefings:

- Tell us about the pre-job briefings? What is typically covered in these and who normally gives them?
- How do these help prepare you for the day's work?
- How would you describe the information conveyed in a pre-job briefing?
- For complex LOTO situations Is there a sign in sheet you sign before adding your lock and tags to the isolations?
- If you were to conduct the pre-job briefing, what would you do differently?

General Questions

- What is working really well in the overall LOTO process?
- What is the most challenging part of the overall LOTO process?
- What would you like to see improved in the overall LOTO process?

Specific to a QEW in addition to the above questions:

Qualified Electrical Worker

Electrical Risk Assessment / Controls:

- How do you perform a Job Safety Plan including a shock and arc flash risk assessment as well as the emergency response plan before a LOTO? Do you rely on the LOTO Procedure for this information?
- How are controls identified and communicated in the work control documents?

Risk Assessments:

- What types of risk assessments might be required for a LOTO procedure involving hazardous electrical energy?
- How are the risk assessments documented?
- How are the risk assessments communicated?

Reviews:

- What is the typical process to review a LOTO procedure for accuracy?
- Who performs these reviews?
- How common is it to find discrepancies between the initial LOTO procedure and the planned work?
- What is the process when discrepancies are noticed in a LOTO procedure?

Timelines:

- How long does it typically take to develop and approve a new LOTO procedure?
- How are LOTO procedures managed when insufficient time is requested for the work?

LOTO Person In Charge

LOTO Procedure Field Use:

- How does a LOTO Person-In-Charge (PIC) learn about a particular LOTO job? How are they informed? Who informs them?
- How much time does a LOTO PIC typically have to review a LOTO procedure before they need to perform a LOTO?
- Tell us about the LOTO procedures. What information do they contain? How do you use them? What is good about these? What is challenging or difficult about these, and what can be improved?
- When a LOTO procedure is handed to you, how confident are you that the procedure is accurate and matches the field conditions and the scope of work that needs to be performed?
- What steps do you take to confirm the LOTO scope of work, isolation points and hazardous energy control sequences are accurate?
- Have you ever discovered discrepancies between a LOTO procedure and the field conditions? If so, what do you do when you notice a discrepancy?

Pre-Job Briefings

- Tell us about the pre-job briefings. What do you typically cover in these?
- What gives you confidence that the workers understand the LOTO information you are communicating?

Close out Documentation

- What do you do with the signed LOTO Procedure after the work has been completed?

General Questions

- What is working really well in the overall LOTO process?
- What is the most challenging part of the overall LOTO process?
- What would you like to see improved about in the overall LOTO process?

Limited LOTO Authorized Person

Initial Planning:

- Have you overlocked on to a LOTO since March 2022?

LOTO Briefings:

- Tell us about the LOTO briefings? What is typically covered in these and who normally gives them?
- How would you describe the information conveyed in a LOTO briefing?

- If you were to conduct the LOTO briefing, what would you do differently?
- Is there a sign in sheet for you to sign before adding your lock and tags to the isolations?

General Questions

- What is working really well in the overall LOTO process?
- What is the most challenging part of the overall LOTO process?
- What would you like to see improved about in the overall LOTO process?

LOTO Program Owner (as applicable)

Reviews:

- What qualifies someone to be a LOTO Approver or LOTO Procedure Evaluator?
- What qualifies someone to be a LOTO PIC?

Approvals:

- Who can approve a LOTO procedure?
- How are these workers authorized?
- How frequently are discrepancies identified?
- What are the most common causes of discrepancies?

LOTO Execution

- What are the typical steps when executing a LOTO?
- What types of precautions are taken to protect workers while executing a LOTO?

Line Management (include supervisors, managers and work leads)

Responsibilities

- Are you aware of your responsibilities listed in Chapter 18, including the requirement to submit an Annual LOTO Certification Form to EHS every year?
- Do you have any questions or concerns around those responsibilities?
- Have you read your division's LOTO Operating Program?
- Has your division provided a list of LOTO Procedure Evaluators and LOTO Approvers to EHS to be added to WPC Activity: EH-0460 – LOTO PROCEDURE APPROVERS AND EVALUATORS

General Questions

- What is working really well in the overall LOTO process?
- What is the most challenging part of the overall LOTO process?
- What would you like to see improved about in the overall LOTO process?

LOTO Procedure Approver/Evaluator

Responsibilities

- Are you aware of your responsibilities listed in Chapter 18?
- Have you been added to WPC Activity: EH-0460 – LOTO PROCEDURE APPROVERS AND EVALUATORS
- Do you use the LOTO Procedure Inspection form listed in Quickbase to perform your LOTO Procedure Evaluations?
    - If not, where are these evaluations documented?

General Questions

- What is working really well in the overall LOTO process?

- What is the most challenging part of the overall LOTO process?
- What would you like to see improved about in the overall LOTO process?

Attachment 2b
Systems/Documents/Records Reviews and Job Observations

Documents/Records Reviews

1. ES&H Manual Chapter 8 and Chapter 18, ES&H Electrical Safety Manual
2. Representative WPC work activities and training records
3. Representative LOTO procedures

[Job Observations Checklist]

1. Has all the equipment that will need to be entered been identified before work begins?
2. Has a description of the job (scope of work) been clearly thought out before work begins?
3. If the following conditions exist, has a complex LOTO Procedure been written, approved, printed and followed:
    a. More than 1 source of power
    b. Setting up a group lock box
    c. Shift Change that requires a transfer of ownership
4. If a complex LOTO procedure is being used, has it been inspected for accuracy within the past year?
5. Has everyone within the limited approach boundary been briefed, signed a briefing sheet and hung the appropriate lock and tag on ALL isolations listed on the procedure?
6. Is it clear where the LOTO Safe Zone has been established to all who lock onto the LOTO points (isolations)?
7. If observing the initial application of LOTO, did the following occur by the LOTO Person in Charge (LPIC) who is establishing LOTO?
    a. Worker used proper body positioning when switching
    b. Worker applied LOTO and challenge the lock, hasp and isolation to make sure it does not come back on for ALL isolations
    c. Worker demonstrated proper use of tag and lock
    d. Worker performed a start test
    e. For electrical isolations, the QEW performing a zero-voltage verification
        i. Filled out a QEW Job Safety Plan
        ii. Checked the meter on known energized source
        iii. Verified zero voltage on all applicable combos:
            1. Phase to ground
            2. Phase to neutral
            3. Neutral to ground
            4. Phase to phase
            5. All exposed parts to be touched
        iv. Checked the meter on known energized source one last time

v. Make sure no meter settings are changed during the Zero Voltage Verifications (ZVV) process

f. The LOTO Procedure is posted nearby along with the signature sheet.

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