Independent Assessment of Safety System Management at Los Alamos National Laboratory Plutonium Facility Building 4 at Technical Area 55

May 2026

U.S. DEPARTMENT of ENERGY | Office of Enterprise Assessments

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Acronyms

CFR	Code of Federal Regulations
CM	Configuration Management
CN	Change Notice
CRAD	Criteria and Review Approach Document
CSE	Cognizant System Engineer
DCF	Design Change Form
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EA	Office of Enterprise Assessments
ERDMS	Electronic Document and Records Management System
FCS	Facility Control System
FSTF	Full-scale Test Facility
IM	Issues Management
LANL	Los Alamos National Laboratory
LCO	Limiting Condition for Operation
LPF	Leak Path Factor
M&TE	Measuring and Test Equipment
MSS	Maintenance Site Services
NA-LA	NNSA Los Alamos Field Office
NNSA	National Nuclear Security Administration
OFI	Opportunity for Improvement
OJT	On-the-job Training
PF	Plutonium Facility
PM	Preventive Maintenance
QA	Quality Assurance
QAP	Quality Assurance Program
QL	Quality Level
SC	Safety Class
SDD	System Design Description
SHR	System Health Report
SS	Safety Significant
SSCs	Structures, Systems, and Components
SSM	Safety System Management
SSO	Safety System Oversight
TA	Technical Area
Triad	Triad National Security, LLC
TSR	Technical Safety Requirement
UPS	Uninterruptible Power Supply
USQ	Unreviewed Safety Question
VSS	Vital Safety System

INDEPENDENT ASSESSMENT OF SAFETY SYSTEM MANAGEMENT AT LOS ALAMOS NATIONAL LABORATORY PLUTONIUM FACILITY BUILDING 4 AT TECHNICAL AREA 55

Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of the effectiveness of safety system management (SSM) at the Los Alamos National Laboratory (LANL) Plutonium Facility, Building 4, at Technical Area 55, from May to July 2025. LANL is managed and operated by Triad National Security, LLC (Triad) for the National Nuclear Security Administration (NNSA) and is overseen by the NNSA Los Alamos Field Office (NA-LA). This assessment was performed within the broader context of targeted SSM assessments at selected high hazard (i.e., hazard category 1 and 2) nuclear facilities across the DOE complex. The purpose of this assessment was to evaluate whether the selected safety systems (i.e., the safety significant [SS] ventilation system, which operates in conjunction with the safety class [SC] confinement system, and the SS full-scale test facility [FSTF]) were appropriately functionally classified and are operated and maintained in a manner that ensures they can reliably perform their intended safety function of protecting workers and the public from analyzed hazards. This assessment also evaluated the effectiveness of NA-LA oversight of LANL's SSM processes.

EA identified the following strengths, including one best practice:

- Triad fabricates parts for facility maintenance needs at its certified Nuclear Quality Assurance-1 facility. (Best Practice)
- Triad qualifies Level I, II, and III receipt inspectors, consistent with American Society for Nondestructive Testing standards and recommended practices.
- Triad uses an effective online tracking system to control the measuring and testing equipment (M&TE) area.
- Triad assigns qualified cognizant system engineers (CSEs) for all systems with multiple qualified backups.
- NA-LA safety system oversight engineers interact frequently with CSEs, walking down systems twice a month and meeting monthly with Triad engineering groups.

EA also identified the following weaknesses, including four findings:

- Triad's mitigated post-seismic accident analysis does not consider and adequately control failure modes of the ventilation system that could potentially compromise the SC confinement function, resulting in an inadequate control strategy. (Finding)
- Triad uses non-conservative accident analysis assumptions for leak path factor modeling and post-seismic fire accident analysis, which could result in mitigated consequences exceeding 25 rem of radiological dose to the public. (Finding)
- Triad did not apply sound engineering principles and appropriate standards to all reviewed engineering documents. (Finding)
- Triad does not sufficiently investigate significant conditions adverse to quality such that causes are identified, and appropriate corrective actions are developed and addressed. (Finding)
- Triad did not appropriately revise, make obsolete, or otherwise disposition design and system description documentation following modification of the uninterruptible power supply system.
- Triad did not conduct sufficient facility condition inspections of the ventilation system or FSTF.

- Triad does not apply a formal on-the-job training program to equipment operator qualifications.
- Triad did not provide documented records to demonstrate that equipment operators are adequately trained and qualified.
- The Triad conduct of operations program does not accurately describe training requirements.
- Triad does not control and store all procured items in accordance with the DOE-approved quality assurance program.

In summary, the SS ventilation system, which operates in conjunction with the SC confinement system, and the SS FSTF were appropriately functionally classified and, in general, are operated and maintained in conformance with applicable requirements. However, the identified weaknesses have the potential to reduce the reliability of the evaluated safety systems in performing their intended safety functions. Resolution of the identified weaknesses will result in a more robust safety basis and increased assurance that the systems will operate reliably.

INDEPENDENT ASSESSMENT OF SAFETY SYSTEM MANAGEMENT AT LOS ALAMOS NATIONAL LABORATORY PLUTONIUM FACILITY BUILDING 4 AT TECHNICAL AREA 55

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Nuclear Engineering and Safety Basis Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of the effectiveness of safety system management (SSM) at the Los Alamos National Laboratory (LANL) Plutonium Facility (PF), Building 4 (PF-4), at Technical Area (TA) 55. This assessment was performed within the broader context of targeted SSM assessments at selected high hazard (i.e., hazard category 1 and 2) nuclear facilities across the DOE complex in accordance with the *Plan for the Independent Assessment of Safety System Management Across the DOE Complex Fiscal Year 2025*. This assessment also evaluated the effectiveness of applicable National Nuclear Security Administration (NNSA) Los Alamos Field Office (NA-LA) oversight processes. The assessment was conducted from May to July 2025.

The primary purpose of the assessment was to evaluate whether selected safety system controls were appropriately developed into technical safety requirements (TSRs), and whether the structures, systems, and components (SSCs) required for the controls are operated and maintained in a manner that ensures they reliably perform the intended safety functions of protecting workers and the public from analyzed hazards. Programs within the scope of the assessment that support safety system operability and reliability are TSR surveillance, design engineering, cognizant system engineer (CSE), configuration management (CM), maintenance, operations and training, procurement quality assurance (QA), feedback and improvement, and Federal oversight. The assessment focused on the effectiveness of DOE and contractor line management in managing and implementing SSM requirements.

LANL is managed and operated by Triad National Security, LLC (Triad) for NNSA and overseen by NA-LA. The TA-55 PF-4 facilities provide multidisciplinary research activities engaged in a variety of programs for DOE and other government agencies.

2.0 METHODOLOGY

The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*, which EA implements through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. This report uses the terms "best practices, deficiencies, findings, and opportunities for improvement (OFIs)" as defined in the order.

As identified in the assessment plan, this assessment considered requirements from EA CRAD 30-11, Revision 1, *Safety Systems Management Review*, in assessing the adequacy of selected programs related to SSM at TA-55 PF-4. The assessment was conducted using a sampling of data and is not intended to represent a full programmatic assessment of all SSM-relevant programs.

EA selected two systems to assess:

- The safety significant (SS) ventilation system in conjunction with the safety class (SC) confinement system – TSR limiting conditions for operation (LCOs) 3.1.1, 3.1.2, and 3.1.3.
- The SS full-scale test facility (FSTF) – TSR LCO 3.4.1.

EA used a written comment process to communicate salient issues identified before the onsite portion of the assessment. Follow-on discussions were conducted with Triad and NA-LA personnel to clarify and resolve comments. Additional issues were identified during the onsite portion of the assessment.

EA examined the development of the selected controls as TSRs based on the hazard and accident analyses and the flowdown of safety basis requirements into technical baseline documents. EA reviewed key documents, including the documented safety analysis (DSA), the TSR document, TSR surveillance records, selected program description documents, system design documents, procedures, training and qualification records, procurement records, critical spares inventories, assessment reports, and issues management (IM) records. EA interviewed personnel responsible for developing and executing the assessed programs; observed performance demonstrations related to operations and surveillance; participated in detailed discussions of procedures and process implementation; and performed walkdowns of accessible areas of the selected systems. EA also conducted interviews and reviewed oversight records to determine whether NA-LA provided adequate oversight of the Triad CSE program and the operability of associated safety systems. The members of the assessment team, the Quality Review Board, and the management responsible for the assessment are listed in appendix A.

EA conducted a previous assessment of SSM at TA-55 in 2022, as documented in EA report *Independent Assessment of TA-55 Fire Water Pump Safety System Management at the Los Alamos National Laboratory, July 2022*. This current assessment examined the completion and effectiveness of corrective actions for the EA findings identified in the previous assessment. Results of the corrective action review are included in section 3.11 of this report.

3.0 RESULTS

3.1 Safety Basis

This portion of the assessment evaluated the safety basis, including control derivation and description, safety control functional classification, and TSR development for the selected systems to determine whether they can fulfill their required safety functions for normal operations and accident conditions, and to verify compliance with DOE-STD-3009-94 Change Notice (CN) 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*.

Control Derivation and Description

The TA-55 PF-4 SS ventilation system effectively mitigates the spread of contamination and releases filtered air to the environment in conjunction with the passive SC confinement system. By maintaining differential pressures between the basement, corridor, laboratory, and glovebox areas, the system provides the driving force for directional airflow from areas of lower to higher contamination potential. In addition, exhaust is routed from the building through the SC confinement system high efficiency particulate air filters, providing a filtered pathway from the facility to the external environment. If the SS ventilation system stops operating, the SC confinement system would remain intact.

The FSTF incorporates well-designed features to prevent and mitigate the inadvertent release of radioactive material. The reaction chamber serves as a robust primary confinement, even during seismic stress. Manual isolation valves (i.e., block valves) redundantly limit the amount of flammable gas that can be transferred to the reaction chamber. An isolation valve is interlocked with the detector and shuts off gas flow automatically to prevent a flammable concentration of the gas in the FSTF gas cabinet. The pressure boundary associated with the piping and fittings inside the reaction chamber prevents the buildup

of a flammable concentration of gas in the FSTF reaction chamber. The DSA correctly identifies SS controls for the FSTF to prevent a postulated deflagration due to leakage of flammable gas.

The DSA, chapter 4, appropriately provides the safety functions, system description, functional requirements, and system evaluation with specific performance criteria for the selected systems.

Safety basis models and calculations that support derivation of safety controls in the DSA are generally technically adequate. However, contrary to the requirements of DOE-STD-3009-94 CN 3, section A.3, the following accident analysis assumptions could result in radiological dose consequence estimates that are not reasonably conservative, which could lead to inadequate identification of safety controls (see **Finding F-Triad-1**):

- The DSA does not adequately justify the basis for assuming only a single seismically induced fire. The supporting calculation reveals that multiple fires should be considered physically possible, as their probability is not significantly lower than a single fire, and therefore they should have been considered in the accident analysis. Moreover, while the DSA accident analysis assumes a fire in a single room with the highest potential consequence, a post-seismic event fire progression involving multiple rooms could result in mitigated accident radiological dose consequences exceeding 25 rem to members of the public. Additionally, the limits for the various material forms provided in the material-at-risk (MAR) Limit Control would not reduce the seismic event radiological dose consequences.
- The leak path factor (LPF) used in the accident analysis assumes a non-conservative wind boundary condition based on TA-55 PF-4 without surrounding buildings. Nearby buildings surrounding TA-55 PF-4 could create wind tunnel effects resulting in higher wind speeds and lower pressure outside of TA-55 PF-4, in turn resulting in a greater pressure differential across TA-55 PF-4 and higher LPFs.

Chapters 2 and 4 of the DSA do not clearly identify that the passive safe shutdown mode is a facility control system (FCS) function and not a facility mode requiring TSRs. Accordingly, the passive safe shutdown mode could be misinterpreted as an undefined facility mode in the DSA and TSR. (See **OFI-Triad-1**.)

Safety Control Functional Classification

In general, the selected systems are appropriately functionally classified in the hazard and accident analyses. However, contrary to DOE-STD-3009-94 CN 3, section 4.3.X.2, the DSA does not identify a control that ensures the ventilation system is maintained in a configuration that supports the LPFs used in the mitigated seismic scenario. (See **Finding F-Triad-2**.) Without proper shutdown of the ventilation system, the SC confinement system may not be able to perform its safety function, resulting in higher public consequences than approved. Specifically, in determining the LPFs following the seismic event, the accident analysis assumes that all ventilation is off; however, it does not account for partial ventilation system failures (e.g., supply fans on with exhaust fans off), which could result in higher LPFs than those assumed in the mitigated analysis.

Technical Safety Requirement Development

Chapters 4 and 5 of the DSA, along with the TSR bases, provide sufficient information to derive the TSR LCOs for the selected systems. The TSR bases adequately describe the reasons for the operating limits and surveillance requirements. The TSR operability and surveillance requirements developed for the selected systems are adequate to ensure that the required safety functions will be met.

Safety Basis Conclusions

The selected controls are appropriately derived and functionally classified, and their associated safety functions, functional requirements, and system evaluations are adequately documented. The TSRs provide sufficient criteria to verify the operability of the selected systems. However, the seismic accident analysis and LPF modeling include non-conservative assumptions, and SC controls were not identified to maintain ventilation in a configuration that supports the mitigated seismic accident analysis.

3.2 Technical Safety Requirement Surveillance

This portion of the assessment evaluated the TA-55 PF-4 TSR surveillance processes for the selected systems to determine compliance with the TSR document.

The reviewed TSR surveillance procedures and their implementation are adequate to ensure that the selected systems can accomplish their safety functions. The surveillance procedures appropriately identify system and test conditions and include clear performance steps. Except for the issues identified in section 3.3, the procedures were appropriately developed, reviewed, and approved. Triad effectively schedules, tracks, and documents surveillances in accordance with the TSR-required frequencies, considering allowable frequency extensions (i.e., TSR-defined grace periods). Observed operators demonstrated strong knowledge of TSR requirements and maintained clear awareness of system statuses during surveillance activities.

Technical Safety Requirement Surveillance Conclusions

Triad's surveillance procedures are generally effective, and performance of required surveillances is adequate in accordance with established frequencies and procedures.

3.3 Design Engineering Process

This portion of the assessment evaluated the TA-55 PF-4 engineering design process for the selected systems to determine whether they incorporate applicable safety basis requirements and comply with 10 CFR 830.122, *Quality assurance criteria*, and appropriate consensus standards.

Triad conduct of engineering procedures meet the requirements of 10 CFR 830.122, criterion 6, for design performance. The procedures provide adequate processes for incorporating applicable consensus standards, developing and controlling engineering design criteria, performing calculations, and developing drawings for the selected systems.

Reviewed drawings were complete and appropriately signed by independent checkers. Design inputs and standards were generally adequate and are appropriate to allow qualified individuals to understand the design requirements. However, contrary to 10 CFR 830.122, criterion 6, some design documents exhibited incorrect results due to inadequately applying sound engineering principles and appropriate standards. (See **Finding F-Triad-3**.) Incompletely documenting the technical baseline, not considering instrument accuracy in surveillance procedures, and inadequately sizing and verifying the facility uninterruptible power supply (UPS) battery system could result in the facility being operated outside the limits analyzed in the DSA. Specifically:

- Instrument accuracy was not accounted for in determining the setpoint for the low instrument air pressure switch, resulting in the pressure switch setpoint not meeting the TSR requirement. The minimum air pressure required for the ventilation system actuators to function reliably is not specified in the instrument accuracy calculation, the system design description (SDD), or the DSA. However,

reviewed vendor data sheets for the three types of actuators installed in the ventilation system show that the highest required instrument air pressure is well below the TSR, thereby alleviating the safety significance of this non-compliance.

- Triad did not use industry accepted methods, such as American National Standards Institute (ANSI)/International Society of Automation (ISA)-67.04.01, *Setpoints for Nuclear Safety-Related Instrumentation*, to establish surveillance values that ensure TSR limits will be met. Specifically, no calculations are being used to justify the values used in the TSR surveillances of the ventilation system.

- There is no engineering calculation to demonstrate that the Facility UPS battery will supply voltage above the inverter low voltage trip setpoint at end of life and minimum operating temperature.

- The Facility UPS battery has not undergone a capacity discharge test at the two-year mark, nor does Triad require testing every five years thereafter as recommended by Institute of Electrical Electronics Engineers (IEEE) Standard 450, *Battery Maintenance*, section 6.3.

Similar issues were identified in Finding F-Triad-1 of EA report *Independent Assessment of TA-55 Fire Water Pump Safety System Management at the Los Alamos National Laboratory, July 2022* (LANL issue management system number IAS-2021-0444). Triad categorized the finding, IM-2023-3933-02, as significance level "low" and thus did not perform a causal analysis, an effective extent-of-condition review, or an effectiveness review. The corrective actions related to the prior EA finding were closed; however, they are insufficient to address the broader causes that may have led to the finding, as discussed further in section 3.11 of this report.

Engineering Design Process Conclusions

Engineering procedures provide adequate processes for performing calculations, developing drawings, and managing design changes. However, sound engineering principles and appropriate standards were inadequately applied in the development of several documented parameters.

3.4 Cognizant System Engineer Program

This portion of the assessment evaluated the implementation of the CSE program to determine its effectiveness in ensuring that the selected systems can reliably perform as intended, and to determine compliance in accordance with DOE Order 420.1C, *Facility Safety*.

Triad has adequately established and implemented procedures for the TA-55 PF-4 CSE program that meet the requirements of DOE Order 420.1C, attachment 2, chapter V, section 3.b, for the selected systems. The CSEs assigned to the selected systems are appropriately trained and qualified in accordance with Triad training procedures. Every TA-55 PF-4 system has a qualified CSE and multiple qualified backup CSEs, which is considered a strength of the program.

The interviewed CSEs and system engineers demonstrated adequate knowledge of system reliability, operational readiness, and required configurations of their assigned systems. Reviewed quarterly system health reports (SHRs) demonstrated appropriate CSE review of system operability, maintenance activities, system reliability, TSR surveillances, modifications, post-maintenance testing, configuration control, and performance trends. The program's monthly system health review meetings are effective in communicating detailed information regarding system status and condition.

The CSEs work closely with the operations and maintenance organizations to troubleshoot equipment issues. The CSEs appropriately monitor the physical configuration of assigned systems by using

walkdowns and performing adequate system condition assessments to verify the adequacy of configuration-controlled SSCs and processes. Technical baseline documents that require updates when impacted by system modifications are appropriately identified. System walkdowns are documented in logs and appropriately identify physical or documentation discrepancies and their resolutions.

Cognizant System Engineer Program Conclusions

The CSE program effectively meets the requirements of DOE Order 420.1C, as demonstrated through reviewed program manuals and implementing procedures. CSEs assigned to the selected systems are appropriately trained and qualified and adequately monitor the physical configuration of their systems. The program's structure, including the assignment of both a qualified CSE and multiple backups for each system, along with routine health monitoring, represent notable strengths.

3.5 Configuration Management

This portion of the assessment evaluated CM processes, technical baseline documents, change control, work control, document control, and assessments to ensure that changes are properly controlled in accordance with DOE Order 420.1C and DOE-STD-1073-2016, *Configuration Management*, such that the selected systems continue to meet their safety functions.

Configuration Management Processes

Triad has established and implemented adequate CM processes to maintain consistency between requirements, engineering documents, operations implementing procedures, and physical configuration, ensuring that the selected systems can reliably perform their safety functions. The CM processes meet the requirements of DOE Order 420.1C, attachment 2, chapter V, section 3.c, and DOE-STD-1073-2016.

The unreviewed safety question (USQ) process is adequately established and implemented as required by 10 CFR 830.203, *Unreviewed Safety Question Process*, and is appropriately applied within the change control, surveillance report testing, and field modification processes. Reviewed USQ determinations demonstrated adequate review of design change forms (DCFs), maintenance modifications, temporary modifications, equivalency evaluations of replacement SSCs, and corrective maintenance work orders.

Triad has an effective CM improvement process that includes action items for all CM elements. Examples of process improvements included establishing an SHR review committee to address issues from SHRs, establishing a minimum technical baseline list for design control, providing training for engineers to effectively use the Electronic Document and Records Management System (EDRMS), and developing a redline process to capture discrepancies in the field. A technical baseline gap analysis adequately resulted in a spreadsheet/interactive tool for tracking technical baseline documentation and status (green/yellow/red) by system. The tracking tools include metrics for SC/SS systems, including the PF-4 ventilation and flammable gas control system in the FSTF.

Technical Baseline Documents

In general, the reviewed technical baseline documents (i.e., SDDs, piping and instrumentation diagrams [P&IDs], and calculations) for the selected systems, other than described in section 3.3 of this report, were adequately identified, developed, approved, and maintained to support SSM programs, operations, and safety basis implementation. Technical baseline documents are also, in general, appropriately tracked and maintained in EDRMS. However, the failure mode of the ventilation dampers upon loss of instrument air is not specified in the DSA, TSR, or SDD; rather, it is only shown on the P&IDs. (See **OFI-Triad-2**.)

While Triad's technical baseline documents are generally adequate, contrary to DOE-STD-1073-2016, section 2.3, and DOE Order 420.1C, attachment 2, chapter V, section 3.c, design and system description documentation have not been appropriately revised, made obsolete, or otherwise dispositioned, following removal of the original Facility UPS and its 125 VDC battery from TA-55 PF-4. (See **Deficiency D-Triad-1**.) Inadequate technical baseline information could result in applying obsolete safety requirements.

Change Control

Reviewed DCFs were appropriately developed, reviewed, approved, tested, implemented, and documented as required by DOE-STD-1073-2016. Reviewed DCFs included adequate scopes of work that demonstrated appropriate control of design changes. Affected design documents, acceptance criteria, testing requirements, and USQ determinations were appropriately included in the packages and received adequate safety and technical reviews and approval. Affected documents (including implementing documents) were appropriately tracked to maintain change control.

Work Control

The reviewed work control documents were adequate for field modifications. Other aspects of work control are discussed in section 3.6 of this report.

Document Control

Document control was appropriately implemented for reviewed DCFs, temporary modification packages, modification work orders, design drawings, and calculations. The latest versions of the technical baseline documents and amendments were adequately maintained in EDRMS.

Assessments

As discussed in section 3.4, the CSEs appropriately perform quarterly SHRs. These reports are intended to conclude that the system is either performing in a reliable manner or that additional management attention is warranted to return the system to a reliable condition. SHRs use colors to communicate the health of the system. Even though many SHRs associated with TA-55 PF-4 list multiple deficiencies, the system status remains green with minor problems because Triad's SHR process recommends that a system is assigned yellow only when it has "significant" deficiencies. The Triad SHR process, however, does not describe what constitutes a "minor" problem or "significant" deficiency. (See **OFI-Triad-3**.)

Configuration Management Conclusions

Triad implements a generally adequate CM program. Reviewed periodic SHR assessments were appropriately conducted. The USQ process is adequately implemented. Reviewed technical baseline documents for the selected systems are generally consistent with design requirements. However, the ventilation system damper failure mode upon loss of instrument air pressure is not specified in high level technical baseline documents.

3.6 Maintenance

This portion of the assessment evaluated the maintenance program and processes used at TA-55 PF-4; control of maintenance, repairs, and modifications; and maintenance shop and measuring and test equipment (M&TE) storage to determine whether maintenance of the selected systems is properly

planned, scheduled, and performed in accordance with DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*, to ensure that those systems can reliably perform their intended safety functions.

Maintenance Program

The NA-LA-approved nuclear maintenance management program (NMMP) establishes adequate requirements for the safe conduct of maintenance for the selected systems. This program provides a comprehensive suite of system-specific inspection, testing, and maintenance procedures that, when followed, can help ensure that the safety systems can perform their intended safety functions. The NMMP documentation adequately addresses the 17 elements of DOE Order 433.1B. NMMP implementation assessments are adequately conducted every three years to evaluate whether all maintenance requirements are appropriately implemented.

Maintenance Processes

The Triad maintenance processes for the selected systems are adequate to conduct maintenance consistent with these systems' functional classifications. Maintenance Site Services (MSS) adequately supports TA-55 PF-4 by coordinating maintenance planning and scheduling with facility management and uses a graded approach to prioritize maintenance of safety SSCs. In general, Triad performs preventive maintenance (PM), predictive maintenance, and corrective maintenance appropriately for the selected systems to ensure their safe, efficient, and reliable operation. PM appropriately includes filter replacement, calibration of instruments, and inspections and maintenance of components. Triad effectively performs operational checks and PM for inspection and functional testing. Triad is adequately managing maintenance performance by working to reduce the existing corrective maintenance backlog. In general, Triad is performing PM on time with some deferrals and work performed in grace periods. Triad prioritizes maintenance work orders appropriately using the plan of the day/week schedules.

DOE Order 433.1B defines facility condition inspections as the process for conducting and implementing routine assessment of facilities to identify issues related to operability, reliability, housekeeping, and general conditions. However, contrary to DOE Order 433.1B, attachment 2, section 2.p, facility condition inspections are not being sufficiently performed on the TA-55 PF-4 ventilation system or FSTF. (See **Deficiency D-Triad-2**.) A lack of periodic facility condition inspections could result in unsafe conditions not being identified in a timely manner. For example, actions such as housekeeping and management of hazardous building materials (e.g., asbestos, lead-based paint), which help ensure appropriate facility conditions, are not presently addressed in the resolution to LANL issue LANL-IM-2023-9706-02. Gaps related to insufficient closure of issues are also discussed in section 3.9 of this report.

Control of Maintenance, Repairs, and Modifications

Maintenance, repair, and modification work performed at TA-55 PF-4 is controlled in accordance with P950, *Conduct of Maintenance*, work planning and control procedures, job-specific work control documents, and the facility activity schedule. The process is adequate for controlling and performing maintenance, and appropriately implements approved modifications, temporary modifications, PM, and corrective maintenance. QA hold points are appropriately included in maintenance work orders.

The maintenance manager was knowledgeable, and reviewed completed work packages demonstrated adequate performance, control, and documentation to ensure system operability. Key performance indicator metrics demonstrated adequate tracking of work order planning backlog, corrective maintenance backlog, PM completion, and monthly work execution schedule compliance.

Maintenance Shop and M&TE Storage

MSS has an extensive maintenance Nuclear Quality Assurance (NQA)-1-certified fabrication shop with capabilities in all craft areas to support mechanical parts and other items needed for maintenance work orders. In addition, MSS conducts predictive maintenance, such as performing vibration testing on rotating equipment, thermographic inspections on electrical equipment, and periodic testing of electrical breaker settings. The M&TE storage area is effectively controlled with an online tracking system for M&TE issued to craft. An accountability system provides notification to users when M&TE has passed calibration periods. The M&TE group also has the capability to deliver tools and M&TE to maintenance personnel at onsite facilities on a daily basis. The ability to function as a one-stop shop is considered a **Best Practice** because it reduces coordination delays, improves response time to maintenance needs, enhances resource efficiency, and ensures faster turnaround for work order execution.

Maintenance Conclusions

The maintenance program is generally adequate to maintain the selected systems in TA-55 PF-4. Maintenance is properly planned, scheduled, and performed to ensure that the selected systems can perform their intended safety functions. Maintenance, repair, and modification work are adequately performed. Triad's one-stop shop for M&TE and parts fabrication is considered a best practice. However, Triad is not performing sufficient facility condition inspections on the ventilation system or FSTF.

3.7 Operations and Training

This portion of the assessment evaluated TA-55 PF-4 operating practices, procedures, and the training program to determine whether operations are conducted in a manner that ensures the selected systems can reliably perform their intended safety functions.

Operating Practices and Procedures

Triad's conduct of operations program, as described in program document PD315, *LANL Conduct of Operations Program*, and the *LANL Conduct of Operations Implementation Matrix*, is generally adequate. TA-55 PF-4 conduct of operations elements are appropriately addressed in PA-AP-01017, *Control of Equipment and Systems Status*, and TA55-AP-00116, *Operations Center*. Overall, the TA-55 PF-4 management and operating personnel responsible for TSR implementation and compliance are knowledgeable and experienced, as demonstrated by interviews and observations. Reviewed logs, operations center watch turnover sheets, building and facility status control, and TSR surveillances were generally adequate. However, one reviewed surveillance document (TA55OPS-STP103-240616) revealed that the test was marked as satisfactory despite troubleshooting and valve realignments being required in order to ultimately pass the test on the third try. A formal investigation was not conducted, so the causes leading to the mispositioned valve, and the amount of time the system was not fully functional, were not determined. Additionally, the degraded condition was not reported in the Occurrence Reporting and Processing System in accordance with DOE Order 232.2A, *Occurrence Reporting and Processing of Operations Information*, for safety system degradation, as discussed in section 3.9 of this report.

Training Program

Previous assessments conducted by NA-LA and EA in 2024 identified significant deficiencies in operator training and qualification. Triad appropriately developed a comprehensive corrective action plan to address the deficiencies. Corrective actions have appropriately resulted in the formation of a central training organization with responsibility for establishing policy and developing and revising institutional

training program procedures. Triad chartered the Integrated Training Action Board to manage the corrective action plan and high-priority, cross-organizational training issues.

Training implementation at TA-55 PF-4 is managed by the Weapons Mission Services (WMS) Division, Facility Training and Compliance organization, which is appropriately evaluating the TA-55 PF-4 training program for weaknesses beyond those identified in the 2024 NA-LA and EA assessments. An analysis report, *On-the-job (OJT)* [sic] *Training for Operations Center Supervisor Position Curriculum: Initial Program Specific Training Requirements (Curriculum 2580)*, resulted in the WMS training group identifying the lack of formal on-the-job training (OJT) for the PF-4 equipment operators required by the qualification standard PA-QS-01008, *TA55 PF-4 Equipment Operator/Supervisor*. Interviewed PF-4 equipment operators confirmed that contrary to the requirements of PA-QS-01008, OJT for equipment operators is provided through informal mentoring and not through a formal OJT process. (See **Deficiency D-Triad-3**.) Not applying a formal OJT process to equipment operator qualification could result in inadequately qualified equipment operators interacting with PF-4 safety systems.

Additionally, other weaknesses related to training and qualification were identified:

- Contrary to DOE Order 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*, attachment 1, chapter I, section 10, and qualification standard PA-QS-01008, section 7.0, there were no documented records to demonstrate that equipment operators are adequately trained and qualified. (See **Deficiency D-Triad-4**.) Improperly or inadequately trained and qualified operators could result in operation of the facility outside of the TSRs.
- Contrary to DOE Order 426.2, attachment 1, chapter I, section 4.b.(5)(a), PD315, section 6.0, states "there is no specific mandatory training required to implement this document." P315, *Conduct of Operations Manual*, attachment 1, also includes the same statement in each training-related section of the attachment as it applies to each conduct of operations element. (See **Deficiency D-Triad-5**.) Not providing conduct of operations training to management and supervisory personnel could result in inadequate direction being provided to operations, maintenance, and technical support outside of the applicable SSM procedures. Further, PD315 and P315 are inconsistent with institutional procedure ITS-FSD-001, *Human Resources Division Conduct of Training Manual*, section 4.6.6, which requires training as part of the initial supervisor training.

Operations and Training Conclusions

Conduct of operations at TA-55 PF-4 is generally adequate. Operations center and equipment operators demonstrate adequate knowledge. Triad is taking appropriate actions to address findings and deficiencies identified in the 2024 NA-LA and EA assessments. However, the current equipment operator training program does not meet OJT requirements. Additionally, Triad did not have documented training and qualification records, and inconsistencies exist between PD315, P315, DOE Order 426.2, and LANL institutional procedures.

3.8 Procurement Quality Assurance

This portion of the assessment evaluated Triad's procurement QA practices and processes to determine whether they comply with 10 CFR 830, subpart A, *Quality Assurance Requirements*, and DOE Order 414.1D, *Quality Assurance*.

Triad has established a generally adequate DOE-approved QA program (QAP) that meets the requirements of DOE Order 414.1D and 10 CFR 830, subpart A. System description SD330, *Los Alamos National Laboratory Quality Assurance Program*, appropriately invokes American Society of Mechanical Engineers consensus standard NQA-1-2008 with the NQA-1a-2009 addenda for nuclear facilities.

Reviewed procedures demonstrated appropriate requirements for procurement and verification of quality-affecting items and services. SC and SS items are appropriately classified as nuclear quality level (QL)-1 procurements. QA personnel are appropriately trained and qualified, including receipt inspectors who are qualified as Level I, II, and III inspectors consistent with the American Society for Nondestructive Testing standards and recommended practices. An adequate commercial grade dedication process is in place for safety systems in nuclear facilities, as is a program for detecting and controlling suspect and counterfeit items. QL-1 suppliers are evaluated on a triennial basis to remain on the controlled institutional evaluated supplier list (IESL). Reviewed procurement-specific information for a sample of safety-related procurements was adequate.

While the QAP is generally adequate, contrary to SD330 and implementing procedure P330-13, *Identification and Control of Items in Controlled Storage Areas*, some management level (ML)-1 and -2 items are not controlled and stored as per the minimum requirements established by the DOE-approved QAP. (See **Deficiency D-Triad-6**.) If the critical spare inventory is not controlled and stored appropriately, then critical spares for the safety systems may not be adequate or available in a timely manner. For example, one of two critical spare items that EA tried to locate in the TA-55 0432 warehouse could not be located. It was later determined that the critical spare was removed from the warehouse 2 years earlier, but the electronic inventory record was not updated in a timely manner. Additionally, some inventory items were stacked atop distorted boxes, at an increased risk of falling or getting damaged.

Procurement Quality Assurance Conclusions

Triad has established generally adequate processes to procure safety-related components from qualified vendors. The QAP appropriately implements the requirements of NQA-1 for procurement of safety-related components. Triad evaluates, maintains, and lists approved suppliers for QL-1 components on the IESL, and uses commercial grade dedication of safety-related components when approved suppliers are not available. The reviewed procurement documents support compliance with established procurement controls. However, weaknesses were identified in the control and storage of critical safety-related items.

3.9 Feedback and Improvement

This portion of the assessment evaluated Triad's feedback and improvement processes, including issues management and performance assurance, to determine whether they comply with 10 CFR 830.122 and DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy*.

Feedback and Improvement

Triad has established generally adequate processes to identify the causes of issues, correct the issues, and identify actions to prevent recurrence. Issues are classified as high, moderate, or low, considering the severity of impact and likelihood of occurrence/recurrence. P322-4, *Issues Management*, table 2, *Descriptions of Issue Significance*, provides some guidance to responsible line managers in making the significance determination. The lessons learned process is well developed and is actively and adequately implemented. Review reports cover a wide range of onsite activities and occurrences and provided some appropriate actionable cautions based on external events.

While issues management processes are generally adequate, issues associated with the implementation of those processes were observed. Contrary to NQA-1, part 1, requirement 16, Triad does not sufficiently investigate significant conditions adverse to quality such that causes are identified, and appropriate corrective actions are developed and addressed. (See **Finding F-Triad-4**.) Without effective categorization of conditions adverse to quality, significant causal factors could be missed, and the likelihood of recurrence increases. The following observations contributed to this finding:

- **Insufficient significance criteria**: SD330 and P322-4 do not provide sufficient criteria to determine the significance of conditions adverse to quality. For example, P322-4, table 2, omits criteria such as environmental impact; equipment or facility reliability, availability, and maintainability; importance in meeting regulatory commitments; and broader implications beyond the initial occurrence.
- **Undefined causal analysis rigor**: P322-4 does not specify the required level of rigor of causal analysis for a significant condition adverse to quality (e.g., root cause analysis).
- **Unimplementable procedure elements**: P322-4 cannot be implemented as written/designed. For example, trending code identification is required in the issues management system for high, moderate, and low significance issues, yet not all issues are required to be managed in the issues management system.
- **Undocumented conditions**: Not all conditions adverse to quality are documented in the issues management system as required. For example:
    - Intermittent failures of analog input cards in FCS Programmable Logic Controller (PLC) cabinets have persisted for about two years since they were newly installed without formal documentation, causal analysis, or corrective action tracking.
    - The causes leading to the mispositioned valve issue (see section 3.7) were not formally investigated, nor was the SS SSC performance degradation reported in accordance with DOE Order 232.2A, group 4, subgroup A.
- **Ineffective issue resolution**: Some corrective actions did not address the root cause or were closed prematurely:
    - Corrective actions to address LANL-IM-2023-9706-02, related to MSS's performance of facility condition inspections required by AP-MNT-004, were not resolved. The issue was closed based on an internal memorandum documenting what MSS believes to be equivalent to the requirement in AP-MNT-004, but Triad did not document a formal exemption to the DOE Order 433.1B requirement.
    - Corrective actions related to NA-LASO-LANL-TA55-2021-0005, *TA55-PF-4 400 Area LAFD Response to Flash in Glovebox (PT-2)*, were not reopened in a timely manner following an effectiveness review (June 2023) that identified four actions as "not effective" or "partially effective."
    - Corrective actions to address LANL-IM-2023-3933-02 related to Finding F-Triad-1 from IAS-2021-0444, *DOE-EA Independent Assessment of TA-55 Fire Water Pump Safety System Management*, did not include an extent-of-condition review of design documentation, which may have produced incorrect results due to inadequate application of sound engineering principles, such as establishing conservative design margins, and the use of traceable and current design inputs.

Performance Assurance

Triad adequately assesses and evaluates organizational performance to ensure that applicable requirements and standards are met for environment, safety, and health, including QA and integrated safety management. Assessment programs are appropriately risk-informed and formally documented. Assessments are adequately scheduled, managed, and performed in accordance with an integrated assessment plan. The integrated assessment plan is prepared annually and approved by an institutional management review board, and includes management and independent assessments, Director's institutional assessments, and critical function evaluations. Reviewed assessments completed over the past three years for the selected systems demonstrated sufficient depth and critical review of the assessed areas.

Feedback and Improvement Conclusions

Triad has established generally adequate processes for issue identification, causal analysis of safety system related issues, and recurrence prevention as part of corrective actions. Triad maintains a well-implemented lessons learned program and a structured risk-informed assessment framework that supports continual evaluation and improvement of organizational performance to ensure that applicable requirements and standards are met. However, while adequate processes have been established, Triad does not adequately investigate or document significant conditions adverse to quality such that causes are identified, nor does it ensure that appropriate corrective actions are developed to address underlying causes or meet all NQA-1 requirements.

3.10 Federal Oversight

This portion of the assessment evaluated the effectiveness of NA-LA's oversight process in ensuring that the selected systems reliably perform their safety functions.

The NA-LA safety system oversight (SSO) program is adequately implemented in accordance with DOE Order 420.1C. SSO personnel actively oversee assigned safety systems to ensure that the systems will reliably perform as required. Management Procedure 06.02, *Safety System Oversight Program*, adequately defines and establishes the Federal oversight program.

There is one qualified SSO engineer assigned to cover the 17 active SC and SS systems at TA-55. Currently, NA-LA has two qualified SSO engineers: one assigned to four waste facilities, and another assigned to the TA-55 facilities and PF-400. Together, they share oversight responsibilities for the Chemistry and Metallurgy Research Building and the Weapons Engineering Tritium Facility. The TA-55 SSO engineer also serves as NA-LA's electrical safety/lockout-tagout subject matter expert. In addition, the NA-LA fire protection subject matter expert, who holds SSO qualifications, supports the program as needed. As of the time this assessment was completed, there was one open SSO engineer position.

NA-LA conducts assessment planning in accordance with Management Procedure 00.08, *Implementation of Los Alamos Field Office Line Oversight*. NA-LA uses the LANL integrated assessment schedule to inform development of its Site Integrated Assessment Plan (SIAP). For safety system oversight, NA-LA reviews the contractor's planning for vital safety system (VSS) assessments and includes those in the SIAP as shadow assessments. For example, the TA-55 SSO engineer shadowed the contractor's 2022 assessment (*Ventilation System Ductwork and Plenums (HVAC) Vital Safety System Assessment*) in accordance with NA-LA Work Instruction 00.04, form A, *Assessment Shadow Record Form A*, and form B, *Assessment Final Report Review Form B*. However, NA-LA has not established a minimum periodicity for assessing the TA-55 safety systems identified as needing periodic SSO reviews, contrary to DOE Guide 226.1-2A, *Federal Line Management Oversight of Department of Energy Nuclear Facilities*. (See **OFI-NA-LA-1**.) Specifically, DOE Guide 226.1-2A recommends a minimum assessment periodicity of three years for SC systems and five years for SS systems.

NA-LA SSO engineers regularly attend meetings and perform scheduled walkdowns twice a month with CSEs. NA-LA also conducts monthly SSO interface meetings with the Triad engineering staff, which address items such as CSE qualification and staffing status, the current fiscal year's VSS assessment schedule, and the VSS stoplight (system health) status. Reviewed SSO assessments conducted by the NA-LA SSOs were thorough and adequately documented. For example, a recent assessment report, which focused on TA-55 PF-4 CM activities, identified one finding regarding the USQ process and one OFI.

Reviewed training and qualification records demonstrate that the SSO engineers meet the training and qualification requirements in accordance with DOE-STD-8000-2021, *Safety System Oversight Functional*

Area Qualification Standard, and the NA-LA site-specific SSO qualification standard. The TA-55 SSO engineer demonstrated thorough knowledge of the systems and recently identified issues affecting the selected safety systems.

Federal Oversight Conclusions

NA-LA's oversight of the selected systems is generally effective. SSO engineers appropriately identify and document issues, communicate their oversight findings, and monitor the development, execution, and closure of associated corrective actions through close coordination with Triad. NA-LA maintains sufficient coordination with the contractor and executes its oversight responsibilities in accordance with Federal requirements. However, NA-LA has not established a minimum periodicity for safety system periodic SSO reviews.

3.11 Follow-up on Previous EA Findings

This portion of the assessment examined the completion and effectiveness for a finding that was documented in EA report *Independent Assessment of TA-55 Fire Water Pump Safety System Management at the Los Alamos National Laboratory, July 2022*.

Finding-F-Triad-1: Design documents exhibited incorrect results due to inadequacies in using sound engineering principles, such as establishing conservative design margins, and contained inaccuracies caused by missing or outdated design inputs. (10 CFR 830.122, criterion 6)

Follow-up: EA reviewed 23 completed corrective actions documented in the iLINK system, which Triad completed to resolve this finding. There was no evidence of a revised fire pump diesel generator short circuit and arc-flash calculation. Triad did perform an extent-of-condition review; however, Triad did not review engineering design products produced by other engineering organizations that support TA-55 PF-4. In addition, having categorized the finding at a "low" significance level, Triad also did not perform a causal analysis or effectiveness review (see section 3.3 of this report). Therefore, Triad's corrective actions were not adequate to address EA's concerns.

Status: Triad has not adequately resolved EA Finding F-Triad-1, as issued in 2022.

Follow-up on Previous EA Finding Conclusions

The implemented corrective actions for the previous EA finding are not adequate to correct the condition.

4.0 BEST PRACTICES

Best practices are safety-related practices, techniques, processes, or program attributes observed during an assessment that may merit consideration by other DOE and contractor organizations for implementation. The following best practice was identified as part of this assessment:

- In addition to tracking, issuing, and storing M&TE, MSS's Central Shops is a certified NQA-1 facility that fabricates mechanical parts to meet facility needs. In addition, they conduct predictive maintenance, such as performing vibration testing on rotating equipment, thermographic inspections on electrical equipment, and periodic testing of electrical breaker settings. The M&TE group can also deliver tools and M&TE to maintenance personnel at the work location. The ability to function as a one-stop shop is considered a best practice because it reduces coordination delays, improves response

time to maintenance needs, enhances resource efficiency, and ensures faster turnaround for work order execution.

5.0 FINDINGS

Findings are deficiencies that warrant a high level of attention from management. If left uncorrected, findings could adversely affect the DOE mission, the environment, the safety or health of workers and the public, or national security. DOE line management and/or contractor organizations must develop and implement corrective action plans for findings. Cognizant DOE managers must use site- and program-specific issues management processes and systems developed in accordance with DOE Order 226.1, *Implementation of Department of Energy Oversight Policy*, to manage the corrective actions and track them to completion.

Triad National Security, LLC

Finding F-Triad-1: Triad uses non-conservative accident analysis assumptions for LPF modeling and post-seismic fire accident analysis, which could result in mitigated consequences exceeding 25 rem of radiological dose to the public. (DOE-STD-3009-94 CN 3, sec. A.3)

Finding F-Triad-2: Triad's mitigated post-seismic accident analysis does not consider and adequately control failure modes of the ventilation system that could potentially compromise the SC confinement function, resulting in an inadequate control strategy. (DOE-STD-3009-94 CN 3, sec. 4.3.X.2.)

Finding F-Triad-3: Triad did not always apply sound engineering principles and appropriate standards to all engineering documents. (10 CFR 830.122, crit. 6)

Finding F-Triad-4: Triad does not sufficiently investigate significant conditions adverse to quality such that causes are identified, and appropriate corrective actions are developed and addressed. (NQA-1, part 1, req. 16)

6.0 DEFICIENCIES

Deficiencies are inadequacies in the implementation of an applicable requirement or standard. Deficiencies that did not meet the criteria for findings are listed below, with the expectation from DOE Order 227.1A for site managers to apply their local issues management processes for resolution.

Triad National Security, LLC

Deficiency D-Triad-1: Triad did not appropriately revise, make obsolete, or otherwise disposition design and system description documentation following modification of the Facility UPS system. (DOE-STD-1073-2016, sec. 2.3, and DOE Order 420.1C, att. 2, chap. V, sec. 3.c)

Deficiency D-Triad-2: Triad did not conduct sufficient facility condition inspections of the ventilation system or FSTF. (DOE Order 433.1B, att. 2, sec. 2.p)

Deficiency D-Triad-3: Triad does not apply a formal on-the-job training program to equipment operator qualifications. (PA-QS-01008)

Deficiency D-Triad-4: Triad did not provide documented records to demonstrate that equipment operators are adequately trained and qualified. (DOE Order 426.2, att. 1, chap. I, sec. 10, and PA-QS-01008, sec. 7.0)

Deficiency D-Triad-5: The Triad conduct of operations program does not accurately describe conduct of operations training requirements. (DOE Order 426.2, att. 1, chap. I, sec. 4.b.(5)(a))

Deficiency D-Triad-6: Triad does not control and store all procured items in accordance with the requirements of the DOE-approved QAP. (SD330, P330-13)

7.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified the OFIs shown below to assist cognizant managers in improving programs and operations. While OFIs may identify potential solutions to findings and deficiencies identified in assessment reports, they may also address other conditions observed during the assessment process. These OFIs are offered only as a recommendation for line management consideration; they do not require formal resolution by management through a corrective action process and are not intended to be prescriptive or mandatory. Rather, they are suggestions that may assist site management in implementing best practices or provide potential solutions to issues identified during the assessment.

Triad National Security, LLC

OFI-Triad-1: Consider clarifying the wording in the DSA to differentiate between the FCS mode of passive safe shutdown and TSR modes.

OFI-Triad-2: Consider describing the failure mode of the ventilation damper upon loss of instrument air in the DSA, TSR, and SDD.

OFI-Triad-3: Consider eliminating "minor" and "significant" and the "separate path to green" actions from the system health reporting process, and instead following an industry best practice using colors to depict system health as follows:

- Green – the system is performing as expected with normal resources.
- Yellow – the system continues to function but has deficiencies that require additional resources to resolve the stated deficiencies in a timely manner in order to return the system to green.
- Red – the system is inoperable or has previously failed to perform its required functions.

NNSA Los Alamos Field Office

OFI-NA-LA-1: Consider establishing a minimum periodicity for assessing the TA-55 safety systems identified as needing periodic SSO reviews, as recommended in DOE Guide 226.1-2A.

Appendix A
Supplemental Information

Dates of Assessment

May 1 to July 18, 2025

Office of Enterprise Assessments (EA) Management

Mark D. Barth, Acting Director, Office of Enterprise Assessments
William F. West, Deputy Director, Office of Enterprise Assessments
Kevin G. Kilp, Director, Office of Environment, Safety and Health Assessments
David A. Young, Deputy Director, Office of Environment, Safety and Health Assessments
Tamara D. Powell, Director, Office of Nuclear Safety and Environmental Assessments
David Olah, Director, Office of Worker Safety and Health Assessments
Terrance J. Jackson, Acting Director, Office of Emergency Management Assessments
Brent L. Jones, Director, Office of Nuclear Engineering and Safety Basis Assessments

Quality Review Board

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