Independent Assessment of Safety System Management at the Lawrence Livermore National Laboratory Plutonium Facility – Building 332

March 2025

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

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Acronyms

AOP	Abnormal Operations Procedure
BLEVE	Boiling Liquid Expanding Vapor Explosion
CFR	Code of Federal Regulations
CM	Configuration Management
CRAD	Criteria and Review Approach Document
CSE	Cognizant System Engineer
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EA	Office of Enterprise Assessments
FHFS	Final HEPA Filtration Stages
GBES	Glovebox Exhaust System
HEPA	High Efficiency Particulate Air
HGCS	Hydrogen Gas Control System
IAP	Integrated Assessment Plan
ITS	Issues Tracking System
LCO	Limiting Condition for Operation
LFO	Livermore Field Office
LLNL	Lawrence Livermore National Laboratory
LLNS	Lawrence Livermore National Security, LLC
MPM	Maintenance Program Manual
M&TE	Measurement and Test Equipment
NMMP	Nuclear Maintenance Management Program
NNSA	National Nuclear Security Administration
OFI	Opportunity for Improvement
PM	Preventive Maintenance
PMT	Post-Maintenance Testing
QA	Quality Assurance
RVS	Room Ventilation System
SC	Safety Class
SDD	System Design Description
SR	Surveillance Requirement
SRP	Surveillance Requirement Procedure
SS	Safety Significant
SSCs	Structures, Systems, and Components
SSM	Safety System Management
SSO	Safety System Oversight
TSR	Technical Safety Requirement
USQ	Unreviewed Safety Question
VSS	Vital Safety System

INDEPENDENT ASSESSMENT OF SAFETY SYSTEM MANAGEMENT AT THE LAWRENCE LIVERMORE NATIONAL LABORATORY PLUTONIUM FACILITY - BUILDING 332

Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of safety system management (SSM) at the Lawrence Livermore National Laboratory (LLNL) Plutonium Facility (Building 332) from October to December 2024. LLNL is managed and operated by Lawrence Livermore National Security, LLC (LLNS) for the National Nuclear Security Administration and is overseen by the Livermore Field Office (LFO). 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 class final HEPA filtration stages and hydrogen gas control systems, and the safety significant glovebox exhaust system) 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 applicable LFO oversight processes.

EA identified the following strengths:

- LLNS entered EA-identified issues into their issues tracking system upon identification of those concerns.
- LLNS has documented comprehensive descriptions of safety systems in the documented safety analysis (DSA).
- The LLNS Operations Review Board effectively evaluates issues for risk and classifies them for disposition.
- LLNS Building 332 operators demonstrated a high level of knowledge of safety systems and processes.
- LFO is well engaged with LLNS regarding technical issues and maintains good overall awareness of the facility.

EA also identified a number of important weaknesses that have the potential to reduce the reliability of the evaluated safety systems, including one finding, as summarized below:

- LLNS does not adequately maintain all measurement and test equipment (M&TE) for the Building 332 safety systems; and personnel responsible for use, storage, and tracking of critical M&TE are not always aware of their assigned roles. (Finding)
- The performance criterion and associated surveillance for the demisters supporting the safety class final HEPA filter stages system do not adequately ensure that the demisters can meet their safety function considering their limited design margin.
- The DSA does not evaluate the current state of the hydrogen gas control system (HGCS) with respect to meeting its safety class function.
- The technical safety requirement (TSR) document is inconsistent with the DSA in that it does not restrict Operating Configuration A (i.e., operation with a large hydrogen bottle) of the HGCS.
- Not all glovebox exhaust system TSR surveillance procedures account for instrument uncertainty using sound engineering principles.

- LLNS does not always adequately prepare and approve reports documenting annual system condition assessments in the specified timeframe.
- LLNS has not ensured consistency between the current HGCS system design description and other controlled design documents.
- The LLNS nuclear maintenance management program (NMMP) does not require maintenance performance metrics for Building 332 safety systems.
- LLNS does not store all loose equipment in an area designated as a storage area such that no potential threat is posed to safety systems from interaction during a seismic event.
- LLNS surveillance and operating procedures do not always specify independent verification requirements or appropriately detailed operator action when surveillance requirements are not met.
- The LLNS initial training program used to certify Building 332 facility operators does not include required training on core subjects or classroom training on certain other fundamental topics.
- LLNS approved issues management procedures do not accurately prescribe causal analysis processes.
- LFO is not approving the NMMP at least every three years.

In summary, EA identified both strengths and weaknesses in how LLNS manages the evaluated safety systems. In most regards, the final HEPA filtration stages, hydrogen gas control system, and glovebox exhaust system were appropriately functionally classified and 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 weaknesses will support a more robust safety basis and increase assurance that the systems will operate reliability.

INDEPENDENT ASSESSMENT OF SAFETY SYSTEM MANAGEMENT AT THE LAWRENCE LIVERMORE NATIONAL LABORATORY PLUTONIUM FACILITY – BUILDING 332

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 independent assessment of the effectiveness of safety system management (SSM) at the Lawrence Livermore National Laboratory (LLNL) Plutonium Facility (Building 332). This assessment was performed within the broader context of 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*. The assessment was conducted from October to December 2024.

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 can reliably perform the intended function 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, engineering design, cognizant system engineer (CSE), configuration management (CM), maintenance, operations/training, feedback and improvement, and Federal oversight. The assessment focused on the effectiveness of Federal and contractor line management in managing and implementing safety system management requirements.

LLNL is managed and operated by Lawrence Livermore National Security, LLC (LLNS) for the National Nuclear Security Administration (NNSA) and is overseen by the Livermore Field Office (LFO). Building 332, located within the Superblock complex at LLNL, supports the nuclear weapons program through research in the physical, metallurgical, and chemical properties of plutonium in support of stockpile stewardship, as well as fabrication, testing, and assembly of plutonium parts in support of the NNSA nuclear testing program.

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 Building 332. 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 safety class (SC) systems, and one safety significant (SS) system:

- Final HEPA filtration stages (FHFS) system – SC (TSR limiting condition for operation [LCO] 3.2, *Final HEPA Filtration Stages*)
- Hydrogen gas control system (HGCS) – SC/SS (functional classification is dependent on the size of hydrogen bottle connected to the system) – (TSR LCO 3.3, *Hydrogen Gas Control System*)

- Glovebox exhaust system (GBES) – SS (TSR LCO 3.7, *Glovebox Exhaust System*).

EA used a written comment and response process to address salient issues identified before the onsite portion of the assessment. Follow-on discussions were conducted with LFO and LLNS personnel to clarify and resolve comments. Additional issues were identified during the onsite portion of the assessment. LLNS entered most EA-identified issues into their issues tracking system (ITS); these reference numbers are included in appendix B.

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 plans, system design documents, procedures, and training and qualification 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 LFO provided adequate oversight of the LLNS CSE programs 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.

A previous independent assessment of SSM at Building 332 was conducted in 2015, as documented in EA report *Office of Enterprise Assessments Targeted Review of the Safety-Class Room Ventilation Systems and Associated Final Filtration Stages, and Review of Federal Assurance Capability at the Lawrence Livermore National Laboratory Plutonium Facility, February 2015*. EA reviewed the actions taken to close the nine findings identified in that assessment.

3.0 RESULTS

3.1 Safety Basis

This portion of the assessment evaluated the Building 332 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 under abnormal operating and accident conditions, and to verify compliance with DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*.

Control Derivation and Description

The Building 332 SC FHFS system consists of the final HEPA filters and plenums for both the room and glovebox ventilation systems. There are two glovebox exhaust plenums and two room ventilation system plenums. The FHFS system is appropriately credited for protection of the public and co-located workers from radiological consequences due to potential fires, a molten metal spill, overpressure events, hydrogen explosions, and the evaluation basis earthquake. The FHFS system contains two stages of HEPA filters, which mitigate any potential releases to below the Evaluation Guideline (EG).

The Building 332 HGCS has both SC and SS functions. The SC function is required for furnace operations using a larger hydrogen supply bottle for which a potential glovebox explosion is a credible event. This configuration is not currently authorized in Building 332. The system is currently operated as SS with a small (two standard cubic feet) hydrogen bottle to protect workers from a limited furnace explosion. The HGCS components for both the SC and SS functions are the same.

The SS GBES is appropriately credited in the hazards analysis to protect workers from radiological exposure by supporting glovebox confinement through the FHFS system.

The DSA, chapter 4, appropriately provides the safety functions, system description, and functional requirements for the selected systems. The system descriptions include a discussion of system components and operability requirements. Functional requirements and performance criteria are generally adequate to demonstrate that the selected systems' safety functions can be met. However, the following exceptions were identified:

- Contrary to DOE-STD-3009-94, section 4.3.X.4, the subjective performance criterion and associated surveillance requirement for the demisters supporting the SC FHFS system (i.e., annual visual inspection to verify they are intact and unplugged) are not adequate to ensure the demisters can meet their safety function considering their limited design margin. (See **Deficiency D-LLNS-1**.) Incomplete system evaluations and subjective performance criteria could compromise the system's ability to meet its safety function. Annual surveillances of the demisters are performed with varying levels of documentation, often indicating observations of "layers of corrosion" without any supporting evaluation statement as to why the observed conditions would not compromise the required demisters' water removal efficiency. Additionally, visual inspection of the demisters is inhibited by their limited accessibility. The required water removal efficiency for the demisters (98.1%) is slightly higher than their design efficiency (98%). The supporting calculation justifies the adequacy of the demisters by qualitatively arguing that the actual efficiency of the stainless-steel demisters is better for the larger droplets produced by the spray nozzles than the design qualification performed for 20-micron droplets. There is no discussion regarding the efficiency of the carbon steel demisters or how corrosion affects their efficiency.
- Contrary to DOE-STD-3009-94, section 4.3.X.4, the DSA, section 4.3.3.4, does not evaluate the current state of the HGCS system with respect to meeting its SC function. (See **Deficiency D-LLNS-2**.) An incomplete evaluation of safety systems could result in an indeterminate state of system operability to meet safety class functions. DSA section 4.3.3 describes and evaluates the HGCS as a system with both SC and SS safety functions dependent on the size of the hydrogen bottle attached to the system. The functional requirements, performance criteria, and TSRs are identical for both safety functions. The DSA states in several places that LFO approval is required to start hydrogen operations in "Operating Configuration A" (i.e., large hydrogen bottle), with no information regarding any required changes to design, operations, or analysis to support the LFO authorization. At a minimum, to support use of the SC "Operating Configuration A," system design changes are needed to eliminate single points of failure.

Safety Control Functional Classification

The selected systems' controls are appropriately functionally classified in the hazard and accident analyses. Several postulated accidents described in chapter 3 of the DSA result in unmitigated radiological consequences exceeding the evaluation guideline of 25 rem (roentgen equivalent man) specified in DOE-STD-3009-94; therefore, the FHFS system is identified as SC to mitigate these events. The HGCS is appropriately classified as SC to prevent a hydrogen explosion that could damage the final stages of the glovebox HEPA filters. The GBES is classified as SS for worker protection and to provide defense in depth.

Technical Safety Requirement Development

The information provided in chapters 4 and 5 of the DSA and the TSR bases is sufficient to derive the TSR LCOs for each of the evaluated systems. The TSR operability and surveillance requirements

developed for the selected systems are adequate to ensure that the required safety functions will be met. The TSR bases adequately describe the reasons for the operating limits and surveillance requirements. However, contrary to 10 CFR 830.205, *Technical Safety Requirements*, (a)(1), the TSR is inconsistent with the DSA in that it does not restrict Operating Configuration A of the HGCS. Specifically, TSR section 5.11, *Specific Administrative Controls*, Table 5-2, *Directive Action Specific Administrative Controls-Hydrogen Controls*, allows the use of larger hydrogen bottles. (See **Deficiency D-LLNS-3**.) Inconsistency between the DSA and TSR could result in inadvertent operations outside of the analyzed safety basis.

Liquid Nitrogen and Argon Storage Tanks

The liquid nitrogen and argon tanks located outside of Building 332 (although addressed in the DSA as a potential asphyxiation hazard) had not been evaluated for the potential for a boiling liquid expanding vapor explosion (BLEVE). A BLEVE is a highly energetic event associated with liquid gas pressure vessels that can cause deflagration damage spanning a wide radius. Lack of complete hazard evaluation could result in unanalyzed vulnerabilities to safety systems (such as the facility structure or outside portions of the HGCS, in this case) and an inadequate set of controls. Upon discovery of the unanalyzed hazard, LLNS management appropriately declared a potential inadequacy in the safety analysis and initiated unreviewed safety question (USQ) determinations for the affected LLNL facilities.

Safety Basis Conclusions

In general, the safety basis for the selected systems is appropriately developed, and the safety functions, functional requirements, and system evaluations are adequately documented. The selected systems are appropriately functionally classified. The TSRs are properly developed. However, the DSA performance criterion for the annual visual inspection of the demisters is not adequate to ensure the safety function can be met; the DSA system evaluation for the HGCS does not evaluate the current state of the system with respect to meeting its SC function, and the TSR is inconsistent with the DSA with respect to prohibiting operation of the HGCS in Operating Configuration A.

3.2 Technical Safety Requirement Surveillance

This portion of the assessment evaluated the Building 332 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, except for the demister surveillances (see Deficiency D-LLNS-1 in section 3.1). The surveillance procedures appropriately identify system and test conditions and include clear performance steps. The procedures were appropriately developed, reviewed, and approved. LLNS schedules, tracks, and documents surveillances effectively to ensure compliance with the TSR-required frequencies, taking into account allowable extensions of surveillance requirements (i.e., TSR-defined grace periods).

Training for LLNS operators performing TSR surveillances is addressed in section 3.7 below.

Technical Safety Requirement Surveillance Conclusions

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

3.3 Engineering Design Process

This portion of the assessment evaluated the Building 332 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.

LLNS has appropriately implemented conduct of engineering procedures that meet the requirements of 10 CFR 830.122, criterion 6, for design performance. These procedures provide adequate processes for incorporation of appropriate 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 adequately identified and are appropriate to allow qualified individuals to understand the design requirements. The LLNS engineering organization performed adequate independent design verifications for reviewed calculations and drawings to ensure that engineering products are technically accurate. However, the engineering calculation for the HGCS hydrogen and oxygen monitors' setpoints does not document the calculation method.

The USQ process has been adequately established and implemented as required by 10 CFR 830.203, *Unreviewed safety question process*, and is being appropriately applied within the design change process. Reviewed USQ determinations demonstrated adequate review of surveillance requirement procedures, operating procedures, and design changes to the HGCS.

While the engineering design process is generally adequate, contrary to 10 CFR 830.122, (f)(1), not all GBES TSR surveillance procedures have implemented a process that accounts for instrument uncertainty using sound engineering principles. (See **Deficiency D-LLNS-4**.) Not accounting for instrument accuracy in surveillance procedure acceptance criteria could result in the facility being operated outside the limits analyzed in the DSA. Building 332 TSR surveillances 4.7.1.a and 4.7.2 require pressure measurement and verification, but LLNS procedures for these surveillances implement verification processes that do not account for the accuracy of the pressure instrumentation used.

Engineering Design Process Conclusions

Engineering procedures provide adequate processes for performing calculations, developing drawings, and managing design changes. The reviewed calculation and drawings were appropriately signed by independent engineers and incorporated applicable requirements from the facility safety design basis and consensus standards. The USQ process is adequately implemented. However, not all GBES TSR surveillance procedures require that instrument uncertainty be accounted for.

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 with DOE Order 420.1C, *Facility Safety*.

LLNS has adequately established and implemented procedures for the Building 332 CSE program that meet the requirements of DOE Order 420.1C for the selected systems. In general, CSEs are appropriately trained and qualified. The CSE assigned to the FHFS system is not fully qualified in accordance with LLNS procedures (i.e., the CSE is qualified as a level I CSE vs. level III); management oversight is provided to ensure the CSE level III function is met. There were no qualified backup CSEs for the selected systems, and most CSEs were responsible for multiple safety systems. (See **OFI-LLNS-1**.)

Staffing shortages of qualified CSEs presents a vulnerability to facility operations and maintenance support of safety systems.

Interviewed CSEs demonstrated adequate knowledge of the reliability, operational readiness, and required configurations of their assigned systems. Reviewed annual system condition assessments demonstrated appropriate CSE review of system operability, system reliability, material condition, and configuration control. The report documenting the system condition assessment for the GBES included appropriate trending data for header pressure readings, and the report documenting the system condition assessment for the FHFS system included appropriate trending data for filter leak testing and differential pressure readings.

The HGCS has not operated since 2012, therefore annual system condition assessments were not required. A readiness assessment was appropriately completed for restart of the system in 2023. The system was returned to service in 2024 for one operational test and an assessment will be performed within a year of authorized restart.

CSEs work closely with the operations and maintenance organizations to troubleshoot equipment issues. CSEs appropriately monitor the physical configuration of their assigned systems using walkdowns and generally adequate system condition assessments to verify the adequacy of CM processes and to ensure that affected documents are properly updated when impacted by implemented modifications. System walkdowns are documented in walkdown logs and appropriately identify physical or documentation discrepancies and their resolutions.

While the CSE program is generally adequate, contrary to FMP-SBK-0212, *System Assessments, Tracking and Trending*, reports documenting the annual system condition assessments are not always adequately prepared and approved in the specified timeframe. (See **Deficiency D-LLNS-5**.) The lack of updated content in reports documenting annual system condition assessments can result in emerging safety system operability issues that are not addressed by management in a timely fashion. As an example of inappropriate report preparation, the report for the 2023 FHFS system condition assessment (documented in April 2024) references and discusses data and results solely from calendar 2022 and is identical to the report for the 2022 assessment.

Cognizant System Engineer Program Conclusions

In general, LLNS has adequately established and implemented procedures for the CSE program which meets the requirements of DOE Order 420.1C. In general, CSEs are appropriately trained and qualified and appropriately monitor the physical configuration of their assigned systems. However, reports documenting system condition assessments are not always adequately prepared and approved. Staffing shortages of qualified CSEs present vulnerabilities to facility operations.

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

LLNS 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 intended safety functions. The LLNS CM implementation plan adequately addresses system requirements and performance criteria identified in the

DSA and the TSRs. The CM processes meet the requirements of DOE Order 420.1C and DOE-STD-1073-2016.

Technical Baseline Documents

In general, technical baseline documents (i.e., system design descriptions [SDDs], piping and instrumentation diagrams, elementary control diagrams, control logic drawings, and calculations) for the selected systems were adequately identified, developed, approved, and maintained to support SSM programs, operations, and safety basis implementation. Technical baseline documents are appropriately tracked and monitored in the document control system. However, contrary to DOE Order 420.1C, attachment 2, chapter V, sections 3.c.(1) and 3.c.(2), subsequent to the hydrogen and oxygen monitor replacement design change, Table 3.1, *Primary Codes, Standards and Regulations*, of the HGCS SDD, was not updated to list ISA-67.04.01-2006 as a standard applicable to the system, as identified in the calculation supporting the modification. (See **Deficiency D-LLNS-6**.) Inconsistent documentation of the system configuration could result in errors in maintenance and design activities.

Change Control

Reviewed change requests for the HGCS transducers and isolation valves included adequate scopes of work that demonstrate appropriate control of design changes. Affected design documents were included in the requests and received appropriate engineering review and approval. With one exception (see Deficiency D-LLNS-6), affected documents (including implementing documents) were appropriately updated or are being tracked to maintain adequate change control.

Work Control

The most recent modification done on the selected safety systems was performed six years ago. The reviewed work control document was adequate for field modifications of HGCS transducers and isolation valves in the vacuum piping system. No other modifications have been performed on the selected systems in the last six years.

Document Control

Document control is appropriately implemented for reviewed design change forms, design change packages, temporary modification packages, work packages, design drawings, and calculations. The latest versions of the technical baseline documents and amendments are contained in a document control system.

Assessments

As discussed in section 3.4, CSEs perform annual system condition assessments to demonstrate review of SSC configurations on the selected systems. System condition assessments 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. However, reviewed system condition assessment summaries do not concisely communicate these conclusions. (See **OFI-LLNS-2**.)

Additional assessments conducted by LLNS and LFO appropriately reviewed functional areas of the CM program (design control, change control, work control, document control, and assessments) and resulted in identified issues and subsequent effective corrective actions.

Configuration Management Conclusions

LLNS implements a generally adequate CM program that meets the requirements of DOE Order 420.1C and DOE-STD-1073-2016. Reviewed technical baseline documents for the selected systems are generally consistent with design requirements. Reviewed periodic CM assessments were appropriately conducted, and subsequent corrective actions improved the CM program. However, the SDD for the HGCS was not updated to include applicable standards following the most recent modification.

3.6 Maintenance

This portion of the assessment evaluated the maintenance program and processes used in Building 332, and control of maintenance, repairs, and modifications to determine whether maintenance of 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 LFO-approved sitewide nuclear maintenance management program (NMMP), MAN-0158, *LLNL Maintenance Management Program for Non-Reactor Nuclear Facilities*, and the maintenance program used in Building 332 establish generally adequate requirements for the safe conduct of maintenance for the selected systems. These programs provide a suite of system-specific inspection, testing, and maintenance procedures to ensure that they can reliably perform their intended safety functions. In general, the NMMP and CMU11-000064, *Superblock Maintenance Program Manual* (MPM), adequately address the 17 elements of DOE Order 433.1B, except for some deficiencies self-identified in a 2022 maintenance program assessment and deficiency D-LLNS-7 discussed below. However, contrary to DOE Order 433.1B, section 4.b, and MAN-0158, section 2.3, LFO has not approved the LLNL NMMP at least every three years, despite having received it from LLNS, as required. (See **Deficiency D-LFO-1**.) Delay of approval of the NMMP results in needed maintenance program changes not being implemented. The NMMP that was approved prior to March 28, 2017, was required to be submitted and approved by March 28, 2020; however, it was not approved by LFO until September 18, 2020, which is beyond the required three-year periodicity. Likewise, after the September 18, 2020, approval, the next LFO approval of the NMMP did not occur until December 12, 2023, which was again not consistent with the requirement.

Maintenance Processes

The LLNS maintenance processes for the selected systems are generally adequate to conduct maintenance consistent with these systems' functional classifications. The maintenance organization supporting Building 332 adequately coordinates maintenance planning and scheduling with facility management and uses a graded approach to prioritize the maintenance of safety SSCs. In general, LLNS performs preventive maintenance (PM), predictive maintenance, and corrective maintenance appropriately for the selected systems to ensure their safe, efficient, and reliable operation considering aging systems. PM appropriately includes FHFS filter replacement, calibration of HGCS instruments, and inspections and maintenance of GBES components, including fans, pneumatic/electrical control systems, and room isolation dampers. LLNS effectively performs operational checks on the FHFS system prior to operations, and PM for inspection and functional testing. LLNS prioritizes PM work orders as category 1 through 5, with category 1, which applies to SC, SS, and defense-in-depth work, being the highest priority. For category 1 PM, LLNS appropriately implements a rigorous and formal maintenance program. In addition, the predictive maintenance program appropriately includes monthly vibration readings on all GBES rotating components.

While the LLNS maintenance processes are generally adequate, contrary to DOE Order 433.1B, attachment 2, section 2.o, the NMMP does not require implementation of a process (e.g., maintenance metrics program) for developing, maintaining, and communicating performance measures (i.e., metrics) for the maintenance of all Building 332 safety SSCs. (See **Deficiency D-LLNS-7**.) Lack of a maintenance metrics program for Building 332 could result in a diminished ability to identify lessons learned, adverse trends, and/or maintenance issues requiring corrective actions. In addition, the lack of a maintenance metrics program could negatively affect safety system availability, maintenance timeliness, and management of maintenance backlogs. Although the NMMP describes optional guidance for keeping maintenance metrics, and LLNS publishes higher-level monthly institutional maintenance metrics, Building 332 does not currently have a maintenance metrics program.

Control of Maintenance, Repairs, and Modifications

The LLNS maintenance process is generally adequate for controlling and overseeing maintenance, and it appropriately implements approved modifications, PM, corrective maintenance, and quality assurance (QA) hold points. As appropriately described in the MPM, all maintenance, repair, and modification work in Building 332 is controlled in accordance with the facility-specific safety plans, work planning and control manuals, job-specific work control documents, and the facility activity schedule. Post-maintenance testing (PMT) for safety SSCs is appropriately required; procurement and handling of maintenance material items and services are adequately addressed in the MPM and in procurement procedures; and the computerized maintenance management system is an appropriate tool to retrieve maintenance records and component failure data.

Interviewed maintenance managers and reviewed completed work packages demonstrated adequate performance, control, and documentation of maintenance to ensure system operability. EA observed tabletop demonstrations and field simulations of PM for the selected safety SSCs, as well as corrective maintenance on the SS criticality alarm system performed by qualified facility operators. During those observations, LLNS demonstrated thorough pre-job and post-job briefings, and disciplined execution including procedural compliance, formal communications, PMT, and system restoration.

FMP-SBK-0701, *Calibration Program for Superblock Facilities Critical Measuring and Test Equipment*, adequately describes the LLNS process used at Building 332 for controlling critical measurement and test equipment (M&TE). However, the following weaknesses were identified:

- Contrary to 10 CFR 830.122, (h)(2), and FMP-SBK-0701, sections 4.0 and 7.0, LLNS did not adequately maintain all M&TE for the selected safety SSCs, and interviewed personnel responsible for use, storage, and tracking (i.e., custodian and users) of critical M&TE were unaware of their assigned roles regarding maintenance of M&TE. (See **Finding F-LLNS-1**.) Five of the ten reviewed items (i.e., measurement and testing instruments) were either improperly stored or unaccounted for in the database that tracks equipment calibration. In addition, not all critical M&TE custodianship responsibilities were clear to all responsible personnel. Inadequate control and handling of M&TE can result in loss, damage, unknown usage history, and loss of calibration and traceability.
- Contrary to the housekeeping requirements in the NMMP, section 3.2.16, and the LLNS Environment, Safety, and Health Manual, document 11.2, *Hazards-General and Miscellaneous*, improperly stored ladders, a large motor, a wheeled cart, and hand tools were observed in an area not identified as a designated storage area and in the proximity of the SC room ventilation system fans and filter plenum. (See **Deficiency D-LLNS-8**.) A potentially unsafe configuration of stored equipment could pose a hazard to installed safety SSCs during a seismic event.

Maintenance Conclusions

The maintenance program is generally adequate to maintain the selected systems in Building 332. In general, maintenance is properly planned, scheduled, and performed to ensure that the selected systems can reliably perform their intended safety functions. LLNS has adequate controls in place for conduct of maintenance and modifications for the reviewed systems. However, Building 332 lacks a maintenance metrics program, and does not implement appropriate handling and storage practices for critical M&TE. Additionally, EA observed one instance of an inadequate equipment storage practice.

3.7 Operations

This portion of the assessment evaluated Building 332 operating practices, procedures, and operator training to determine whether operations are conducted in a manner that ensures that the selected systems can reliably perform their intended safety functions.

Operating Practices and Procedures

The conduct of operations matrix used for Building 332 appropriately provides a crosswalk between DOE Order 422.1 and site implementing procedures. Procedures appropriately implement DOE Order 422.1, including development of shift orders, identification of systems requiring independent verification, log keeping performance, and control of equipment and system status. Building 332 facility management and operating procedures are adequate to ensure that operators (i.e., facility operators and fissile material handlers) can operate equipment properly.

Observation of procedure performance, tabletops, walkdowns, and daily facility inspections (including logs), demonstrated adequate performance. Building 332 management and operating personnel responsible for TSR implementation and compliance are knowledgeable and experienced, as demonstrated by interviews and observations.

Operations in Building 332 are conducted in a manner that supports operability of the selected systems. In general, reviewed facility management and operating procedures, operational safety plans, surveillance requirement procedures, and daily facility inspections are adequately developed and implemented. However, contrary to DOE Order 422.1, attachment 2, appendix A, paragraph 2, and ELM-U No: 1006888822, *Applicability of Independent Verification for Superblock Safety Systems*, LLNS procedures do not always specify appropriate operator action or independent verification requirements (See **Deficiency D-LLNS-9**.) The lack of sufficient performance details and independent verification requirements could result in operations outside of the analyzed safety basis or decreased reliability of safety systems. Specifically,

- OPP-B322-001, *Operating Procedure for HYDEC Process in the Metal Conversion Glovebox*, does not contain the appropriate details for task performance as required by DOE Order 422.1, attachment 2, appendix A, paragraph 2.p.(3)h. OPP-B322-001, step 7.6.10, instructs the operator to "IDENTIFY and REPAIR the Hydride/Nitride Furnace leak" when rate-of-rise acceptance criteria are not met, without any further delineation of the steps required to complete this action.
- LLNS has not incorporated independent verification into surveillance procedures SRP-B332-4.3.3.a, *Semiannually – Calibrate the Glovebox Hydrogen Detectors*, and SRP-B332-4.3.3.b, *Annually - Calibrate the Glovebox Oxygen Detectors*, as required by DOE Order 422.1, attachment 2, appendix A, paragraph 2.j.(1), and LLNS procedure ELM-U No: 1006888822. Additionally, procedure OPF-B332-016, *Increment 1 GBES Cross Connect Procedure*, does not require independent verification despite directing potentially extensive valve manipulation in an SS system.

Operator Training

LLNS has generally established an adequate training program for operations staff (fissile material handlers and facility operators). The training implementation matrix for Building 332 adequately addresses each element of DOE Order 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*. The training manual for Building 332 comprehensively identifies roles and responsibilities. LLNS appropriately utilizes an electronic learning management system to document training plans, identify training needs, and to schedule and track personnel qualification and certification. Personnel certification records are maintained to document completion of qualifications and periodic requalification. Reviewed staff training plans provide adequate training requirements for the various staff positions.

Building 332 operator qualifications appropriately include web-based training and performance demonstrations for LCO requirements. Web-based training appropriately includes safety basis fundamentals. The operator certification records document completion of required training and qualification activities. Personnel interviews, review of procedures, walkthroughs, and surveillance requirements procedure tabletops demonstrated that operators are knowledgeable of their assigned tasks.

While the Building 332 training program is generally adequate, contrary to DOE Order 426.2, attachment 1, chapter II.6, and CMU05-000095, *Superblock Training Manual*, section 4.2, the initial training program to certify facility operators does not meet all applicable requirements. (See **Deficiency D-LLNS-10**.) Not including all required training topics could result in inadequate performance. Specifically, the qualification program described in PU5070, *B332 Certified Facility Operator Certification Record*, lacks required training on core subjects, including SC and SS SSCs, as well as classroom training on the following topics:

- Normal and emergency procedures
- Administrative procedures
- Radiation control practices
- Locations and functions of pertinent safety systems and equipment
- Procedures for making changes or alterations in operations and operating procedures
- TSRs.

Classroom and core training in areas that are fundamental to the candidate's assigned tasks is essential to ensure that personnel are familiar with all aspects of their positions and can perform required tasks and operate systems within the analyzed safety basis.

Operations Conclusions

Conduct of operations and training programs used in Building 332 are generally adequate. However, there are some weaknesses in procedures due to a lack of specificity of performance requirements and missing independent verification requirements. The training program has weaknesses related to lack of classroom training on safety systems and the safety basis, and lack of core training on SC and SS systems.

3.8 Feedback and Improvement

This portion of the assessment evaluated LLNS'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*.

Issues Management Processes

LLNS has established generally adequate processes to identify the causes of problems and prevent recurrence as part of correcting the problems. The contractor assurance system description, together with DES-0071, *Analysis Program*, appropriately describes site-wide processes that are implemented by generally adequate procedures, including PRO-0042, *Assessments, Issues, and Corrective Action Management*, PRO-0070, *Causal Analysis Manual*, and PRO-0082, *Reporting Occurrences to DOE*. However, contrary to 10 CFR 830.122, (d)(1), approved procedures do not accurately prescribe causal analysis processes. (See **Deficiency D-LLNS-11**.) Specifically, DES-0071 refers to an appendix D in PRO-0082 that no longer exists, as well as LLNS procedures (PRO-0073, *Analyzing Events and Conditions for Apparent Cause*, PRO-0074, *Analyzing Events for Root Causes*, and PRO-0075, *Analyzing Issues for Root Cause*) that are cancelled. The lack of a documented causal analysis process with clearly defined requirements can result in inadequate identification and correction of events and issue causes.

Operational Review Board

The LLNS issues management program includes an Operational Review Board (ORB) that has responsibility for Building 332 and meets bi-weekly with consistent value to review all issues and categorize them with a risk-informed significance level. Assurance managers pre-screen issues before they are reviewed by the ORB. Reviewed training records for assurance managers and issue screeners are adequate. Forms have recently been developed to support formal qualification recordkeeping for issue screeners and assurance managers, but these forms are not yet implemented. Issue screeners and the ORB adequately categorized the reviewed issues related to the selected systems.

For the 5-year sample of LLNL issues that EA reviewed, the source, type, and significance of issues were used to determine minimum requirements for analysis and resolution. These minimum requirements are effectively built into the ITS. When the source, type, and significance of an issue required a documented root cause, the issues were adequately analyzed. When issues did not require a formal root cause, but required some lesser documented causal analysis, the analyses did not result in corrective actions that would effectively prevent recurrence. Six of the seven Building 332 significance level 3 issues that required a lesser level of documented causal analysis were not evaluated beyond direct causes. (See **OFI-LLNS-3**.) Causal analyses that address only direct causes may not be effective in preventing recurrence because they may not identify and correct the underlying causes that led to the issue.

Performance Assurance

LLNS adequately assesses and evaluates organizational performance to ensure that applicable requirements and standards for environment, safety, and health, including QA and integrated safety management, are met. LLNS assessment programs are risk-informed and formally documented. Assessments are adequately scheduled, managed in ITS, and performed in accordance with an integrated assessment plan (IAP). Assurance managers, functional area managers, and line managers effectively identify areas needing focus, considering recent trends in ITS, regulatory requirements, and operational needs. The IAP is prepared annually, and adequately includes internal independent, joint functional area manager/line management assessments, and management self-assessments. Reviewed assessments completed over the past three years for the selected systems were adequate.

Feedback and Improvement Conclusions

LLNS has established generally adequate processes to identify the causes of problems and work to prevent recurrence as part of correcting the problem. Conditions adverse to quality, safety, and operability are adequately managed and tracked. Assurance systems are in place to provide appropriate

feedback and improvement processes that address safety system performance. However, some approved procedures do not accurately prescribe analysis processes, and some lower-level issues lack adequate analyses to identify and correct underlying causes.

3.9 Federal Oversight

This portion of the assessment evaluated LFO oversight to determine whether LFO effectively ensures that the selected systems reliably perform their safety functions.

The LFO safety system oversight (SSO) program is consistent with DOE Order 420.1C, and DOE Order 426.1B, *Department of Energy Federal Technical Capabilities*. SSO personnel are responsible for overseeing assigned safety systems to ensure that the systems will perform as required. The SSO program is adequately established in Livermore Field Office Process (LFO P) 420.1, *Safety System Oversight Program*.

Consistent with LFO P 420.1, LFO implements a facility engineer model at Building 332 to perform SSO activities of their assigned vital safety systems (VSS), which include the SC and SS systems. There is one qualified SSO engineer assigned to cover the 17 active SC and SS systems. Currently, LFO has two SSO engineer positions; at the time of this assessment, LFO explained that they are actively working to fill the second position.

The SSO engineer appropriately conducts VSS assessments, consistent with the periodicity established by the Joint Master Assessment Schedule and the IAP. The periodicity of the oversight activities follows the guidance in DOE Guide 226.1-2A, *Federal Line Management Oversight of Department of Energy Nuclear Facilities*, which recommends a minimum assessment periodicity of three years for SC systems and five years for SS systems.

The LFO SSO engineer appropriately conducts a variety of independent oversight activities, both in terms of documented operational awareness and formal assessment review activities based on an approved assessment plan. The reviewed assessment plans were generally effective in identifying assessments for the next fiscal year. Five reviewed VSS assessments of the selected systems conducted between 2019 and 2024 were effective in identifying issues that improved nuclear safety in various areas, including the evaluation of the implementation of the CSE program. Based on SSO VSS assessment results, issues were appropriately entered into the LLNS ITS, assigned a unique number for development and tracking of corrective actions, and are effectively monitored to closure. In addition to these formal oversight activities, the SSO engineer conducts periodic operational awareness activity reports covering the safety systems' operability, as well as aspects of the CSE program.

Reviewed training and qualification records demonstrated that the SSO engineer meets the training and qualification requirements specified in DOE-STD-8000-2021, *Safety System Oversight, Functional Area Qualification Standard*, and LFO Qualification Standard 002, *Safety System Oversight Position Qualification Program*. The SSO engineer demonstrated thorough knowledge of the systems and recently identified issues at the facility associated with the selected safety systems.

In addition to the SSO engineers, LFO has assigned two Facility Representatives (FRs) for Building 332. Both are appropriately qualified per DOE-STD-1151, *Facility Representative Functional Area Qualification Standard*, and LFO P 1063.2, *Facility Representative Training and Qualification Program*, which includes generally applicable FR competencies and identifies facility-specific appendices that FRs must complete for their assigned facilities. The FRs demonstrated thorough knowledge of the selected safety systems and recently identified issues associated with these systems. One of the many FR responsibilities is to conduct daily oversight of safety systems in Building 332. Four reviewed

operational awareness activities of the selected systems conducted between 2022 and 2024 demonstrate that FRs are maintaining adequate operational awareness of safety systems status.

Federal Oversight Conclusions

Overall, LFO implements an adequate SSO program for the oversight of the selected systems. LFO appropriately communicates its oversight findings and monitors associated corrective action development, execution, and closure through close coordination with LLNS. LFO oversight is effective and is appropriately documented.

3.10 Follow-up on Previous EA Findings

This portion of the assessment evaluated the completion and effectiveness of corrective actions for nine findings from EA-predecessor report *Office of Enterprise Assessments Targeted Review of the Safety-Class Room Ventilation Systems and Associated Final Filtration Stages, and Review of Federal Assurance Capability at the Lawrence Livermore National Laboratory Plutonium Facility, February 2015*.

- **Finding LLNS-Ops-1**: LLNS has written several abnormal operations procedures (AOPs) in a confusing manner, and some contain significant technical errors, making them cumbersome, error-prone, and in some cases, impossible to perform as written, contrary to the requirements of DOE Order 422.1, 2.p.

  Follow-up: Four reviewed corrective actions to resolve this finding were adequately completed.

  Status: LLNS has adequately resolved EA Finding LLNS-Ops-1.

- **Finding LLNS-Ops-2**: LLNS did not develop and/or maintain some facility operator training materials and certification documentation sufficiently to fully meet the requirements for a systematic approach to training program as required by DOE Order 426.2.

  Follow-up: Six reviewed corrective actions to resolve this finding were adequately completed. In addition, this assessment report identified a weakness in the current Facility Operator training program due to lack of specifying classroom training and SC and SS systems overview training which will be resolved through additional corrective actions as a result of this assessment (see section 3.7).

  Status: LLNS has adequately resolved EA Finding LLNS-Ops-2.

- **Finding-LLNS-Maint-1**: LLNS has not properly maintained the technical basis for room ventilation system (RVS) maintenance activities to ensure the continued health and reliability of the system as required by DOE Order 433.1B.

  Follow-up: Thirteen reviewed corrective actions to resolve this finding were adequately completed.

  Status: LLNS has adequately resolved EA Finding LLNS-Maint-1.

- **Finding-LLNS-ST-1**: LLNS has not sufficiently incorporated surveillance requirements (SRs) into facility surveillance requirement procedures (SRPs) to ensure that the operability of the RVS functions is adequately verified, tracked, and documented as required by the DSA.

  Follow-up: Two reviewed corrective actions to resolve this finding were adequately completed. The corrective actions included a review of the RSV testing to verify operability, and the SRP was updated to include the SRs.

  Status: LLNS has adequately resolved EA Finding LLNS-ST-1.

- **Finding-LLNS-ST-2**: LLNS does not periodically check alarms and annunciators to ensure satisfactory operation as required by DOE Order 422.1.

Follow-up: Two reviewed corrective actions to resolve this finding were adequately completed. The corrective action closure identified section 7.2.4 of the facility daily inspections (OPP-B332-001) as the section that was corrected. However, the latest revision, AP, of the procedure has the applicable section as section 7.3.

Status: LLNS has adequately resolved EA Finding LLNS-ST-2.

- **Finding-LLNS-CSE-1**: LLNS issued SDD-B332-013 under the signature of a single individual without additional review, verification, or approval, contrary to the requirements of 10 CFR 830.122 and the NMTP [Nuclear Materials Technology Program] QA program.

  Follow-up: EA reviewed the current revision of the SDD, SDD-B332-013, Rev. AG, and it has been appropriately reviewed and approved.

  Status: LLNS has adequately resolved EA Finding LLNS-CSE-1.

- **Finding-LLNS-CSE-2**: LLNS does not implement the work control process adequately to "ensure consistency among system requirements and performance criteria, system documentation, and physical configuration of the systems within the scope of the program" as required by DOE Order 420.1C, attachment 2. The work package closure process does not ensure that affected design documents are updated prior to closure, and no other formal tracking mechanism is in place.

  Follow-up: Three reviewed corrective actions to update some of the affected design documents were adequately completed. In addition, LLNS has developed and implemented a new electronic work control process to replace the formerly manual process. Based on a review of sample closed work packages, the new process has adequately addressed the EA concern.

  Status: LLNS has adequately resolved EA Finding LLNS-CSE-2.

- **Finding-LLNS-CSE-3**: LLNS's application of the like-in-kind process to the procurement of replacement HEPA filters with higher flow capacity (and higher pressure drop at rated flow) created a potential for reduced flow margin in the SC RVS that was not evaluated using the USQ process, contrary to the requirements of 10 CFR 830.

  Follow-up: Five corrective actions to resolve this finding were adequately completed.

  Status: LLNS has adequately resolved EA Finding LLNS-CSE-3.

- **Finding-LLNS-CSE-4**: Contrary to the requirements of DOE Order 420.1C, LLNL's modifications to the anchorage of an RVS exhaust fan caused a reduction in seismic capacity, invalidating the vendor seismic qualification. This was not evaluated in the change package, nor was the introduction of a new failure mode (concrete anchor failure) evaluated as a potential USQ.

  Follow-up: Five reviewed corrective actions to resolve this finding were closed by LLNS; however, no evidence was provided that a USQ was completed to evaluate the change in anchorage. LLNS has created a new ITS entry, ISS-138083.20, to address the remaining EA concern.

  Status: LLNS has not adequately resolved EA Finding LLNS-CSE-4.

Follow-up on Previous EA Findings Conclusions

Actions taken by LLNS adequately resolved EA concerns for eight of the nine findings selected for follow-up during this assessment. For the remaining finding, insufficient evidence was provided to demonstrate adequate resolution of the issues raised by EA. Additional follow-up on this finding will be conducted during subsequent assessments.

4.0 BEST PRACTICES

No best practices were identified during this assessment.

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.

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Finding F-LLNS-1: LLNS does not adequately maintain all M&TE for use as applied to the Building 332 safety SSCs, and personnel responsible for use, storage, and tracking of critical M&TE are not always aware of their assigned roles. (10 CFR 830.122, (h)(2) and FMP-SBK-0701, secs. 4.0 and 7.0)

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.

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Deficiency D-LLNS-1: The performance criterion and associated surveillance for the demisters supporting the SC FHFS system are not adequate to ensure that the demisters can meet their safety function considering their limited design margin. (DOE-STD-3009-94, sec. 4.3.X.4)

Deficiency D-LLNS-2: In the Building 332 DSA, section 4.3.3.4, LLNS does not evaluate the current state of the HGCS with respect to meeting its SC function. (DOE-STD-3009-94, sec. 4.3.X.4)

Deficiency D-LLNS-3: The Building 332 TSR is inconsistent with the DSA in that it does not restrict Operating Configuration A of the HGCS. (10 CFR 830.205, (a)(1))

Deficiency D-LLNS-4: Not all LLNS GBES TSR surveillance procedures have implemented a process that accounts for instrument uncertainty using sound engineering principles. (10 CFR 830.122, (f)(1), and FMP-SBK-0212)

Deficiency D-LLNS-5: LLNS does not always adequately prepare and approve reports documenting annual system condition assessments in the specified timeframe. (FMP-SBK-0212)

Deficiency D-LLNS-6: LLNS has not ensured consistency between the current HGCS SDD and other controlled design documents (e.g., calculation). (DOE Order 420.1C, att. 2, chap. V, secs. 3.c.(1) and 3.c.(2))

Deficiency D-LLNS-7: The LLNS NMMP does not require implementation of a process for developing, maintaining, and communicating performance measures (i.e., metrics) for the maintenance of all Building 332 safety SSCs. (DOE Order 433.1B, att. 2, sec. 2.o)

Deficiency D-LLNS-8: LLNS does not store all equipment in a storage cabinets or designated storage areas such that no potential threat is posed to safety SSCs from interaction during a seismic event. (NMMP, sec. 3.2.16, and the LLNS Environment, Safety, and Health Manual Document 11.2)

Deficiency D-LLNS-9: LLNS surveillance and operating procedures do not always specify independent verification requirements or appropriately detailed operator action when surveillance requirements are not met. (DOE Order 422.1, att. 2, app. A, par. 2.p(3)h and 2.j.(1), and ELM-U No: 1006888822)

Deficiency D-LLNS-10: LLNS does not include required training on core subjects or classroom training in its initial training program used to certify Building 332 facility operators. (DOE Order 426.2, att. 1, chap. II.6, and CMU05-000095, sec. 4.2)

Deficiency D-LLNS-11: LLNS approved issues management procedures do not accurately prescribe causal analysis processes. (10 CFR 830.122, (d)(1))

NNSA Livermore Field Office

Deficiency D-LFO-1: LFO is not approving the LLNL NMMP at least every three years. (DOE Order 433.1B, sec. 4.b, and MAN-0158, sec. 2.3)

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 suggestion that may assist site management in implementing best practices or provide potential solutions to issues identified during the assessment.

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OFI-LLNS-1: Consider alternative methods for providing adequate qualified backup CSEs (e.g., CSE cross training, CSE training of design engineers) to ensure continuous CSE coverage of all safety systems.

OFI-LLNS-2: Consider using a concise dashboard, possibly color-coded, to depict SSC health status. See the best practice in EA report *Independent Assessment of Safety System Management for the Advanced Test Reactor at Idaho National Laboratory, January 2023*.

OFI-LLNS-3: Consider updating procedures that relate to causal analysis (PRO-0042, PRO-0070) to require that documented causal analyses address both direct causes and underlying issues (e.g., latent organizational weaknesses and cultural factors) that led to those issues.

Appendix A
Supplemental Information

Dates of Assessment

October 1 to December 18, 2024

Office of Enterprise Assessments (EA) Management

John E. Dupuy, 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
Thomas E. Sowinski, Director, Office of Nuclear Safety and Environmental Assessments
Kimberly G. Nelson, Director, Office of Worker Safety and Health Assessments
Jack E. Winston, Director, Office of Emergency Management Assessments
Brent L. Jones, Director, Office of Nuclear Engineering and Safety Basis Assessments

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Appendix B
Weakness to ITS Numbers Crosswalk

Weakness	ITS Number
F-LLNS-1	ISS-138083.18
D-LLNS-1	ISS-138083.19
D-LLNS-2	ISS-138083.13
D-LLNS-3	ISS-138083.14
D-LLNS-4	ISS-138083.17
D-LLNS-5	ISS-138083.05
D-LLNS-6	ISS-138083.09
D-LLNS-7	ISS-138083.07
D-LLNS-8	ISS-138083.16
D-LLNS-9	ISS-138083.06/ ISS-138083.01
D-LLNS-10	ISS-138083.02/ ISS-138083.03/ ISS-138083.10/ ISS-138083.11
D-LLNS-11	ISS-138083.08
D-LFO-1	ISS-138083.04