

**Office of Enterprise Assessments Review of the
Los Alamos National Laboratory
Plutonium Facility
Restart of Fissile Material Operations**



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Table of Contents

Acronyms	ii
Executive Summary	iii
1.0 Purpose	1
2.0 Scope	1
3.0 Background	1
4.0 Methodology	2
5.0 Results	3
5.1 Criticality Safety	3
5.2 Conduct of Operations	10
5.3 LANS Feedback and Improvement.....	15
5.4 NA-LA Feedback and Improvement.....	20
6.0 Findings.....	22
7.0 Opportunities for Improvement.....	22
8.0 Items for Follow-up.....	23
Appendix A: Supplemental Information.....	A-1
Appendix B: Key Documents Reviewed, Interviews, and Observations.....	B-1

Acronyms

AC	Administrative Control
ADNHOO	Associate Director for Nuclear and High Hazard Operation
ADPSM	Associate Director Plutonium Science and Manufacturing
ALR	Augmented Limits Review
ANS	American Nuclear Society
ANSI	American National Standards Institute
BOM	Balance of Machining
CFR	Code of Federal Regulations
CRA	Contractor Readiness Assessment
CRAD	Criteria, Review, and Approach Document
CSED	Criticality Safety Evaluation Document
CSLA	Criticality Safety Limit Approval
CSLR	Criticality Safety Limit Requirement
CSP	Criticality Safety Program
DOE	U.S. Department of Energy
DOP	Detailed Operating Procedure
EA	Office of Enterprise Assessments
FMO	Fissile Material Operation
FRA	Federal Readiness Assessment
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
MOV	Management Observation and Verification
MSA	Management Self-Assessment
NA-LA	NNSA Los Alamos Field Office
NCSB	Nuclear Criticality Safety Board
NDA	Non-Destructive Assay
NNSA	National Nuclear Security Administration
OFI	Opportunity for Improvement
OJT	On-the-Job Training
ORPS	Occurrence Reporting and Processing System
PF-4	Plutonium Facility
PFITS	Performance Feedback and Improvement Tracking System
PFS	Pit Flow Sheet
PIC	Person In Charge
PMP	Project Management Plan
SD	System Description
SME	Subject Matter Expert
TA	Technical Area
TSR	Technical Safety Requirement
UET	Use-Every-Time

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EXECUTIVE SUMMARY

The U.S. Department of Energy Office of Nuclear Safety and Environmental Assessments, within the independent Office of Enterprise Assessments (EA), conducted an independent review of the effectiveness of actions taken at the Plutonium Facility (PF-4) in Technical Area (TA)-55 at Los Alamos National Laboratory (LANL) to correct significant weaknesses in the criticality safety and conduct-of-operations programs. LANL is operated by Los Alamos National Security, LLC (LANS) under contract to the DOE National Nuclear Security Administration Los Alamos Field Office (NA-LA). The LANS Laboratory Director directed a pause in fissile material operations on June 27, 2013, to address those weaknesses. The EA review was performed concurrently with Federal readiness assessments of the Balance of Machining (June 22 to July 1, 2015) and Pit Flow Sheet (November 9 to 18, 2015) work activities supporting restarting these operations in PF-4. EA also reviewed a sample of resumed work activities in PF-4 during these readiness assessments and during the week of October 26, 2015.

Overall, LANS has adequately implemented appropriate measures to ensure that a conservative set of criticality safety requirements is being implemented and that the resumed and restarted fissile material operations at PF-4 are conducted safely. LANS has significantly improved the level of detail and execution of procedures, criticality safety postings, fissile material labeling, and worker training and qualification. Many of the changes are in worker and management training and qualification programs, facility procedures, and organizations' roles and responsibilities documents to encourage long-term implementation. LANS also has reestablished a functioning criticality safety division, although additional qualified staffing is needed to support a sustainable work level and to address corrective actions. In addition, LANS has established an adequate TA-55 Nuclear Criticality Safety Board that provides management direction and accountability for the implementation of a sound criticality safety program.

The TA-55 management team demonstrated that managers recognize the significance of the safety issues that led to the safety pause and are leading extensive changes in processes and behaviors to achieve safe resumption of all operations. Workers observed by EA demonstrated a thorough knowledge of and adherence to the posted criticality safety requirements. They also have embraced increased rigor in conduct of operations and full compliance with criticality safety requirements, and stated that would pause work for clarification if they encountered a change in operational conditions or a problem with a procedure.

LANS's corrective actions for criticality safety, including compensatory measures, were developed sequentially and focused on formality of operations and safe execution of fissile material operations for each group of work activities being restarted. However, EA observed several deficiencies in these efforts since the safety pause. LANS has missed opportunities during several periods of corrective action development to determine the compliance status of all elements of its criticality safety program and to formally identify the compensatory measures or corrective actions for systemic deficiencies for all of its fissile material operations. The restrictive compensatory measures taken for resumed and restarted work, such as implementing reduced criticality safety mass limits, conducting senior supervisory watches, and implementing the conditions defined in the *Evaluation of the Safety of the Situation for the Potential for Criticality in a Glove box due to Fire Water*, and other measures are required to remain in place until the systemic deficiencies in its criticality safety program are corrected.

LANS management significantly reduced the resources dedicated to sustaining improved performance for resumed operations while supporting restart activities. As more production areas restart over the next

several months, LANS is likely to encounter further challenges in sustaining improvements for resumed activities. LANS has not yet appropriately revised and implemented its sustainment strategy and actions to ensure that operations and criticality safety gains are properly maintained through the entire restart effort. Also, although LANS has made some improvements in management communication with workers, self-identification of issues, and performance assurance systems, additional engagement with workers and the development of organizational self-assessments present opportunities to accelerate improvement in safety performance.

NA-LA is actively overseeing resumed fissile material operations, restart activities, and actions established to improve criticality safety and conduct of operations performance for work performed in PF-4. NA-LA conducted criticality safety program assessments in March 2014 and December 2015 to evaluate program compliance. NA-LA has fully supported and coordinated the Federal readiness assessments reviewing restart of PF-4. The completed Federal readiness assessments that EA observed were adequate in validating readiness for restart. Overall, NA-LA personnel are adequately overseeing LANS management self-assessments and contractor readiness assessments; and Federal readiness assessments and are also confirming positive progress in criticality safety and conduct-of-operations performance at PF-4 for restarted activities.

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1.0 PURPOSE

The U.S. Department of Energy (DOE) Office of Nuclear Safety and Environmental Assessments, within the Office of Enterprise Assessments (EA) conducted an independent review of the restart of fissile material operations at the Los Alamos National Laboratory (LANL) Technical Area (TA)-55 Plutonium Facility (PF-4). LANL is operated by Los Alamos National Security, LLC (LANS) under contract to the DOE National Nuclear Security Administration (NNSA) Los Alamos Field Office (NA-LA).

The Laboratory Director paused all fissile material operations in PF-4 on June 27, 2013, because of significant deficiencies in performance related to required criticality safety and conduct-of-operations standards. LANS established its *TA-55 Criticality Safety and Conduct of Operations Improvement Plan* (referred to as the Improvement Plan in this report) on December 6, 2013, to address these deficiencies. LANS also developed PA-Notice-01007, *Resumption Release Process for Programmatic Activities in PF-4* (referred to as the Resumption Release Process in this report) to sequentially restart work activities after ensuring that requirements for criticality safety and conduct of operations were met. The Secretary of Energy directed EA to review the progress and adequacy of corrective actions and restart of operations within PF-4. This review evaluated the implementation of corrective actions for resumed activities and for two activities being restarted under a series of Federal readiness assessments (FRAs) in accordance with DOE Order 425.1D, *Verification of Readiness to Start Up or Restart Nuclear Facilities*.

To review the performance of LANS and NA-LA oversight in reviewing the implementation of criticality safety and conduct of operations at PF-4, EA conducted its review concurrently with the teams performing two of the FRAs: the one for the Balance of Machining (June 22 to July 1, 2015) and the one for Pit Flow Sheet (November 9 to 18, 2015). EA also reviewed a sample of resumed activities in PF-4 during the week of October 26, 2015. This report discusses the scope, background, methodology, and results of the review, as well as the findings and opportunities for improvement (OFIs) identified by the EA review team.

2.0 SCOPE

This review evaluated the effectiveness of the corrective actions and compensatory measures implemented to improve the criticality safety and conduct-of-operations performance for PF-4 fissile material operations (FMOs). As the Balance of Machining (BOM) and Pit Flow Sheet (PFS) activities were restarted, EA conducted concurrent reviews of the FRAs. EA also reviewed the activities that were restarted under the contractor's purview in accordance with the DOE Order 425.1D restart verification process. This review focused on programmatic work at PF-4 and also evaluated the improvement and sustainment plans developed to address weaknesses in the criticality safety and conduct-of-operations programs. Additional areas for review were the LANS and NA-LA feedback and improvement processes for overseeing operations in PF-4.

3.0 BACKGROUND

As an independent office within DOE that has no line management or policy-making responsibilities or authorities, EA implements DOE's independent oversight program for safety and security. This program

is designed to enhance DOE safety and security programs by providing DOE and contractor managers, Congress, and other stakeholders with an independent evaluation of the adequacy of DOE policy and requirements, and the effectiveness of DOE and contractor line management performance in safety and security and other critical functions as directed by the Secretary. The independent oversight program is described in and governed by DOE Order 227.1, *Independent Oversight Program*, and a comprehensive set of internal protocols, operating practices, assessment guides, and process guides.

Concerns regarding safe operations of plutonium programmatic work at LANL's PF-4 have been longstanding. Since 2006, approximately 250 Performance Feedback and Improvement Tracking System (PFITS) actions have identified a number of issues in the technical adequacy of the PF-4 criticality safety evaluation documents (CSEDs) and implementation of the LANS Criticality Safety Program (CSP) expectations. In most of the CSEDs, the main technical issue was that many of the assumptions supporting the criticality safety fissile material limits and other stated requirements were not documented. Accordingly, LANS prepared a project improvement plan to prioritize and schedule updates to the deficient CSEDs. In 2008, LANS and NA-LA developed an augmented limits review (ALR) process to ensure that appropriate and conservative fissile material limits were implemented in the interim while the hundreds of deficient CSEDs were being updated. LANS updated the project improvement plan (PIP) in 2014, and changed the document into a project management plan (PMP), NCS-Plan-14-001, *Nuclear Criticality Safety Program Improvements*. NA-LA approved the PMP, and LANS incorrectly viewed this approval as NA-LA's continued acceptance of the risks of allowing FMOs to continue with deficient CSEDs with the ALR process as a supplement. During this time frame, LANS believed the CSP was in compliance with the technical safety requirement (TSR) expectations. Between 2008 and 2011, LANS updated some of the CSEDs per the PIP established schedule; however, progress was delayed by LANS CSE staff attrition that started in 2011.

The significant attrition of criticality safety personnel greatly impacted most elements of the CSP implementation. For example, only two criticality safety analysts remained on staff when the pause in PF-4 operations was directed in June 2013. LANS estimated that approximately 25 personnel would be needed to support implementation of a fully compliant CSP and resolve the technical issues. The attrition of CSE personnel also diminished field presence of CSEs thereby resulting in the number of infractions related to CSP implementation to increase. Furthermore, the increase in infractions and declining conduct of operations implementation for numerous FMOs both eventually contributed to the 2013 operational pause at PF-4.

After the pause in operations in June 2013, LANS chartered both an internal team and an external team to review its CSP and conduct of operations for FMOs in PF-4. The resultant causal analysis and the report are documented in LA-UR-13-29297 dated November 12, 2013, and LANS report U1400044 dated October 7, 2013. LANS subsequently developed its Improvement Plan (LANS transmittal to the Associate Director Plutonium Science and Manufacturing: 13-060 dated December 6, 2013) to "address deficiencies in the conduct of operations, personnel training, and implementation of [its] criticality safety program. Additionally one of the major plan elements is focused on improvement sustainability over the long-term for safe and efficient operations in PF-4." Due to the significant safety risk associated with fissile material operations in PF-4 and the significant delays in programmatic work resulting from extended shutdowns, the Secretary of Energy directed EA to review the restart efforts in PF-4 to provide an independent assessment on the progress and effectiveness of corrective actions.

4.0 METHODOLOGY

EA completed the review by observing meetings, work activities, and demonstrations performed for the teams chartered by NNSA for the BOM and PFS FRAs and by observing resumed activities in PF-4 that

did not require Federal readiness assessments per the DOE Order 425.1D restart verification process. EA also conducted detailed reviews of documentation associated with TA-55 criticality safety and conduct of operations. To evaluate NA-LA and LANS feedback and improvement processes, EA reviewed development, implementation, and evaluation of corrective actions and dissemination and review of program and process documents; interviewed responsible managers and staff; and evaluated assessment reports, issues management documentation, trend and performance indicator reports, incident and event analysis reports, and lessons-learned publications.

The EA team used selected elements from the following criteria, review, and approach documents (CRADs): CRAD 45-18, Rev. 1, *Criticality Safety Controls Implementation*; CRAD 45-11, Revision 3, *Safety Systems Inspection Criteria, Approach, and Lines of Inquiry* (operations); and CRAD 45-21, Rev 1., *Feedback and Continuous Improvement Inspection Criteria and Approach – DOE Field Element*. The EA team specifically used the lines of inquiry (interview questions) from the LANS causal analysis to support EA's assessment of the effectiveness of actions taken in accordance with the Improvement Plan.

EA's review process was divided into several stages, including onsite and offsite planning, onsite data gathering activities, report writing, validation, and review. Planning included discussions with responsible site personnel, determination of the operations to be reviewed, scheduling of the review, collection of applicable site procedures and documents, and document reviews. After the onsite data collection period, a draft independent review report identifying overall perspectives, deficiencies, and OFIs was made available to line management for review and feedback. Finally, EA briefed the results of the review to key managers, consistent with NNSA program office and site needs.

5.0 RESULTS

5.1 Criticality Safety

This section discusses EA's assessment of:

- CSP implementation at PF-4 after the pause in operations in June 2013
- Technical basis for the selection of criticality safety requirements
- Management processes intended to provide assurance that criticality safety requirements are implemented and maintained
- Communication of criticality safety requirements to the workers in PF-4.

Criteria:

Criticality safety controls are crafted using sound engineering/scientific principles (e.g., defense in depth, conservative design margins, and human factors engineering) and appropriate standards, including the American National Standards Institute/American Nuclear Society (ANSI/ANS) Series 8 Standards, as applicable. [DOE Order 420.1C, Chapter III, 3.b, 3.d and 3.f; ANSI/ANS 8.1, 4.2 and 4.3.3]

Management organizational structures and systems provide assurance that criticality safety controls are implemented and are being maintained such that they will fully and reliably perform their safety functions over the life of the facility. [DOE Order 420.1C, Chapter III, 3.b and 3.f; ANSI/ANS 8.1, 4.1.1, 4.1.5 and 4.1.6; ANSI/ANS 8.19 4.5, 4.6, and 4.7; and DOE-STD-1158, 1.0, Criteria 4.5, 4.6, and 4.7]

Criticality safety controls and how they are implemented are adequately communicated to workers via training, statements in procedures, workplace postings, and other operator aids as appropriate. The need for material labeling and other identifiers used to prevent criticality is understood and are adequate i.e., workers may readily verify limit compliance. [DOE Order 420.1C, Chapter III, 3.b; ANSI/ANS 8.1,

4.1.1, 4.1.3, and 4.1.4; ANSI/ANS 8.19, 5.3, 7.6, and 9.4; and DOE-STD-1158, 1.0, ANSI/ANS 8.20, 6.1 and 6.2; and DOE-STD-1158, 2.0, Criteria 5.3 and 5.6]

2013 Criticality Safety Pause Recovery Plan

To resolve the issues identified through LANS and NNSA assessments and causal analyses, LANS prepared the Improvement Plan, which contained seven goal statements. Two of those goals focused on improving nuclear CSP implementation and ensuring the sustainability of nuclear criticality safety improvements. During the EA review, LANS personnel presented the crosswalk table linking the deficiencies identified in the NNSA and LANS assessments and the corrective actions and improvements identified in the *TA-55 Criticality Safety and Conduct of Operations Improvement Plan*. The crosswalk clearly identified the PFITs actions which were assigned for each issue and all issues had been assigned corrective actions. The Improvement Plan was focused on PF-4; therefore, the 2014 PMP was developed to identify improvement initiatives for the laboratory-wide issues and associated corrective actions.

The resumption of FMOs used an appropriate risk-based approach that allowed for the restart of the lower criticality risk FMOs with reduced fissile material mass limits and the implementation of the LANS Resumption Release Process, which revised and verified the adequacy of the operating procedures, criticality safety requirements, and conduct-of-operations implementation for FMOs. The reduced mass limits provided a greater margin of safety to justify continued operations with known deficiencies in criticality safety evaluations and conduct-of-operations performance. The resumption process was intended to ensure safe operations and acceptable criticality safety postings during updating of the CSEDs to be fully compliant with the requirements in System Description (SD)-130, *Nuclear Criticality Safety Program*. A review of a sample of ongoing FMO's s indicated the resumption process was effective in achieving a safe FMO.

Between the pause in June 2013 and the present, LANS has hired criticality safety staff with varying levels of experience, from recent college graduates to personnel with decades of criticality safety experience in the DOE complex. In addition to restoring the criticality safety staff, LANS's main focus has been the actions to resume FMO activities and correct the criticality safety deficiencies to meet the requirements of SD-130. To coordinate the correction of the CSP implementation deficiencies across LANL, LANS prepared the PMP, dated June 30, 2014, which established five elements and supporting actions but did not adequately analyze and explain how the proposed plan of actions would revise the LANS CSP to be fully compliant with the requirements of DOE Order 420.1C, *Facility Safety*. Even though the current full implementation status of SD-130 is unclear for the resumed FMO's, a margin of safety is being maintained through reduced fissile mass limits. The reduced mass limits along with the improvements in conduct of operations should maintain the operations safe and accommodate any credible process upset condition. Furthermore, the PMP did not adequately identify the compensatory measures or corrective actions needed for sustained safety performance and a fully compliant CSP supporting restart of the remaining, more complex FMOs. (See **OFI-LANS-01**.)

EA interviewed NA-LA and LANS managers and subject matter experts (SMEs) and examined completed reviews and improvement plans to understand their approaches to resolve the significant list of identified weaknesses in the CSP. Recently, LANS updated its PMP nuclear CSP improvements to manage the resolution of the large number of PFITS action items for deficiencies in meeting SD-130 requirements. Although the update will resolve approximately 250 open actions, EA finds, consistent with NA-LA, that the proposed LANS PMP update is incomplete since it is not sufficient to fully correct all deficiencies and achieve full compliance. NA-LA and LANS continue to work to establish an acceptable PMP. Both NA-LA and LANS are conducting ANSI/ANS 8.19 based assessments to understand the effectiveness of the CSP. LANS completed its compliance assessment in September 2015, while NA-LA completed an assessment in 2014 and is scheduled to complete another in December 2015.

After NA-LA's latest assessment is completed, the full extent of the CSP deficiencies and compensatory measures needed to achieve compliance with SD-130 and the TA-55 TSRs are expected to be identified. (See **OFI-LANS-02**.)

LANS Criticality Safety Compensatory Measures

EA evaluated the multiyear development of compensatory measures. Following the 2013 safety pause, multiple assessments of the CSP resulted in findings and hundreds of PFITS items with associated corrective actions. EA's observation of the resumption efforts indicated progress in resolving the PFITS items, and the corrective actions have improved formality of operations and the overall safety of FMOs. However, the corrective actions focused mainly on those two items and did not clarify the status of LANS implementation of or compliance with SD-130. LANS has missed several opportunities to formally determine the compliance status of its CSP implementation and identify the full set of compensatory measures (e.g., results of ALR process) needed for compliance until the root causes can be corrected to sustain fully compliant performance throughout LANL (not just within PF-4). LANS and the BOM and PFS FRA criticality safety personnel stated and the proposed corrective action schedules show that it will take some years to complete all corrective actions and restore full compliance with the Safety Management Plan.

In 2007, before the 2013 PF-4 safety pause, PF-4 FMOs were suspended due to concerns about the adequacy of the CSEDs. The ALR process, initiated as a compensatory measure, used an expert-based review to ensure that a conservative set of criticality safety limits was established until the CSED documentation could be updated. The ALR process began with the assumption that all evaluations were deficient and reviewed each CSED for the technical adequacy of the CSEDs, the postings, and the procedures, providing a significant margin of safety for FMOs. NA-LA reviewed and accepted the results of the ALR process as a basis for establishing a conservative safety margin to support resumption of FMOs in 2008. However, the ALR process is a compensatory measure that was not formally documented and tracked as such by LANS or NA-LA. The ALR process is also not an SD-130 compliant process to establish criticality safety limits.

LANS has implemented several compensatory measures to ensure that appropriate criticality safety requirements are implemented for safe operations. EA's review of the completed actions from the Improvement Plan, the PMP, and the Resumption Release Process indicated that compensatory actions have addressed deficiencies in the implementation of SD-130, but the actions often were not formally designated as compensatory measures to ensure that they are sustained through resolution of the root causes per the PMP. Furthermore, additional compensatory measures may be required if the upcoming FRA activities identify additional deficiencies. LANS has not developed a complete list of these compensatory measures to justify a conclusion that SD-130 is implemented for all FMOs. The absence of a mutually agreed listing of deficient conditions and compensatory measures could hinder full readiness for future activities. Once LANS has a better understanding of and obtains a common agreement with NA-LA on the deficiencies that impact full compliance with SD-130, compensatory measures may be formally documented to justify continued operations until the CSP is brought into full compliance. (See **OFI-LANS-02**.) The decision to continue operations for resumed FMOs and activities covered by the BOM and PFS FRAs is acceptable because the criticality controls for these activities are less complex than for the work still paused in PF-4, and because the very conservative (low) mass limits have been invoked for this resumed/restarted work.

The next PMP revision presents an opportunity to combine, within one plan, both the corrective action plan to upgrade the SD-130 implementation and the compensatory measures and implementation processes that will ensure sustained safety performance and TSR compliance for the resumed FMOs. In addition, the revised improvement/sustainment plan could establish a mechanism for feedback between

the compensatory measures/sustainment actions for resumed FMOs and the corrective actions to improve SD-130 implementation. (See **OFI-LANS-01**.)

Results from Completed PF-4 Federal Readiness Assessments

EA's observation of the criticality safety activities for the BOM and PFS FRAs indicated that the criticality safety core functions were thoroughly reviewed by FRA team members which were qualified criticality safety SMEs with multiple years of experience. The FRA team members were selected from other DOE sites and were independent of LANL operations. Observation of the daily FRA activities indicated the team members worked together well and conducted a thorough and detailed review of the demonstrations of the field activities, compliance with the associated operating procedures, and adequacy of the criticality safety evaluations. The series of FRAs to restart PF-4 to date have not included an overall compliance review of the CSP defined by SD-130. The BOM FRA recommended that NA-LA conduct a full review of the CSP. In general, NA-LA and LANS worked together to identify and agree on which operations may be restarted under reduced mass limits to compensate for the identified issues in CSP implementation and the multiple deficiencies in the CSEDs. The initial two FRAs addressed less-complex FMOs and focused attention on bringing the BOM into compliance with the currently known issues with the CSP. However, in the absence of full identification of the deficiencies associated with SD-130 implementation, LANS may be challenged with restarting and in sustaining safety performance with the more complex FMOs. (See **OFI-LAN-01**.)

LANS Management Engagement and Leadership

EA conducted many interviews and field observations with supervisors, division managers, and program managers. These personnel in leadership positions fully embraced, and showed by their actions, increased attention to ensuring that programmatic work is safely performed at PF-4, as demonstrated by performing work in accordance with both posted criticality safety requirements and written procedures, regardless of production pressures. The PF-4 managers have demonstrated that operations were not resumed until readiness was properly validated. For low mass limit criticality activities, management validation included ensuring that workers were properly trained and qualified, approved criticality safety postings were in place, procedures were validated and approved, and operations were fully demonstrated to the management team prior to resumption. For higher mass limit FMOs management assigned the necessary resources to ensure that these activities had the proper criticality safety evaluations, qualified operators, procedures, and equipment. The BOM and PFS activities were reviewed by separate management self-assessment (MSA), contractor readiness assessment (CRA), and FRA teams. High mass limit FMOs are to be restarted only after these reviews are completed in order to ensure that all required, relevant corrective and/or compensatory actions are completed. The PF-4 management team also fully encourages workers to stop work when there is any safety question or potential problem with a procedure. In addition, if an infraction occurs, formal processes are in place and routinely used to conduct fact-finding meetings. EA observed several of these meetings, and they were generally well conducted, are supported by management, and provide good lessons learned and/or corrective actions to improve the safety of operations. The management team at TA-55 understands the significance of the safety issues that led to the 2013 pause and is taking active steps to develop and implement the necessary changes in processes and behaviors necessary to fully resume operations at PF-4.

Nuclear Criticality Safety Board

LANS established a Nuclear Criticality Safety Board (NCSB) to administer and implement the nuclear CSP at TA-55, as identified in administrative procedure TA55-AP-522, *Nuclear Criticality Safety Program at TA-55*. EA interviewed the NCSB chair and several board members, including the Criticality Safety Division group leader and the Facility Operations Director, and observed several fact-finding

meetings led by the NCSB. The NCSB chair is well qualified, experienced, and knowledgeable in criticality safety and the issues and corrective actions for PF-4. Management within TA-55 adequately uses the NCSB to direct and track improvements in the CSP and implementation at PF-4. Each quarter, the NCSB reviews, through a formal Management Review Board, all criticality safety issues and the adequacy of associated corrective actions to prevent recurrence. The Board ultimately ensures the effective completion of identified corrective actions. The NCSB also reviews and evaluates PMP corrective actions prior to formal closure. Other NCSB functions include sponsoring self-assessments per DOE-STD-1158, *Self-assessment Standard for DOE Contractor Criticality Safety Program*, and developing criticality safety lessons learned for the PF-4 workers to improve implementation of the CSP at PF-4. The NCSB also maintains a priority listing of near-term corrective actions for the most significant open PFITS items.

Criticality Safety Program Technical Safety Requirements

LANL TA-55 TSR Administrative Control (AC) 5.6.6, *Criticality Safety Program*, specifies that a CSP is implemented and maintained for PF-4 operations in accordance with the ANSI/ANS 8.1 Standard via SD-130. The Criticality Safety group provides day-to-day guidance on criticality safety to organizations working with fissile materials. However, the TSR statement only commits to implementation of ANSI/ANS 8.1, not to all applicable ANSI/ANS Subcommittee 8 National Standards required by DOE Order 420.1C and the associated DSA. Even though AC 5.6.6 does not fully identify the requirements to be implemented, EA's review of SD-130 indicated that the full scope of applicable ANSI/ANS Subcommittee 8 Standards were evaluated for program implementation and included in SD-130. SD-130 defines the appropriate elements of a CSP and, if fully implemented, would fulfill the expectations of TSR AC 5.6.6, DSA, and DOE Order 420.1C. However, since the expectations of the DSA for CSP requirements should flow down from the DSA through the TSRs, AC 5.6.6 should be revised to properly reference all of ANSI/ANS Subcommittee 8 Standards. (See **OFI-LANS-03**.)

LANS Actions Following the 2013 Pause

Following the pause in June 2013, LANS assessment results indicated that its CSP implementation was deficient and had to take action to ensure that the criticality safety requirements have a sound engineering/scientific basis with conservative design margins. Given the identified deficiencies from assessments, LANS criticality safety staff once again adequately examined the adequacy of the technical basis captured within the CSEDs and supporting technical documents to verify that they would provide a sufficient safety margin for each FMO across LANL. Except for PF-4, LAN's examination found all the CSEDs to be adequate. For the PF-4 CSEDs, the criticality safety analyst identified weaknesses in that some CSEDs did not evaluate a water ingress (flooding) scenario. For this analysis deficiency, LANS prepared an evaluation of the safety of the situation, which identified additional compensatory measures to address the evaluation deficiency, was approved by NA-LA, and was implemented as a supplement to the deficient CSEDs. NA-LA and LANS appropriately concluded that the evaluation of the safety of the situation and the results of the ALR process have established a sufficient safety margin to allow the FMOs with lower criticality risk to restart through the documented resumption process.

Criticality Safety for Resumed Activities

To resume a majority of the FMO activities, LANS implemented its Resumption Release Process, which supports resumption of the lower criticality risk FMOs. The process uses a series of checklists to verify that the criticality safety and conduct-of-operations requirements were properly flowed down and formally implemented for each FMO. EA's review of this process and the resulting documentation indicated that the process was thoroughly conducted to verify implementation of criticality safety requirements and formality of operations in accordance with conduct-of-operations expectations.

EA observed several activities that were resumed under the Resumption Release Process. These included non-destructive assay (NDA) of plutonium-contaminated waste in 55 gallon drums and activities associated with the repack, consolidation, and disposal project; vault activities; Pu-238 project activities; and the removal of clean and contaminated trash from the PF-4 rooms. All activities that EA observed were in compliance with the criticality safety requirements posted for the activities, and the personnel conducting the activities were knowledgeable of the associated criticality safety requirements.

In all of the observed FMO activities, the criticality safety limits and requirements were properly communicated to the operators, either through posting at the work stations or through specific identification in the detailed operating procedures (DOPs). The operators demonstrated good adherence to the posted criticality safety requirements. All fissile material containers and staging locations were properly labeled to indicate the material types and masses so that the operators could verify compliance with criticality safety limits. Operations personnel demonstrated a thorough knowledge of the criticality safety requirements for their assigned FMO. When questioned on whether the new formality of operations requirements to verify compliance with the criticality safety limits was a burdensome work practice, operators responded that it was definitely not burdensome and that they should have been conducting operations that way from the beginning. In addition to embracing the new formality of operations expectations, operators strictly complied with criticality safety requirements and stated that if they encountered a change in operational conditions, they would not hesitate to pause the activity to obtain clarification from the immediate supervisor on required actions to proceed.

The NDA operations activities observed were of low complexity, and the operators were knowledgeable of the activities and the DOPs. The DOPs for most activities are designated as reference, and when asked, the NDA personnel were able to immediately produce an electronic controlled copy of the reference DOP documentation. EA reviewed the DOPs and observed the activity to load a 55 gallon drum into the NDA equipment to measure the fissile material quantity in the waste drum. The operators conducted the activity in compliance with the reference DOPs.

In further review of the DOPs and criticality safety documentation associated with staging waste drums for NDA activities, EA found that the DOPs could result in conditions that may deviate from criticality safety limits before measurement of the actual quantity of fissile material in a waste drum. This potential infraction condition arises because the waste drums are shipped to the NDA area under a criticality safety limits approval (CSLA) with a ≤ 200 gram limit based on process knowledge. When the drum arrives in NDA, the drum is staged in a one by five array marked on the floor, with no spacing requirements; drums are placed with surfaces touching. The CSLA for the array says the basis for assuming that the drum has ≤ 200 grams is that the waste comes from all over the facility and is composed of items such as gloves, wipes, bags, filters, tools, parts of dismantled process vessels, slag, salts, crucibles, and items that have simply no other path forward but disposal.

Given this broad list of waste streams, generating a waste drum holding more than 200 grams of fissile material would be a rare but expected event. For example, in a recent event, a waste drum was sent to the NDA area and staged in the one by five array awaiting mass verification. The fissile material mass measurement of the waste drum showed that it contained more than 200 grams of fissile material, so the drum was no longer in compliance with the CSLA for the array. The NDA DOP provides no approved directions for dispositioning the over-mass drum. The fact-finding for the event established criticality safety actions for the over-mass drum that required placing it 12 inches from other waste drums. EA observed that the drum in the one by five staging array was posted to maintain the 12-inch spacing.

The criticality safety posting for the one by five array does not recognize staging of waste drums with higher than assumed mass values, and the implementation of criticality safety requirements described in the DOPs and CSLA for NDA activities continues to place NDA activities in conditions that could result

in process deviations and a criticality infraction. LANS identified this weakness in the DOPs and CSLA documentation for NDA activities, as well as a weakness in the process flow that will occasionally result in anticipated over-mass process deviations that would only be revealed late in the process flow, after the waste drum is placed in a staging array. Additionally, the NDA DOP does not provide an adequate disposition strategy for drums over the conservatively set criticality mass limit. (See **OFI-LANS-04.**)

Observation of FRA Activities

The FMOs associated with BOM were of low complexity, and the demonstration of these activities was conducted in a safe and compliant manner. The DOP documents were of sufficient quality to provide for safe conduct of the BOM operations. Since the DOP for conducting lathe activities to open a plutonium component was not available at the time of the FRA, LANL demonstrated lathe activities using a DOP for a segregated 3013 container, and the FRA team reviewed the draft DOP for lathe operations and viewed a video of lathe operations on a plutonium component. The FRA team properly identified a pre-start finding to require approval and implementation of the procedure before lathe activities begin.

The FMOs associated with PFS were of moderate complexity, and the demonstration of these activities was professionally conducted in a safe and compliant manner. The EA review team identified that one activity in the demonstration to the FRA team could conflict with the expectations of a criticality safety limit requirements (CSLR). The CSLR for the room in question designates the whole room as one material control and accountability area, except for a storage location within the room for fissile material. The whole room and the storage location have separate and different criticality safety limits. The storage location is far enough from any process station to be considered isolated and to support a separate limit. However, the CSLR recognizes only one fissile material limit for the general area of the room and is written such that the delivery, processing, and removal of the fissile material from the room would be controlled under the single room limit and not the storage location. If fissile material is being processed in the room and additional fissile material is brought into the room for storage or staging, the additional material must be evaluated against the overall room mass and compared to the limit for the room – not the storage location – until it is placed in the storage location. Interviews with operations staff and PFS management indicated different opinions about control of the additional fissile material mass being brought into the room. The FRA team identified this issue to LANS management during the daily FRA closeout and as a post-start finding since the technical safety basis of the cart used to transport the material did not explicitly address potential interactions of material on the cart with material in nearby locations.

Summary of Criticality Safety Conclusions

Observation of the FRA activities for both BOM and PFS indicated that the criticality safety core functions were thoroughly reviewed by qualified criticality safety SMEs with multiple years of experience. Overall, LANS has adequately implemented appropriate measures to ensure that a conservative set of criticality safety requirements is implemented and that the resumed and restarted FMO activities at PF-4 are safe. It was apparent that the management team at TA-55 understands the significance of the safety issues that led to the 2013 safety pause and is actively working to develop and make the necessary changes in processes and behaviors to fully resume operations at PF-4.

TA-55 has established an effective NCSB that routinely reviews all criticality safety issues and the adequacy of associated corrective actions to prevent recurrence. The NCSB ultimately ensures the effective completion of identified corrective actions.

The PF-4 operators involved in the observed FRAs demonstrated a thorough knowledge of and adherence to the posted criticality safety requirements. All fissile material containers and staging locations were

properly labeled with material types and masses for the operators to verify compliance with criticality safety limits. The operators have embraced the new formality of operations expectations and strict compliance with criticality safety requirements, and indicated that they would not hesitate to pause the activity and obtain clarification from their immediate supervisor if they encountered a change in operational conditions.

Corrective actions to date have focused mainly on improving the formality of operations and overall safety of the FMOs, not on fully clarifying the implementation status of SD-130. LANS has missed several opportunities to formally determine and declare the compliance status of the CSP implementation and to identify the full set of compensatory measures (e.g., results of ALR process) needed to establish compliance until the deficiencies in the program implementation can be corrected.

5.2 Conduct of Operations

EA reviewed conduct-of-operations performance for PF-4 FMOs to ensure an adequate level of protection for workers, the public, and the environment. This review focused on LANS's corrective actions to address the root causes from the pause in operations in June 2013 and LANS's implementation of portions of DOE Order 422.1, *Conduct of Operations*, via LANS's *Conduct of Operations Manual*, P-315.

Criteria:

Criticality safety controls and how they are implemented are adequately communicated to workers via training, statements in procedures, workplace postings and other operator aids as appropriate. The need for materials labeling and other identifiers used to prevent criticality is understood and are adequate, i.e., workers may readily verify limit compliance. [DOE Order 420.IC, Chapter III 3.b; ANSI/ANS 8.1, 4.1.1, 4.1.3 and 4.1.4; ANSI/ANS 8.19, 5.3, 7.6, and 9.4; ANSI/ANS 8.20, 6.1 and 6.2 and DOE-STD-I 158, 2.0, Criteria 5.3 and 5.6, 1st bullet]

Non-adherences to controls are investigated, corrected, and documented. Additionally, cases where controls are discovered to be confusing or inadequately understood are resolved whether or not an actual non-adherence occurs. [DOE Order 420.IC, Chapter III 3.b; ANSI/ANS 8.19, 7.7 and DOE STD 1158-2002, 3.0, Criterion 6.7]

*Formal processes have been established to control programmatic equipment to ensure that proper operational configuration control is maintained in accordance with DOE Order 422.1, *Conduct of Operations*.*

Causal Analysis and Corrective Action Plan

Following the pause in operations in June 2013, LANS appropriately chartered comprehensive reviews by both an internal and an external team to review LANS's CSP and conduct of operations for TA-55 FMOs. The resultant causal analysis and the report documented in LA-UR-13-29297, *Criticality Safety Infractions Causal Analysis*, dated November 12, 2013, and LANS report U1400044, dated October 7, 2013, adequately identified the following causes for the weaknesses leading to the pause in operations:

- **Management Commitment & Communication:** Management has not yet fully embraced its commitment to criticality safety, self-discovery, communication to the worker, and continuous improvement.

- Roles, Responsibilities, Authorities, and Accountabilities: Roles and responsibilities are not yet clearly documented, flowed down, or understood. Authorities and accountabilities are not yet clearly defined or implemented.
- Conduct of Operations: Improvement has not kept pace with expectations and the rigor necessary to compensate for reduced criticality safety analyst resources.
- Performance Assurance: Processes are not effective in identifying discrete problems in order to drive enduring improvements.
- Criticality Safety Resources: Losses in personnel and corporate knowledge continue to challenge the viability of the criticality safety program.

LANS subsequently developed its Improvement Plan, dated December 6, 2013, to address the deficiencies in conduct of operations, personnel training, and CSP implementation. Additionally, one of the major plan elements focuses on improvement sustainability over the long term for safe and efficient operations in PF-4. The plan has actions to revise the level of detail and the execution of procedures, improve criticality safety postings, revise worker training and qualification, address elements of conduct of operations, and sustain improvements.

Revised Approach to Procedure Detail Level/Execution

LANS revised its procedure format and execution to make their format and content more consistent and easier to execute as written. Improvement actions included evaluating which work documents and procedures need to be used every time and which are simply available to workers as a reference, developing and implementing processes and infrastructure to manage and access procedures electronically, streamlining the process for developing and changing procedures, and conducting annual performance-based assessments of procedural compliance.

DOPs are used to authorize work with a specific system, and Special Process Instructions are used for specific process operations. The sample of DOPs that EA reviewed adequately convey the expectations for stopping/pausing work, hazards associated with the system, criticality safety limits, TSRs, training and qualification requirements for workers and supervisors, and general requirements for using the procedure. The reviewed sample of Special Process Instructions adequately provided instructions for performing specific processes, and they are to be used only in conjunction with the parent, work-authorizing DOP for the applicable system.

The DOPs used for the demonstrations during the PFS FRA were labeled as reference procedures, and the Special Process Instructions were designated as Use-Every-Time (UET) procedures (i.e., procedures that are followed step by step during the execution of work activities). The Associate Director Plutonium Science and Manufacturing (ADPSM) directed (via a memorandum ADPSM: 14-032 dated August 1, 2014) that process-specific, nuclear work authorizing documents (e.g., DOPs) are to be executed as UET procedures, including those designated as reference procedures. The operators properly demonstrated the use of DOPs as UET procedures.

During the review of resumed programmatic work in PF-4, the Person In Charge (PIC) of the work activities adequately executed the work authorizing documents in accordance with this memorandum, ensuring that hazards and safety requirements were discussed during the pre-job briefings and followed during the execution of the work activity. Fissile material handlers and PICs interviewed by EA during the PFS FRA stated that this enhanced formality was the “right way to go” to standardize the execution and control work for FMOs. Despite LANS procedure PA-AP-1016, *Technical Procedure Use & Development Process*, specifying that procedures should be designated as UET for work with higher consequences of failures, training and qualification requirements, complexity, and desired degree of

standardization, work authorizing documents for FMOs in PF-4 are designated as reference procedures. (See **OFI-LAN-5**.) The fissile material handlers and PICs also noted that since the pause, they have been actively involved in revising and improving the procedures “to make them workable,” and the time to revise and approve procedure changes was significantly reduced to a more reasonable period.

EA discussed the status of LANS efforts to update its procedures with the TA-55 Senior Advisor. In 2013, over 400 procedures needed to be updated. As of June 2015, 3 integrated work documents, 25 DOPs, 15 surveillance test procedures or in-service inspection procedures, 12 radiation protection procedures, 4 administrative procedures, and 9 system alignment checklists still needed to be updated. Since June, approximately half of the TSR-related procedures have been reviewed and revised.

Criticality Safety Requirements Flowdown to Postings

Postings and documents reviewed during EA tours and observations of programmatic work were properly updated to reflect the clarified criticality safety requirements. Additionally, operators and PICs of work activities stated and demonstrated that they were able to understand the new posting and criticality safety requirements in programmatic work documents. During the PFS FRA, however, EA identified to the FRA team a potential issue between the criticality safety posting for a room and the movement of material through this room. The details of this issue were included in the FRA report for the PFS for resolution (also see Section 5.1 above, under Observation of FRA Activities).

Revised Approach to Worker Training and Qualification

LANS made improvements to the criticality safety training for fissile material handlers and strengthened core qualification requirements for them and glovebox workers for the major PF-4 programmatic work areas. The programmatic work procedures were then streamlined to consider these core requirements. LANS also developed on-the-job-training (OJT) using mockups and supervised instruction by qualified instructors in PF-4 work areas to support worker qualification.

EA observed one OJT session using a “cold lab” mockup, two workers performing work under instruction during PFS FRA evolutions, and one OJT session with the trainee supporting Pu-238 operations under instruction. The OJT mockup training effectively included a mix of small-group tabletop discussions of requirements, good work practices, and emergency response actions, followed by practical demonstrations on the mockup. Four trainees, an instructor, and a manager overseeing the training participated in the observed training session. The cold lab had the capacity to support twice as many trainees. The unqualified workers stated that performing work under instruction helped them develop the process-specific skills they need to perform the duties of a fully qualified worker. The PICs demonstrated acceptable control of the trainees during demonstrations and operations.

Conduct-of-Operations Elements

Programmatic Worker Staffing Plans. The ADPSM chief of staff discussed with EA the ADPSM staffing plans to ensure that adequate numbers of trained personnel are available, in light of ADPSM’s projected attrition and projected funding for future work. Overall, ADPSM is planning to hire 200 workers over the next five years to support the ADPSM projections for future work, taking into consideration the time needed for these workers to obtain security clearances, qualify, and become proficient in the process-specific skills. Although ADPSM has historically hired only 10 to 20 personnel per year, 53 personnel were hired in fiscal year 2015, demonstrating that ADPSM human resources personnel can support the increased rate of hired employees. The ADPSM chief of staff also confirmed that LANS has the capacity to train the projected number of personnel to be hired.

Shift Routines and Operating Practices. During the work activities EA observed, workers and supervisors were attentive to daily announcements of changes in facility status.

Control Area Activities. During the work activities EA observed, workers adequately notified the PF-4 operations center before initiating work. Access controls were established, and operations were professional. System status and the status of outstanding inspections and surveillances were readily displayed.

Communications.

Communications between operators and PICs were adequate during the work activities EA observed. Pre-job briefings were interactive, and some PICs prompted more interactive pre-job briefings by quizzing operators on hazards and the process steps while other PICs simply reading through procedures and then asked operators whether they had any questions. During the work, operators repeated back instructions prior to execution of work.

EA's interviews of fissile material handlers, engineers, first line managers, and group leaders identified that they have only a very basic understanding of the problems that led to the pause in operations (e.g., they stated that there were problems with criticality safety and that procedures were not followed). They were not familiar with the root cause analysis or the goals and objectives of the Improvement Plan. (See **OFI-LANS-7**.)

Control of Equipment and System Status. During EA's observation of work activities supporting the PFS FRA, operators and PICs mostly demonstrated adequate knowledge and control of system and equipment status, but the EA and FRA team observers noted potential improvements in the operating procedures for establishing valve lineups for low pressure gas operations. For example, the procedure was unclear on the expected initial position of valves, simply stating that the operator should ensure that a valve was open instead of providing more specific direction to open or check open the valve. The FRA report for the PFS noted this issue.

Operator Aid Postings. EA found a few instances of informal (uncontrolled) postings, some uncontrolled operator aids, and several informal postings for out-of-service equipment. EA observed these items in the NDA laboratory, Alpha Spectrometry, and the vault area and discussed them with the Operations Manager. For example, for the NDA measuring equipment for waste drums, the control panel had an informal operator aid posted over the start button to ensure that a padlock was removed before turning on the equipment and later adjusting the equipment to physically receive a waste drum; if the padlock and cable system is engaged when the drum holder position is adjusted, the equipment could be damaged. The padlock and cable are intended to physically restrict the motion of the drum holder to ensure that the drum could not be removed from the measuring equipment. This informal operator aid was a plain sheet of paper with a handwritten note and did not meet LANS requirements for an operator aid. This aid was still in use during the PFS FRA in November, even though EA identified this concern to LANS staff during the BOM FRA in June. (See **OFI-LANS-9**.)

Improvements in Sustainability of Conduct of Operations

As noted in the LANS December 2013 Improvement Plan, actions to sustain improvements in conduct of operations include actions to redefine and communicate roles, responsibilities, accountabilities, and authorities and develop, communicate, and monitor expectations for ADPSM management engagement and oversight of procedure adequacy and compliance.

The LANS actions to redefine and assign roles, responsibilities, accountabilities, and authorities to clarify work authorization in PF-4 at the room and glovebox levels was documented by NCO-D0:2014-003, *Closure Package For PFITS #2014-85 (Action 7.2.1)* dated March 12, 2014. This memorandum summarized the changes in roles for wing controllers, wing and room owners, managers, and supervisors to improve work control for PF-4. Wing controllers are trained surveillance performers and conduct the daily combustible loading inspections and other reviews to establish the basis for posting and releasing the room for work. Interviews during the EA review indicated that the revisions to work control methods were understood and appropriate. The EA team also observed adequate implementation of the work control process during observations of resumed work.

One of the sustainment actions in the LANS Improvement Plan is to perform assessments of procedural compliance in accordance with LANS *Management Assessment*, P-328 every six months. Over the past year, LANS performed four of these assessments. While these assessments were informative, they were limited to observations of only a few selected work activities and lacked a more comprehensive review of worker performance in conduct of operations since the last assessment. (See **OFI-LANS-8**.)

The sustainability strategy also involved managers performing work area observation and mentoring during work activities. The ADPSM initially required managers to observe work activities once a month using the LANS Management Observation and Verifications (MOV) process. The frequency was increased to two MOVs a week to ensure adequate oversight, considering the complexity of operations in TA-55 associated with the resumption of many plant operations with updated procedures and criticality safety guidance, implementation of new criticality safety guidance, and readiness activities for many PF-4 processes. LANS later required managers to increase their field presence to 25% of their time and to continue performing MOVs, but removed the expectation for the number of MOVs to be performed (allowing some of this field presence to be conducted outside the MOV process). Despite the significant improvements in the programmatic workers' training and qualification programs, the ADPSM requirements for MOVs have not included any direction or expectations for performing MOVs of worker training or qualification processes to ensure that the goals of the Improvement Plan are sustained. (See **OFI-LANS-6**.)

Overall, management oversight of restart activities has diverted resources from the oversight of resumed work that LANS intended to use to sustain adequate conduct of operations for this work. Over the past year, the average number of MOVs that managers performed for ADPSM has been small (approximately two per month), and the quality and scope of the documentation of some of the MOVs are relatively superficial. For example, many of the over 360 MOV reports submitted in July through October 2015 provided very good summaries of the evolutions performed, but most of the narratives in the MOV documentation provided only two sentences or less related to feedback or coaching. Approximately 11% did not include a narrative, and 4% were not related to FMOs (e.g., they were tours of office spaces and observations of pedestrian crossings). Group leaders are also unaware of, or do not have the time to support, the MOV process. For example, a group leader in the Manufacturing Engineering and Technologies Division supporting PFS work at PF-4 stated that he did not have time to perform MOVs during restart activities, and a group leader in the Nuclear Components Operations Division did not know that MOVs were assigned to him to ensure that improvements in the conduct of operations were sustained.

As a separate sustainment effort, the LANS Associate Director for Nuclear and High Hazard Operation (ADNHOO) issued the *Conduct of Operations Maturity Plan*, dated August 14, 2013, to improve the conduct of operations across LANL. The Operations Support Division Leader within the ADNHOO organization stated that independent evaluations of ongoing work (i.e., "Find-it Fix-it" efforts) for conduct of operations per this maturity plan were suspended in order to focus these resources on restart

activities. As a result, no routine self-assessments of conduct of operations are currently being conducted for resumed activities at PF-4, contrary to the *Conduct of Operations Maturity Plan*.

As more production areas are restarted, LANS will have a larger scope of active work for which LANS management will have to ensure sustained performance improvements, in parallel with managing the remaining restart efforts. LANS management has not updated its planned actions to sustain conduct-of-operations performance to support the growing scope of active (resumed and restarted) work in TA-55 while also supporting the readiness assessments of the production areas remaining to be restarted. (See **OFI-LANS-6**.)

Summary of Conduct-of-Operations Conclusions

Overall, LANS actions to revise the level of detail and the execution of procedures, improve criticality safety postings, and revise worker training and qualification have significantly improved conduct of operations for FMOs in PF-4. Workers stated that their input on procedure changes is valued more than in the past and that changes are more timely. Many of the changes made since the pause in operations in June 2013 have been codified (e.g., changes in the worker and management training and qualification programs and individuals' roles and responsibilities) to help maintain improved performance. However, LANS has not fully encouraged and obtained the engagement and feedback from its workers to further improve performance in its development of workable corrective actions and more informed execution of corrective actions and improvements resolving the weaknesses that led to the pause in operations.

Oversight of restart activities has diverted resources from the oversight of resumed work that LANS also intended to use to sustain adequate conduct of operations. As more production areas are restarted, LANS will have a larger scope of active work for which LANS management is responsible for ensuring that performance improvements are sustained, while also managing the remaining restart efforts. LANS management lacks an updated plan to sustain conduct-of-operations performance to support both the growing scope of active (resumed and restarted) work in TA-55 and the readiness assessments of the remaining production areas. The divisions are not performing comprehensive, periodic self-assessments to proactively identify and resolve future declines in performance earlier and to allow more senior management to focus on systemic issues that include multiple divisions or functional areas.

5.3 LANS Feedback and Improvement

EA evaluated a portion of LANS's corrective actions for the following root causes that LANS determined had contributed to the pause in operations in June 2013:

- **Management Commitment & Communication:** Management has not yet fully embraced its commitment to criticality safety, self-discovery, communication to the worker, and continuous improvement.
- **Performance Assurance:** Processes are not effective in identifying discrete problems in order to drive enduring improvements.

Criteria:

The contractor's assurance system monitors and evaluates criticality safety and operations of programmatic work, and effectively utilizes performance indicators/measures in identifying performance trends and potential problems, allocating resources, and applying lessons learned and good practices.

Formal processes are in place and effectively implemented to identify and analyze criticality safety and operations of programmatic work problems and issues; including operational events; to identify, track,

monitor, and close corrective actions; to verify the effectiveness of corrective actions; to identify lessons learned from external and internal sources; to disseminate lessons learned to appropriate personnel; and to ensure that lessons learned are understood and applied.

Formal programs and processes have been established and effectively implemented to solicit feedback from workers and programmatic work activities on the effectiveness of criticality safety and operations, and to apply lessons learned.

Management Communication since the Safety Pause

Following the pause in operations in June 2013, LANS management met with workers to communicate management's expectations for procedure compliance. As noted above in Section 5.2 under Revised Approach to Procedure Detail Level/Execution, in August 2014 the ADPSM directed that process-specific, nuclear work authorizing documents are to be executed as UET procedures, even those designated as reference procedures. Implementation of these expectations and direction was evident during EA observations of resumed work and the work activities demonstrated during the FRAs.

However, EA's interviews with fissile material handlers, engineers, first line managers, and group leaders identified that they have only a very basic understanding of the problems that led to the pause in operations (e.g., they stated that there were problems with criticality safety and that procedures were not followed). They were not familiar with the root cause analysis or the goals and objectives of the Improvement Plan. (See **OFI-LANS-7.**)

Self-discovery of Issues and Performance Assurance

EA's review of the critiques and Occurrence Reporting and Processing System (ORPS) reports over the past year identified seven ORPS reports on surveillances and inspections of significant safety systems that were not adequately completed at the required periodicity. In many of these reports, operations personnel performed inspections and surveillances within the required time frame, but the cognizant system engineer's reviews later identified deficiencies in the surveillances and inspections. These ORPS reports included actions to adequately complete these surveillances and inspections and to perform extent-of-condition reviews to find other similar missed inspections, but they did not discuss the contributing causes that allowed this trend to continue. (See **OFI-LANS-8.**) EA examined the systems and equipment for these surveillances and inspections and found only minor deficiencies that did not impact worker safety or the safety of the general public.

The Nuclear Criticality Safety Division adequately conducts comprehensive quarterly assessments of its performance to better manage and improve the LANL nuclear CSP. These assessments were developed using metrics that are based on best practices from across the DOE complex and provide leading and lagging indicators of the Nuclear Criticality Safety Division's performance. For example, the assessments address recent events and infractions (reportable and non-reportable), the backlog of field support requests and criticality safety evaluations, staffing, and measures of staff field presence to proactively self-identify trends in performance and to help the division's management make informed decisions. Organizations within ADPSM do not periodically issue comprehensive assessments of their own performance. (See **OFI-LANS-8.**) The lack of comprehensive self-assessments by other organizations, like those performed by the Nuclear Criticality Safety Division, represents a missed opportunity for lower level management to proactively self-identify and resolve potential systemic issues allowing senior management to focus on larger systemic and programmatic issues (e.g., whose scope extends outside of a single division within TA-55).

Restart MSA and CRA

As part of the restart of the selected activities, LANS has adequately conducted multiple MSAs and CRAs. As the first step, LANS provided the necessary resources, procedures, staff training, and demonstrations to establish adequate criticality safety and conduct of operations for restart activities. At the appropriate time, each restart activity was reviewed in an MSA and CRA to verify acceptable performance. These reviews have identified issues that were addressed prior to the FRAs. Because the MSA and CRA reviews were thorough, the final FRAs were able to be completed. Although the FRA teams have been able to identify some findings, they have recommended approval to restart the reviewed activities.

NNSA and LANS Reviews of the Criticality Safety Program

Several different internal and external reviews with different objectives and scopes were conducted over a span of several years. LANS adequately used most of these assessments to define corrective actions to restore CSP implementation and formality of operations after the decision to pause all PF-4 FMOs. EA therefore evaluated how effective LANS's actions based on these reviews have been in driving improvements in the LANL and TA-55 CSP. Overall, the CSP has improved in many areas, but remains not fully compliant with SD-130.

LANL conducted a CSP assessment, SBD-CS-PLAN-13-001-R0, *Nuclear CSP Assessment*, in April 2013, and then in May 2013 conducted an organizational learning, development, and conflict resolution review that consisted of interviews of past and current criticality safety staff (known as the Lande Report). Additionally, the DOE Criticality Safety Support Group (CSSG) conducted an assessment in May 2013, CSSG Tasking 2013-02, *CSSG Assessment of Scope of Operations and Criticality Safety Staff Capacity and Review of LANL CAP and Metrics for the Nuclear CSP*. After the June 2013 pause in operations, LANL conducted a causal analysis on criticality safety infractions, LA-UR-13-29297, *Criticality Safety Infractions Causal Analysis*; an implementation review of safety management programs at PF-4, ADPSM-14-049, *Red Team Review of the Safety Management Programs Supporting the TA-55/PF-4 Facility*; and a Laboratory Director external review, *External Review of the Los Alamos Nuclear CSP*. None of these reports, individually, constituted a complete CSP implementation review; rather, each review evaluated some elements of the CSP implementation, with some amount of overlap between the reviews. In summary, those reviews found that:

- The technical adequacy of the CSP implementation cannot be endorsed.
- Management has not yet fully embraced its commitment to criticality safety, self-discovery, communication to the worker, and continuous improvement.
- There is a pervasive culture within LANL of reactive management. This management style is embodied in the failure to fully assess, understand, and correct issues identified within the laboratory.
- Many LANL mid- and senior-level managers deny that any real threat to criticality safety exists, and no genuine effort has been made to change this mindset.
- Processes are not effective in identifying discrete problems in order to drive enduring improvements.
- Roles and responsibilities are not clearly documented, flowed down, or understood.
- Significant weaknesses were found in the implementation of material labeling requirements.
- Significant weaknesses were found in CSEDs.
- Weaknesses were found in the evaluation of the calculation bias and establishment of adequate margin of subcriticality.
- There was an inadequate number of qualified nuclear criticality safety staff, due to attrition resulting from a distrustful relationship between staff and management following the realignment

of the criticality safety group lower down in the organizational structure. The criticality safety staff perceived the organizational changes as punitive.

- There was an inordinately large number of open PFITS items assigned to the Nuclear Criticality Safety Division, many of them dating back several years.
- Trust issues and safety concerns from the Lande Report do not appear to be fully resolved.

In March 2015, NA-LA conducted an operational awareness activity and assessed the status of SD-130 compliance using ANSI/ANS 8.19 as review criteria. This NA-LA assessment identified several elements that were fully compliant, deficient (not compliant), or marginally deficient (several sub-elements of the CSP main element were not compliant). The results of this assessment were not documented in a formal assessment report but were provided to LANS via an email. LANS completed a review of the CSP implementation in September 2015. EA developed the following table to provide a crosswalk between the normally accepted elements of a CSP based on ANSI/ANS 8.19, and the results of the key assessments previously described.

Element Number	Criticality Safety Program Element	LANS & CSSG Reviews 2012 & 2013 Time Frame (e.g., red team)	NA-LA Compliance Status Based on ANSI/ANS 8.19 2014	LANS CSP Implementation Review September 2015
1	CSP Program Documentation SD-130, <i>Nuclear Criticality Safety Documentation</i> ,	Compliant	Compliant	Compliant
2	Management Responsibilities, ANS 8.19 Section 1.0	Deficient	Deficient	Marginally Deficient
3	Criticality Safety Staffing and Qualification, ANS 8.19 Section 4.4	Deficient	Marginally Deficient	Improving
4	Criticality Safety Evaluation Development and Approval, ANS 8.19 Section 8.1, 8.3	Deficient	Deficient	Deficient
5	Criticality Safety Evaluation Implementation, ANS 8.19 Section 5.1 -5.7, 7.1, 7.2	Compliant	Compliant	Compliant
6	NCS Posting/Labels, ANS 8.19 Section 7.6	Compliant	Compliant	Compliant
7	NCS Assessments, ANS 8.19 Section 4.6, 4.7, 6.6, 6.7	Deficient	Deficient	Marginally Deficient
8	NCS Infractions and Non-compliances, ANS 8.19 Section 7.7	Deficient	Deficient	Compliant
9	NCS Training for Workers, ANS 8.19 Section 5.3	Compliant	Compliant	Compliant
10	Criticality Safety Alarm System, ANS 8.19 Section 10.2	Compliant	Compliant	Compliant
11	Response to Criticality Events, ANS 8.19 Section 10.1	Compliant	Compliant	Compliant
12	Formality of Operations, ANS 8.19 Multiple Sections	Deficient	Deficient	Marginally Deficient
13	Fire Fighting Requirements, ANS 8.19 Multiple Sections	Deficient	Deficient	Deficient
14	Criticality Controls Review Process	Marginally Deficient	Marginally Deficient	Marginally Deficient
15	Closure of open issues associated with Criticality Safety Program	Numerous PFITs Items Being Developed	Numerous PFITs Items Open and ~10% Past Due	Numerous PFITs Items Open and ~15% Past Due

The results of the individual assessments between 2012 and 2015 indicate that CSP implementation has been improving since the pause. Even though the overall CSP implementation has improved, the backlog of open PFITS items remains significant. The Nuclear Criticality Safety Division has been monitoring its backlog of open issues in its quarterly self-assessments, and division management stated that they were formulating a path forward to improve performance in closing PFITS items. Also, LANS and NA-LA differed on the compliance status of some elements of the CSP, notably Infractions and Non-compliances (ANSI/ ANS 8.19, Section 7.7). The difference may be an artifact of the different time frames of the reviews.

Summary of LANS Feedback and Improvement Conclusions

LANS has adequately completed several assessments of the CSP to identify weak areas and develop a supporting corrective action plan. For restart activities, MSAs and CRAs have adequately verified that these operations are prepared for restart and ready for the FRAs. The Nuclear Criticality Safety Division adequately conducts quarterly assessments of its performance to better manage and improve the LANL nuclear CSP. Although the root cause analysis identified weaknesses in the ADPSM's management commitment and communication and in its performance assurance processes, the Improvement Plan did not explicitly address these areas. EA determined that although some improvement is evident, improvement in management communication with workers, support of self-discovery of issues, and performance assurance systems would facilitate continued improvement in criticality safety and the conduct of operations by more proactively identifying and resolving adverse trends in performance early in their development.

5.4 NA-LA Feedback and Improvement

Weaknesses in NA-LA's establishment of a fully effective oversight program are known. NA-LA has faced challenges with recent staff turnover, hiring new staff, and working with a reduced staffing limit. NA-LA has not performed a systematic, formal review of TA-55 conduct-of-operations for several years. NA-LA has requested NNSA support for a review of procedures and of safety basis safety management programs in 2016 including conduct-of-operations. NA-LA is coordinating the several Federal readiness reviews that have been completed or are to be completed for selected activities at PF-4. In addition, NA-LA has conducted, and plans to conduct, its own reviews of criticality safety. EA's review focused on NA-LA oversight at TA-55, where NA-LA has assigned two full-time Facility Representatives and an SME in criticality safety.

Criteria:

DOE field element line management has established and implemented effective oversight processes that evaluate the adequacy and effectiveness of contractor assurance systems and DOE oversight processes. DOE field element line management has established and implemented oversight processes that evaluate contractor and DOE programs and management systems, including site assurance systems, for effectiveness of performance (including compliance with requirements). Such evaluations are based on the results of operational awareness activities; assessments of facilities, operations, and programs; and assessments of the contractor's assurance system. The level and/or mix (i.e., rigor or frequency in a particular area) of oversight may be tailored based on considerations of hazards, and the maturity and operational performance of the contractor's programs and management systems. (DOE Order 226.1B 4b(1))

PF-4 Facility Representatives

The two Facility Representatives assigned to TA-55 that includes PF-4 are the primary source of operational awareness information. They prepare daily reports and rollup reports of facility status and provide them to line management, and they provide findings and significant issues directly to the contractor. The Facility Representatives are closely following both the resumed activities and the activities falling under the formal restart process. They are also overseeing the corrective actions from the different reviews during the restart process (MSAs, CRAs, and the FRA) to determine whether the corrective actions adequately address the findings and are adequately implemented.

Criticality Safety Oversight

Since the operational pause, NA-LA has conducted an ANSI/ANS 8.19 based criticality safety assessment in March 2014 and another DOE-STD-1158 based assessment in December 2015. The NA-LA criticality safety SME understands that the PF-4 criticality safety problems are significant and is actively engaged, concurrent with LANS, in reviewing existing and revised CSED documentation, discussing the resolution of PFITS items, and developing the PMP to ensure resolution of open CSP PFITS items, implementation of SD-130 for compliance with the TA-55 TSRs, and sustainment of CSP implementation well into the future.

EA reviewed the interaction of NA-LA and LANS related to criticality safety issues at PF-4 after the June 2013 pause in operations at PF-4. NA-LA actively provided formal direction to LANS to resolve the identified deficiencies in CSP implementation. In most cases, LANS has adequately responded to formal NA-LA direction/guidance. As one exception, NA-LA has not yet resolved the results of the March 2015 NA-LA criticality safety evaluation that identified inadequacies with the LANS CSP. There was some confusion with the communication of the results of this review between NA-LA and LANS. (See **OFI-NA-LA-01** and **OFI-LANS-01**.)

Federal Readiness Assessment

NA-LA has supported the conduct of the multiple FRAs. Many of the team members for the different FRA teams are staff members from NA-LA, supported directly by NNSA and a senior technical advisor from the DOE Office of Nuclear Safety (AU-31). EA observed that FRAs were well done and that the completed FRAs in the reviewed areas have verified improvements in criticality safety, conduct of operations, and the implementation of the CSP.

Summary of NA-LA Feedback and Improvement Conclusions

NA-LA is actively overseeing fissile material activities and the closure of specific PFITS items established to improve criticality safety and conduct-of-operations performance for work at PF-4. The two PF-4 Facility Representatives adequately review resumed activities and the performance of the FRAs, CRAs, and MSAs for selected restart activities. Since the operational pause, NA-LA has adequately conducted an ANSI/ANS 8.19 based criticality safety assessment and another DOE-STD-1158 based assessment in December 2015. The NA-LA criticality safety SME is actively engaged in reviewing CSED documentation, discussing resolution of PFITS items, and developing the PMP to ensure resolution of open CSP PFITS items, implementation of SD-130 for compliance with the TA-55 TSRs, and sustainment of CSP implementation. The completed FRAs adequately verify readiness to restart an activity and also confirm improved performance in criticality safety and conduct of operations at PF-4.

6.0 FINDINGS

None.

The results section of this report identifies deficiencies including isolated non-compliances that did not meet the criteria for a finding. Site processes should be consulted in response to these deficiencies.

7.0 OPPORTUNITIES FOR IMPROVEMENT

Opportunities for improvement are suggestions offered in Independent Oversight appraisal reports that may assist cognizant managers in improving programs and operations. While they may identify potential solutions to findings and deficiencies identified in appraisal reports, they may also address other conditions observed during the appraisal process. Opportunities for improvement are provided only as recommendations for line management consideration; they do not require formal resolution by management through a corrective action process. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are suggestions offered by EA that may assist site management in implementing best practices or provide potential solutions to issues identified during the conduct of the review. In some cases, OFIs address areas where program or process improvements can be achieved through minimal effort.

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- **OFI-LANS-01:** Consider revising the CSP PMP to establish a more systematic approach to improving SD-130 implementation, clarifying TSR compliance with the criticality safety management program, and achieving sustained safety performance for ongoing FMOs. The combined improvement/sustainment plan should provide for a feedback mechanism between the implementation of compensatory measures and sustainment actions for resumed FMOs and the corrective actions to improve SD-130 implementation.
- **OFI-LANS-02:** Consider taking actions to better understand the SD-130 implementation status and comparing the actions to date against the most recent NA-LA SD-130 compliance assessment. Communicate the results of the evaluation to NA-LA to facilitate a common understanding of the deficiencies in SD-130 implementation and the compensatory measures needed to sustain the implementation of SD-130 and TSR compliance until the CSP improvement efforts are completed.
- **OFI-LANS-03:** Consider revising TSR AC 5.6.6 to include a fuller reference to ANSI/ANS Subcommittee 8 Standards, or a reference to the NA-LA approved CSP document.
- **OFI-LANS-04:** Consider reviewing the DOPs and CSLA documentation for NDA waste drum activities with mass predictions that were generated through process knowledge, and establish a process flow that will not result in discovery of anticipated over-mass process deviations late in the process flow, after the waste drum is in a staging array.
- **OFI-LANS-05:** Consider formally and permanently changing the designation of the programmatic procedures (DOPs) from reference procedures to UET documents. The ADPSM recently, but temporarily, directed via a memorandum that process-specific, nuclear work authorizing documents (e.g., DOPs) are to be executed as UET procedures, even those designated as reference procedures.
- **OFI-LANS-06:** Consider updating the planned actions to sustain conduct-of-operations performance

of the growing scope of active (resumed and restarted) work in TA-55 while also supporting readiness assessments of the production areas remaining to be restarted. Also consider including expectations for management observations of worker training and qualifications in these sustainment actions.

- **OFI-LANS-07:** Consider discussing with personnel throughout TA-55 the root causes that led to the pause in operations, the status of actions to resolve these issues (e.g., per the Improvement Plan), and future actions to help ensure that actions are understood and appropriately implemented and to encourage input on how to sustain and build upon performance improvements.
- **OFI-LANS-08:** Consider directing groups and/or divisions within the ADPSM to periodically issue comprehensive assessments of their performance to improve their ability to self-identify and resolve potential systemic issues.
- **OFI-LANS-09:** Consider conducting a review of postings to ensure proper control of equipment.

NNSA Los Alamos Field Office

- **OFI-NA-LA-01:** Consider performing formal assessments of conduct of operations and criticality safety to ensure that performance in these areas is thoroughly reviewed and that the results are formally presented to LANS for timely resolution.

8.0 ITEMS FOR FOLLOW-UP

EA will conduct a follow-up review of the status of criticality safety PMP actions one year after approval of the revised 2014 PMP.

Appendix A Supplemental Information

Dates of Review

Onsite Review: June 22 to July 1, October 26 to 30, and November 9 to 19, 2015

Office of Enterprise Assessments (EA) Management

Glenn S. Podonsky, Director, Office of Enterprise Assessments
William A. Eckroade, Deputy Director, Office of Enterprise Assessments
Thomas R. Staker, Director, Office of Environment, Safety and Health Assessments
William E. Miller, Director, Office of Nuclear Safety and Environmental Assessments
Patricia Williams, Director, Office of Worker Safety and Health Assessments
Gerald M. McAteer, Director, Office of Emergency Management Assessments

Quality Review Board

William A. Eckroade
Karen L. Boardman
John S. Boulden III
Thomas R. Staker
William E. Miller
Patricia Williams
Gerald M. McAteer
Michael A. Kilpatrick

EA Site Lead for Los Alamos National Laboratory

Ronald S. Bostic

EA Reviewers

William E. Miller – Lead
Ronald S. Bostic (BOM only)
Jimmy S. Dyke
Joseph E. Probst (PFS and the week of October 26, 2015)
Eric R. Swanson

Appendix B Key Documents Reviewed, Interviews, and Observations

Documents Reviewed

- TA55-ESS-14-002-R3, *Evaluation of the Safety of the Situation for the Potential for Criticality in a Glove box due to Fire Water*, 05/28/14
- TA55-TSR-2011-R1.7, *TA-55 Technical Safety Requirements Administrative Control 5.6.6*, Revision 1.7, 2011
- TA55-DSA-2011-R1.7, *TA-55 Documented Safety Analysis Chapter 6*, Revision 1.7, 2011
- System Description SD-130, *Nuclear Criticality Safety Program*, Revision 2, 02/26/14
- TA55-AP-522, *NCSP at TA-55*, Revision 15, 09/11/15
- TA55-CHTR-014, *PSM NCSB Charter, Revision 4*, 08/28/15
- PA-AP-01031, *ADPSM Training Process*, Revision 2, 07/14/15
- PA-CSP-01249, *Post Assembly Operations*, Revision 0, 04/02/15
- Criticality Safety Evaluation , NCS-CSED-11-038, *Criticality Safety Evaluation for Material Staging, Inspection, Rework, Pass Through, and Weighing, PF-4*
- Criticality Safety Evaluation , NCS-CSED-15-074, *Criticality Safety Evaluation for MC&A Location X128, PF-4*, 05/20/15
- Criticality Safety Evaluation , NCS-CSED-15-075, *Criticality Safety Evaluation for MC&A Location G110, PF-4*, 05/20/15
- Criticality Safety Evaluation , NCS-CSED-15-076, *Criticality Safety Evaluation for MC&A Location G110, PF-4*, 05/20/15
- Criticality Safety Limit Approval, *Neutron Barrel Counter, NO2*, 06/04/08
- Criticality Safety Limit Approval, *Floor Storage of Waste Containers, MASS Location 433F*, 03/30/10
- Criticality Safety Limit Approval, *Drum Movement, Unpack, and Pack*, 03/13/13
- Criticality Safety Limit Approval, *Transport of 55-Gallon Waste Containers*, 10/16/12
- NA-LA Operational Awareness Report, *LANL CSP Implementation Compliance to ANS/ANSI 8.19 Expectations*, 03/25/15
- SBCS-ASMT-13-001-R0, *1Q FY13 Assessment of the Nuclear Criticality Safety Program Metrics*, 02/13
- TA55-AP-522, *Nuclear Criticality Safety Program at TA-55*, Revision 13, 02/09/15
- PA-RD-01009, *TA55 Criticality Safety Requirements*, Revision 5, 03/05/15
- DOP NPI-4, *Operating and Calibrating the Neutron Barrel Counter*, Revision 1, 03/12/14
- TA55 Notice PA-Notice-01007, *Resumption Release Process for Programmatic Activities in PF-4*, Revision 4, Draft
- LANS Memorandum, *NCSB Guidance on the Implementation of TA-55-AP-522, Section 5.7*, 10/28/13
- LANS Memorandum, *Update to NCSB Guidance on the Incorporation of Operational Requirements into Operating Procedures, CSLA's, and CSP's*, 09/09/15
- Project Management Plan, NCS-Plan-14-001, *Nuclear Criticality Safety Program Upgrades*, 06/30/14
- LANS Assessment, *Red Team Review of the Safety Management Programs Supporting the TA-55/PF-4 Facility 10/13/14 to 10/24/13*, 10/31/14
- E-mail NA-LA to LANL, *Walk Down of Balance of Machining Operations*, 03/06/15
- LANS Presentation, *Readiness Causal and CAP Discussion*, 06/23/15
- LANS Presentation, *Criticality Safety Update*, 02/28/13
- CSSG Tasking 2013-02, *CSSG Assessment of Scope of operations and Criticality Safety Staff and Review of Los Alamos National Laboratory CAP and Metrics for the Nuclear Criticality Safety Program*, 05/13

- LANL External Review, *External Review of the Los Alamos Nuclear Criticality Safety Program*, Revision 0, 10/07/13
- Performance Feedback and Improvement Tracking System Items: 2012-4497, 2014-267, 2014-315, 2014-319, 2014-336, 2015-1390
- Release Review for Leak testing
- ANS/ANSI 8.1, *Nuclear Criticality Safety in Operations with Fissionable Material Outside of Reactors*
- NCSB Status Update, January - September 2015
- NCSB Issue, Tracking, and Priority Listing, 11/10/15
- NCS-Guide-01, *Guide for Criticality Safety Evaluations*
- NCS Memo 15-022, Review of the NCS Controls for Pit Flow Sheet Operations Under TA-55-ESS-14-002 for Elevation to Safety Basis, 08/12/15
- ANS/ANSI 8.19, *Administrative Practices for Nuclear Criticality Safety*
- Defense Nuclear Facilities Safety Board Letter, *DNFSB Review of the LANL CSP in May 2013*, 07/15/13
- TA55 Operations Organization Chart, 03/19/15
- Battelle Memorial Institute Report, *Chapter 27-Nuclear Safety and Criticality of Plutonium*, LA-UR-13-29297, Criticality Safety Infractions Causal Analysis, November 12, 2013
- LANS report U1400044, October 7, 2013
- *TA-55 Criticality Safety and Conduct of Operations Improvement Plan*, December 6, 2013
- ADPSM: 14-032, August 1, 2014
- *Conduct of Operations Maturity Plan*, August 14, 2013
- Operational Drill 16-022, Autoclave Operations, November 10, 2015
- Organization Chart for Manufacturing Science and Engineering (MET-2), August 17, 2015
- Organization Chart for Non-Destructive Testing & Evaluation (AET-6), October 29, 2015
- Organization Chart for Process Equipment Maintenance and Decontamination Services (NPI-3), September 30, 2015
- Organization Chart for TA-55 Operations (TA55-DO), August 10, 2015
- Organization Chart for Weapons Component Manufacturing & Surveillance (NCO-1), January 7, 2015
- OS-DO-RA-15-005R, R0, TA-55 Pit Flow Sheet Contractor Readiness Assessment, October 14, 2015
- P313, R9, Roles, Responsibilities, Authorities, and Accountability, March 4, 2015
- P315, R6, Conduct of Operations Manual, July 8, 2015
- PA-AP-01016, R5, Technical Procedure Use & Development Process, May 22, 2015
- PA-AP-01020, R2-IPC1, Pre-Job Briefing and Post-Job Review, October 8, 2015
- PA-DOP-01051, R4, Weighing Operations, November 3, 2015
- PA-DOP-01064, R6, Surface Prep Operations, October 29, 2015
- PA-DOP-01110, R2, Cabinet Radiography Operations, August 15, 2015
- PA-DOP-01118, R4, Assembly Gas Operations, November 4, 2015
- PA-DOP-01136, R2, Pit Tube Operations, July 23, 2015
- PA-DOP-01138, R4, Autoclave Operations, October 27, 2015
- PA-DOP-01189, R3, Overpacking Pit Operations, September 8, 2015
- PA-DOP-01190, R3, Unpacking Pit Operations, September 8, 2015
- PA-DOP-01327, R2, Downdraft Room Operations, September 2, 2015
- PA-DOP-01549, R2, Dye Penetrant Test Operations, October 27, 2015
- PA-PLAN-01119, R1, (UCNI) Restart Plan for Pit Flow Sheet Operations, August 4, 2015
- PA-PLAN-01121, R1, LANL Readiness Assessment Plan of Action to Resume Plutonium Facility Pit Flow Sheet Operations, July 23, 2015

Interviews

- LANL Group Leader for Criticality Safety Program
- TA-55 NCSB Chair
- Balance of Machining Operations Responsible Manager
- Balance of Machining Operations Responsible Supervisor
- Balance of Machining Operators
- Pit Flow Sheet Operations Responsible Manager
- Pit Flow Sheet Operations Responsible Supervisor (2)
- Pit Flow Sheet Operators (8)
- Cognizant System Engineers (3)
- TA-55 NDA Operations Responsible Supervisor
- TA-55 NDA Technicians (3)
- TA-55 Repack, Consolidation, and Disposal Person in Charge (PIC)
- Nuclear Process Infrastructure-2, Infrastructure Operations, Group Leader
- Nuclear Process Infrastructure-2 Operations Responsible Supervisor for Vault Operations
- LANL Improvement Management Coordinator for Criticality Safety Issues
- Manufacturing Engineering and Technologies Division Leader
- Manufacturing Engineering and Technologies-2 Field Line Manager
- Manufacturing Engineering and Technologies-2 Group Leader
- Nuclear Components Operations-1 Group Leader
- Senior Supervisory Watch

Observations

FRA demonstrated operations for BOM
FRA demonstrated operations for PFS
Resumed activities for NDA of waste drum activities
Resumed activities for vault operations
Resumed activities for repack, consolidation, and disposition
Plutonium-238 activities
Video of BOM lathe operations