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

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Office of Nuclear Safety and Environmental Assessments
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Table of Contents

Acronyms

AM	Assistant Manager
AOP	Abnormal Operations Procedure
ASME	American Society of Mechanical Engineers
CAM	Continuous Air Monitor
CAS	Contractor Assurance System
cfm	Cubic Feet per Minute
CFR	Code of Federal Regulations
CM	Corrective Maintenance
COC	Certificate of Conformance
CRAD	Criteria, Review and Approach Document
CSE	Cognizant System Engineer
DMC	Document Management Center
DOE	U.S. Department of Energy
dP	Differential Pressure
DSA	Documented Safety Analysis
EA	Office of Enterprise Assessments
ES&H	Environment, Safety, and Health
FAR	Functional Area Review
FHFS	Final HEPA Filtration Stages
F&I	Facilities and Infrastructure
FMR	Functional Management Review
FR	Facility Representative
FY	Fiscal Year
HEPA	High-Efficiency Particulate Air
HVAC	Heating, Ventilation, and Air Conditioning
IAP	Institutional Assessment Plan
IIA	Internal Independent Assessments
ITS	Issues Tracking System
IVR	Implementation Verification Review
JCO	Justification for Continued Operations
JFLMA	Joint Functional Area Manager/Line Management Assessment
LFO	Livermore Field Office
LLNL	Lawrence Livermore National Laboratory
LLNS	Lawrence Livermore National Security, LLC
M&TE	Measurement and Test Equipment
MA	Management Self-Assessment
MAP	Master Assessment Plan
MAS	Master Assessment Schedule
MOA	Memorandum of Agreement
MOVI	Management Observation, Verification & Inspection
MUSD	Maintenance and Utility Services Department
NCR	Nonconformance Report
NNSA	National Nuclear Security Administration
NMMP	Nuclear Maintenance Management Program
NMTP	Nuclear Materials Technology Program
OA	Operational Awareness
OFI	Opportunity for Improvement
OJT	On-the-Job Training
ORB	Operations Review Board

ORPS	Occurrence Reporting and Processing System
P	Process
PEB	Plenum Equipment Building
PEP	Performance Evaluation Plan
PER	Periodic Evaluation Report
P&ID	Piping and Instrumentation Diagram
PIR	Periodic Issue Report
PISA	Potential Inadequate Safety Analysis
PM	Preventive Maintenance
PO	Purchase Order
QA	Quality Assurance
QL	Quality Level
RI	Responsible Individual
RVS	Room Ventilation System
SBK	Superblock
S/CI	Suspect/Counterfeit Item
SC	Safety-Class
SDD	System Design Description
SME	Subject Matter Expert
SR	Surveillance Requirement
SRP	Surveillance Requirement Procedure
SS	Safety-Significant
SSC	Structures, Systems, and Components
SSO	Safety System Oversight
TSR	Technical Safety Requirement
USQ	Unreviewed Safety Question
VSS	Vital Safety System
WCI	Weapons and Complex Integration
WI	Work Instruction

Executive Summary

The U.S. Department of Energy (DOE) Office of Environment, Safety and Health Assessments, within the Office of Enterprise Assessments (EA), conducted an independent assessment of the safety-class room ventilation systems and associated final high-efficiency particulate air (HEPA) filtration stages at the Lawrence Livermore National Laboratory (LLNL) Plutonium Facility. EA also reviewed the performance of DOE oversight, as appropriate, to evaluate the effectiveness of the Federal assurance capability. This independent assessment, conducted during June 2014, was part of a larger targeted assessment of safety-class and safety-significant structures, systems, and components across the DOE complex.

In general, the room ventilation systems and the final HEPA filtration stages are well maintained through an acceptable maintenance program. Surveillance and testing activities for the selected safety systems are, for the most part, properly performed in accordance with technical safety requirements (TSR) surveillance requirements. Operations are largely conducted by experienced operators in a manner that ensures the availability of the selected safety systems to perform their intended safety functions when required, and most procedures are technically adequate to achieve the required level of system performance. The cognizant system engineer program for the Plutonium Facility meets the requirements of DOE Order 420.1C, *Facility Safety*, and the cognizant system engineers are knowledgeable of facility processes and their assigned systems, however, several areas of the program needed improvement to strengthen the effectiveness of this vital role in system health and reliability. Although EA identified a few areas of needed enhancements in feedback and improvement processes in both the laboratory and field office organizations, in general, the management and operating contractor, Lawrence Livermore National Security, LLC, (LLNS) has established and implemented the feedback and improvement programs and processes necessary for evaluation of nuclear safety processes and performance at LLNL. Further, the Livermore Field Office has generally established and implemented a compliant oversight program. For the most part, the Livermore Field Office Facility Representatives and safety system oversight (SSO) personnel provide effective continuous, routine operational awareness and surveillance feedback to the contractor and DOE management, although improvement in rigor of SSO assessments and operational awareness is needed for optimum oversight effectiveness.

Although LLNL's programs and processes for ensuring safety system capability are, for the most part, effectively implemented, EA identified several significant areas of weaknesses that warrant management attention:

- Reviewed preventive maintenance procedures do not provide an adequate technical basis for maintenance of the room ventilation systems and other safety-class and safety-significant systems. These documents lack sufficient detail to ensure that preventive maintenance activities can be performed consistently and as intended, and they do not require analysis of collected vibration data. Also, as also noted in an independent oversight report from 2009, preventive maintenance for new safety-class or safety-significant equipment procured as "like-for-like" is not adequately correlated with vendors' recommendations or the evaluation and basis for deviation is not documented.
- Annual TSR surveillance requirement procedures did not address all possible safety system configurations required by the TSR surveillance requirements, resulting in a TSR violation lasting several years. Further, facility procedures do not include periodic testing of system alarms. Although facility management has addressed specific deficiencies in surveillance requirements for the safety systems reviewed by EA and appropriately reported the TSR violation, the implementation status of all TSR surveillance and alarm testing requirements, beyond those selected for this review, warrants verification.

- Some conduct-of-operations problems, if left uncorrected, could reduce the level of confidence in the selected safety systems' ability to perform as required. The most significant areas of concern include the quality, accuracy, and usability of abnormal operations procedures and the lack of a systems approach to training, as required by DOE order, for facility operator training.
- The Nuclear Facility Configuration Management Plan and its implementation have shortcomings in the areas of design control, change control, work control, and document control. Specifically, the design basis for the safety-class room ventilation system is not adequately documented in approved essential systems piping and instrumentation diagrams; the change control process does not adequately ensure that design documents are kept current; record keeping for quality assurance records is spread through several organizations; and vendor manuals were not readily available.

Overall, the reviewed LLNL safety systems are capable of performing their safety functions, and many aspects of operations, testing, and maintenance are performed in accordance with DOE requirements. Also, essential assurance processes, such as the cognizant system engineer program and the site office Facility Representative and safety system oversight programs are in place and contribute to safe operations by monitoring conditions and identifying improvements. However, the overall reliability of and confidence in the system performing as designed is reduced by a number of weaknesses and shortcomings in various aspects of analysis, maintenance, testing, conduct of operations, and configuration management. If not corrected, these problems could result in operational errors during an event or components that do not function when needed and could result in inoperable or degraded safety system performance. To increase confidence in the safety of the systems, the identified problems warrant management attention by LLNS and the Livermore Field Office, including more emphasis on performance based assessments, with a particular focus on processes that support the nuclear safety basis.

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

1.0 PURPOSE

The U.S. Department of Energy (DOE) Office of Environment, Safety and Health Assessments, within the independent Office of Enterprise Assessments (EA), conducted an independent review of the safety-class (SC) room ventilation systems (RVSs) and associated final high-efficiency particulate air (HEPA) filtration stages (FHFS) at the Lawrence Livermore National Laboratory (LLNL) Plutonium Facility, which is operated by Lawrence Livermore National Security, LLC (LLNS), under contract to the DOE National Nuclear Security Administration (NNSA) Livermore Field Office (LFO). EA also reviewed the performance of DOE oversight, as appropriate, to evaluate the effectiveness of the Federal assurance capability. EA performed a scoping and planning visit on site May 6-8, 2014 and the onsite data collection portion of the review during June 2-13, 2014.

2.0 SCOPE

This targeted review of management of safety systems evaluated the effectiveness of processes for operating, maintaining, and overseeing the performance of selected safety systems at the Plutonium Facility. Specifically EA selected two SC room ventilation systems and the associated FHFS[1]. The review consisted of an evaluation of the procedures and processes used to demonstrate the ongoing operability and reliability of the systems and specific evaluation of the implementation of those procedures and processes for a sample of components within those systems. The review focused on the implementation of Plutonium Facility's safety basis as it relates to the selected systems but did not evaluate the adequacy of the documented safety analysis (DSA). EA also evaluated the effectiveness of DOE safety system oversight (SSO) and the effectiveness of the Federal assurance capability. Key observations and results from this review are presented in Section 5.0.

Selected objectives and criteria from the following sections of the Criteria, Review and Approach Document (CRAD) 45-11, Revision 3, *Safety Systems Inspection Criteria, Approach, and Lines of Inquiry*, were used to define the scope of this targeted review:

III. Configuration Management
IV. Maintenance
V. Surveillance and Testing
VI. Operations
VII. Cognizant System Engineer and Safety System Oversight
VIII. Safety System Feedback and Improvement.

This review also evaluated the effectiveness of both the contractor and field office programs in managing and maintaining safety system performance. The review team used the following criteria from CRAD 45-21, Revision 1, *Feedback and Continuous Improvement Inspection Criteria and Approach – DOE Field Element*, to collect and analyze data on field office oversight activities for evaluation of the effectiveness

[1] At the Plutonium Facility, the FHFS for all SC ventilation systems are considered a single SC system. For this review, EA limited the scope of the FHFS portion of the review to the components associated with the selected room ventilation systems.

of the Federal assurance capability:

- DOE Field Element Line Management Oversight Inspection Criteria 1-6
- DOE Field Element Facility Representative Program Inspection Criteria.

3.0 BACKGROUND

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

In a memorandum to DOE senior line management dated November 6, 2012, EA identified "Safety-Class or Safety-Significant Structures, Systems and Components" as a targeted review area, with a series of reviews starting in 2013. The memorandum also stated that the areas would be further defined in associated review plans and that the performance of DOE oversight would be evaluated during the targeted reviews to provide input to the overall evaluation of DOE's Federal assurance capability. The review of safety systems covered several DOE sites to ensure that EA has sufficient information to provide insights into DOE-wide performance. When all the selected DOE sites have been reviewed, EA will prepare a report summarizing the conclusions of the assessment regarding the overall status of safety system management throughout the DOE complex, common issues, and lessons learned.

LFO oversees LLNS and is responsible for administering the performance-based contract, executing assigned NNSA and DOE programs, and conducting oversight of work performed at LLNL in support of NNSA requirements and priorities. LLNL's primary mission is to strengthen U.S. security through development and application of world-class science and technology to enhance the nation's defense; reduce the global threat from terrorism and weapons of mass destruction; and respond with vision, quality, integrity, and technical excellence to scientific issues of national importance. LLNS is a partnership that includes the University of California, the Babcock and Wilcox Company, Bechtel National, Inc., the Washington Division of URS Corporation, and Battelle.

The SC room ventilation systems selected for this review provide confinement and ventilation safety functions for certain areas of the Plutonium Facility (Building 332), one of four nuclear facilities located in the LLNL Superblock. The confinement function is essential for accident consequence mitigation and has an active role in lowering the source term from an accidental release of radioactive material. Various structures, systems, and components (SSC) support the function of active confinement components within the systems. These SSC are identified as either active engineered safety features or passive design features within the DSA and technical safety requirements (TSRs).

Although the review focused primarily on the selected safety systems, EA considered additional systems during field observations as necessary to obtain a clearer perspective for evaluating implementation of some of the CRADs.

4.0 METHODOLOGY

EA completed the targeted review through detailed document reviews and an onsite review of contractor safety system engineering, operations, maintenance, and feedback and improvement activities; system material condition; and field office oversight of the selected SC systems. The review included observation of contractor and/or field office personnel during facility walkthroughs, safety system walkdowns, maintenance work package workability walkdowns, surveillance tests, and contractor assessments or observations of maintenance on the safety system. The EA team also performed detailed reviews of documentation associated with system design and change control, completed surveillance tests, assessments of safety system performance, and maintenance history for the selected safety systems. To evaluate contractor and field element feedback and improvement processes, EA also reviewed development, implementation, and evaluation of corrective actions and dissemination and review of program and process documents; interviewed responsible managers and staff; and evaluated samples of process outputs, such as assessment reports, issues management documentation, trend and performance indicator reports, incident and event analysis reports, and lessons-learned publications.

The targeted review process was divided into several stages, including onsite and offsite planning, onsite data gathering activities, report writing, validation, and review. Planning included discussions with responsible site personnel, determination of the details of safety systems to be reviewed, scheduling of the review, collection of applicable site procedures and documents, and document reviews. After the onsite data collection period, a draft independent review report identifying overall perspectives, deficiencies, and opportunities for improvement (OFIs) was prepared and made available to line management for review and feedback. Finally, the results of the review were briefed to key managers, consistent with site needs.

5.0 RESULTS

The EA review team applied the elements of HSS CRAD 45-11 to evaluate the following areas:

- Maintenance
- Surveillance and testing
- Operations
- Cognizant system engineer program and configuration management
- Safety system feedback and improvement
- LFO safety oversight program.

5.1 Maintenance

Criteria

The safety system is included in the nuclear facility maintenance management program and the DOE approved Nuclear Maintenance Management Plan required by DOE Order 433.1B, and is maintained in a condition that ensures its integrity, operability, and reliability.

Maintenance processes for the system are in place for corrective, preventive, and predictive maintenance and to manage the maintenance backlog; and the processes are consistent with the system's safety classification.

The system is periodically inspected in accordance with maintenance requirements.

Maintenance activities associated with the system, including work control, post-maintenance testing, material procurement and handling, and control and calibration of test equipment, are formally controlled to ensure that changes are not inadvertently introduced, the system fulfills its requirements, and that system performance is not compromised.

Requirements are established for procurement and verification of items and services. Processes are established and implemented that ensure that approved suppliers continue to provide acceptable items and services.

EA reviewed selected elements of the Building 332 maintenance program in detail: plans and programs; corrective, preventive, and predictive maintenance; periodic inspections; maintenance configuration control and conduct; and procurement processes, including provisions for precluding introduction of suspect or counterfeit items (S/CIs). Review activities included walkthroughs of the RVS and FHFS systems, review of the previous three years of corrective maintenance (CM) and preventive maintenance (PM) records, review of the Occurrence Reporting and Processing System (ORPS) reports for the last five years (2010-2014), observation of simulated performance of two PMs (no PMs were scheduled to be performed for the RVS or FHFS during the onsite assessment), and attendance at a twice-weekly work planning and control review meeting. These elements are discussed in more detail in the following subsections.

Nuclear Maintenance Management Plan and Program

Maintenance of SC and safety significant (SS) SSC (which include RVS and FHFS) is addressed in the DOE-approved nuclear maintenance management program (NMMP) for LLNL non-reactor nuclear facilities, as required by DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*. The NMMP also supports compliance with DOE Order 430.1B, *Real Property Asset Management*, as it relates to maintenance of those assets. The NMMP references and is supported by multiple implementing maintenance manuals. With one exception (noted below), the implementing documents adequately reflect the NMMP requirements.

The RVS and the FHFS are well maintained. During the review, the systems were fully operable, with no out-of-service equipment, no active temporary modifications, and no out-of-date calibration on any system instrumentation requiring it. Both systems were in proper alignment, and the only observed field condition affecting continued configuration control was the lack of equipment labeling (see Section 5.3, Operations, for further details). No complex CM and very few minor maintenance activities have been performed on RVS or FHFS in the last three years. There is no current backlog of CM or PM, and no evidence of deferred maintenance associated with these systems. No ORPS reports specifically involving performance degradation of these systems have been filed in the last four years.

One of the NMMP implementing documents, the Superblock Maintenance Program Manual (hereafter referred to as the "maintenance manual"), addresses each of the elements of the NMMP and generally complies with DOE Order 433.1B and the accompanying DOE Guide 433.1-1A, *Nuclear Facility Maintenance Management Program Guide for Use with DOE O 433.1B.* However, Section 15 of the maintenance manual, which covers performance measures, does not fully meet the expectations of the guide. Specifically, the basis for the formation of performance measures is not included in the maintenance manual, and objective and trackable measures have not been developed for the Superblock nuclear facilities. (See **OFI-LLNS-Maint-1**)

Corrective, Preventive, and Predictive Maintenance

Overall, acceptable maintenance processes for the RVS and FHFS systems are in place for CM and PM, and the processes are consistent with the systems' SC designation. Maintenance processes, including provisions for CM and PM and covering SC and SS systems for the Plutonium Facility, are addressed in the maintenance manual. This manual does not specifically address predictive maintenance and backlog management, except for certain activities (e.g., vibration analysis of SC/SS rotating equipment) that are a part of the PM program. Even though the manual does not address the management of maintenance backlog, the selected systems had no backlog of CM or PM activities, and EA found no historical problems related to a backlog of maintenance within the last five years.

PM procedures (also known as task codes) for the LLNL facilities are performed by the Facilities and Infrastructure (F&I) organization and are developed for certain types of facility equipment. Each of the PMs covering the equipment in the RVS and FHFS systems addresses types of equipment (e.g., Air Handler PM or Fan Annual PM) rather than specific items of equipment. PMs for RVS and FHFS systems include HE-103, *SBK-B332 Monthly Vibration Analysis Data Collection*; HE-141, *SBK-Air Handler PM for Critical Facilities*; and HE-145, *BSS-SBK-Fan Annual PM for Critical Facilities*. There is very little detail in the procedures, and most of the criteria are subjective and non-specific. For example, HE-141 is a three-page document (including the cover page) that consists of six simple steps, including "Check bearings for excessive heat or vibration…," with no direction as to where and how the check is to be made and no specific direction or criteria for determination of "excessive" heat (such as use of thermography or thermocouple temperature readings) or vibration. Although the excessive vibration check performed under HE-141 is backed-up by the monthly vibration data collection obtained under HE-103, no quantitative temperature data is documented for SC/SS rotating equipment. (See **Finding-LLNS-Maint-1**)

During the walkdown of the RVS system, EA observed a piece of paper taped to the SS SSC continuous air monitor (CAM) blower with the message to use a specific type of lubricant on the blower's bearings. This paper had no procedure or controlled document number on it, and the systems engineering manager stated that this was information for the craft to make sure that they used the correct grease. At least two types of grease are stored near the blower, and the PM for lubricating this equipment (HE-141) does not include any information specific to this piece of equipment or specify which type of grease to use. This is another example of PM procedures that lack sufficient information to ensure that the PM is performed correctly. Inadequate detail in PM procedures was first identified as an issue by a joint LLNS-LFO assessment of maintenance conducted in 2009, and the same problem was later identified as a deficiency in a September 2012 joint functional area manager/line management assessment (JFLMA) report. Since 2012, little progress has been made in improving the PM procedures covering RVS and FHFS systems. (See **Finding-LLNS-Maint-1**)

During the onsite portion of the EA assessment, no PMs were scheduled for the RVS or FHFS, so EA requested the simulated performance of two PMs. The first was a simulation of the monthly vibration PM on an RVS exhaust fan. HE-103 is the PM procedure for collecting vibration data for all rotating equipment within Building 332. However, the procedure does not contain detailed steps for taking the measurements and does not specify where on the equipment to take the measurements. A data logging device used during the PM provides some indication of where to take the readings, such as motor inboard or outboard, and some fans/motors have pre-installed transducers to facilitate taking measurements consistently. In addition, most of the motors and fans have markings (e.g., a dot or *X*) with a permanent marker pen on fan/motor locations where (presumably) data is to be taken. However, neither the PM nor any other Superblock document requires analysis of the data taken, and markings to permit consistent measurements were not present on all SC fans in the RVS. (See **Finding-LLNS-Maint-1**)

The F&I engineer who formerly analyzed the vibration data collected under HE-103 was reassigned over a year ago; now, only a subjective evaluation of the data is made by the F&I technician taking the data to identify any changes since the last data was collected. Without an analysis by a qualified individual, subtle problems in the vibration signature indicative of motor or fan degradation might not be identified. F&I has recently procured a new data taking device, and two system engineers and two F&I technicians are scheduled to attend training later this year to learn how to interpret the results from this device. Although not yet trained, the technician who simulated the PM on an RVS exhaust fan used the new data collector because the old one had been sent back to the vendor. Further, for the next several months, the vibration data will be collected with the new device (which is not referenced in PM HE-103) before the conduct of training. (See **Finding-LLNS-Maint-1**)

The second simulated PM activity was the annual in-place final HEPA filter leak test, which is also a TSR surveillance requirement (SR). This activity is performed under procedure *Annually, HEPA Filter In-Place Leak Test, SR 4.2.1.a* (SRP-B332-4.2.1.a), and a technician from the Industrial Hygiene Instrument Laboratory organization obtains the data. The simulation of the test was conducted in accordance with the procedure and the additional notes (see discussion below). The personnel involved with the test were knowledgeable of the equipment and the process for conducting the test. The Responsible Individual (RI) for this simulated activity was a facility operator who, while simulating the pre-job briefing, stated that in addition to the procedure, an informal set of notes would be used to make sure that the personnel supporting the test were in the proper positions to ensure an accurate test. (See Section 5.3, Operations, for further details.) (See **OFI-LLNS-Ops-2**)

The System Design Description (SDD) for the FHFS system identifies American Society of Mechanical Engineers (ASME) N510-2007, *Testing of Nuclear Air Treatment Systems*, as the testing standard for the system, and these requirements are properly reflected in SRP-B332-4.2.1.a, discussed above. The HEPA filter leak test meets the testing requirements of the ASME N510 standard.

EA observed two actual maintenance-related activities during the review: the annual emergency diesel generator load test, and the triennial change-out of the fire suppression tank relief devices. SRP-B332-4.5.2, *Annual Four Hour Load Test of the Emergency Diesel Generators, SR 4.5.2*, was conducted with an operator in the role of RI and Maintenance and Utility Services Department (MUSD) High Voltage Group personnel performing specific steps and recording data. The cognizant system engineer (CSE) was also present to observe the test. The test procedure (classified as "continuous use") was followed step by step.

The triennial replacement of the pressure relief devices on the fire suppression water tank was performed under a work permit. The pre-job briefing for this activity was thorough and addressed the hazards and associated controls, as well as the conduct of the work activity. The craft performing the activity were engaged in the discussion, and the system engineer was present for the entirety of the job. The craft were knowledgeable of the systems and their importance as SC systems and followed the work instructions in the work package under the direction of an operator who was the RI for the job.

The F&I organization has developed performance measures using a process described in a Maintenance Management Plan (PLAN-MNT-004), and the performance measures present data covering the entire Laboratory (not individual facilities, such as Building 332). The process in PLAN-MNT-004 describes how the F&I organization reviews and acts upon the information contained in the performance measures (called balance scorecards). However, the Nuclear Materials Technology Program (NMTP) is not under this plan and does not evaluate the performance measures prepared under this plan. The NMMP covering Building 332 states only that "Metrics should be established to measure performance and identify maintenance issues requiring corrective actions and lessons learned." This statement simply repeats the verbiage of DOE Order 433.1B and does not meet the expectations for maintenance performance

measures in the accompanying maintenance DOE Guide 433.1-1A. This was first identified as an issue by a joint LLNS-LFO assessment of maintenance conducted in 2009, and the same problem was later identified as a deficiency in a September 2012 JFLMA report. In addition, the performance measures that F&I use do not include any analysis of the data/trends, and in some cases the goals are not challenging. (See **OFI-LLNS-Maint-1**)

When the SC RVS fan motors were procured in 2009 to replace motors that had been in service for more than 30 years, the new vendor manual was not cross-checked with the existing set of PM activities. These fan motors were procured as "like-for-like." (LLNS defines the like-for-like process as obtaining an item that is identical—including part number—to the item currently in service or spares inventory.) Neither the procurement process nor the configuration control program specifically required verification that the maintenance recommended by the vendor manual for the motors had not changed. At the request of EA, the CSE reviewed the vendor manual against the current PM activities and identified two activities that were recommended by the vendor but were not being performed. Although there is no evidence that omission of these additional recommended maintenance items has resulted in a problem with equipment performance or reliability, it does demonstrate incomplete implementation of vendor maintenance recommendations without a documented technical justification. This issue was previously identified in an independent oversight review report dated December 2009. (See **Finding-LLNS-Maint-1**)

Periodic Inspections

Various groups periodically inspect the RVS and FHFS systems. The F&I organizations conduct inspections through the condition assessment survey program. The Planning and Integration Department within F&I is responsible for implementing this program. Inspectors trained in the areas of architectural/structural, roofing, civil, mechanical, and electrical perform these inspections. The condition assessment survey program plan, PLAN-MNT-0002, defines the program intended to meet the real property assessment requirements of DOE Order 430.1B, *Real Property Assessment Management*. LLNS implements this plan through procedure PRO-MNT-0005, *Condition Assessment Survey*, which requires that SSCs at nuclear facilities be assessed annually. The condition assessment survey reports for Building 332 for the last three years were comprehensive and did not identify any follow-up items for RVS or FHFS systems indicative of degraded performance in SSCs.

CSEs perform annual condition assessments to meet the requirements of DOE Order 420.1C, *Facility Safety*. These assessments are conducted in accordance with FMP-SBK-0212, *System Assessments, Tracking and Trending.* The stated purpose of this procedure is to establish the process for vital safety system (VSS) assessments, tracking, and trending. Condition assessments are intended to be documented evaluations of a system's overall health in terms of operability, reliability, material condition, configuration control, and ability to perform the safety function. In practice, the CSE collects the data for the annual condition assessments throughout the year during various system activities (e.g., system walkdowns). Condition assessment reports of the selected systems for the last three years tended to be subjective determinations lacking adequate detail. (See Section 5.4, Cognizant System Engineer Program and Configuration Management, for further information.) (See **OFI-LLNS-CSE-04**)

Maintenance Configuration Control and Conduct of Maintenance

Maintenance is conducted in accordance with the NMTP *Work Planning and Control Manual.* Work is planned and coordinated in twice-weekly review meetings where the RI and all organizations involved in conducting, supporting, and approving the work are in attendance. The purpose of the meetings is to identify the hazards and controls associated with the work to be performed, confirm the resources needed for the job, and identify when the plant configuration could support the performance of the job. Also during the planning meeting, a tentative schedule date for performing the work is established. EA

attended one of these meetings and found the planning conducted during the meeting to be thorough.

Completed CM work packages demonstrated that planned activities are implemented effectively. In each case, the documentation indicated that the work was performed according to the work instructions in the work package and that the defined post-maintenance testing was adequately documented and was adequate to re-establish operability of the SC/SS SSCs involved in the activities.

NMTP-FMP-0701, *Calibration Program for NMTP Facilities Critical Measuring Test Equipment*, provides direction for the calibration of measurement and test equipment (M&TE). The M&TE items observed by EA were properly within the established calibration frequency, and each of the maintenance work packages reviewed containing M&TE also documented the proper calibration of M&TE items.

Procurement, Receipt Acceptance, and Suspect/Counterfeit Items

NMTP has established requirements for the procurement and receipt acceptance of Quality Level (QL)-1 and QL-2 equipment in NMTP-FMP-0500, *Procure/Acceptance Process for Quality Level 1 and 2 Purchase Orders*. RVS and FHFS system SSCs are procured as QL-1 items. Suppliers of SC/SS equipment have either a quality assurance (QA) program that meets 10 CFR 830.122 or must be inspected by LLNS or a third party to determine whether the item meets requirements. Nuclear vendors meeting the quality requirements of 10 CFR 830.122 are placed on an approved supplier list.

EA selected a sample of eight SC RVS spare parts in storage to determine whether the parts had been properly procured, receipt-inspected, and stored. The parts included fan belts, motors, and differential pressure (dP) gauges. All of the purchase orders (POs) for these items were properly designated as QL-1, the acceptance process for these items was consistent with the NMTP procurement procedure except as noted below, and the items were properly stored. NMTP does not maintain a controlled list of RVS spare parts for Building 332, and parts are stored in locked cabinets throughout the facility. The facility management and staff do not know how many spare parts are on hand.

For the selected RVS spare parts reviewed, EA found that five of the eight spare parts procurement package receipt inspections were completed with inadequate Certificates of Conformance (COCs). The COC requirements are stipulated in the PO and are required to be verified as part of the receipt inspection. In each of the examples below, one or more of the requirements in the PO COC section were not provided in the supplier's COC that accompanied the SC spare part. (See **Finding-LLNS-Maint-1**)

- PO B561246 (requisition file # 06-089) ordered 12 magnehelic/photohelic dP gauges as QL-1 equipment. The COC section of the PO states, "The Seller shall include a COC for each line item stating that the provided material was manufactured, assembled, and tested in accordance with the Manufacturer's QA procedures." The PO COC section also includes a requirement that the Certificate shall indicate the items listed by the applicable National Recognized Testing Laboratory or ASTM standard. However, the COC only states that "We certify that the material, in the quantity called for on the subject purchase order conforms to the requirements and warranty of our published catalog." The QA inspector performing the receipt inspection identified the COC as acceptable and did not place a QA hold on the material or file a non-conformance report (NCR).

- PO B569758 (requisition file # 07-061) ordered 11 SC magnehelic dP gauges from the same supplier. The PO COC section includes requirement language almost identical to PO B561246. However, the supplier failed to provide the requested affirmations. Just as before, the QA inspector accepted the gauges and the COC that accompanied them without any holds or NCRs to resolve the COC discrepancy.

- PO B605083 (requisition file # 13-155) ordered another 44 SC magnehelic gauges. The PO COC section required the COC from the supplier to state that all items supplied "were manufactured and inspected in accordance with the manufacturer's ISO 9001:2008 compliant QA program." However, the supplier's COC only stated that "we certify that the material, in the quantity called for on the subject purchase order conforms to the requirements and warranty of our published catalog." The parts successfully completed NMTP receipt inspection by the QA inspector with no holds placed on the parts and no discrepancy was noted.

- PO B606335 (requisition file # 13-251) ordered ten fan belts as QL-1 equipment. The PO COC section included requirements for affirmation that the items were "manufactured and inspected in accordance with the manufacturer's ISO 9001:2008 QA program." The COC was also to affirm that "All items on Purchase Order B606355 meet all of the manufacturer's published requirements." The COC from the supplier did not reference the LLNL PO number but did reference another number (CA24-00147589) and referenced the 2000 version of the ISO 9001 standard instead of the 2008 version. Again, the material passed the receipt inspection, and no holds or NCRs were placed to resolve the discrepancy.

- PO B550364 (requisition file # 05-013) ordered three fan motors as QL-1. The PO COC section included the following statement, "The Seller shall include a Certificate of Conformance for each line item stating that the provided material was manufactured, assembled and tested in accordance with the Manufacturer's QA procedures." However, the COC received with the motors made no statement affirming that the motors were "manufactured…in accordance with the Manufacturer's QA procedures." The material again passed the receipt inspection, and no holds or NCRs were placed to resolve the discrepancy.

EA found no specific evidence to suggest that the items identified above are non-conforming. However, management attention is needed to ensure that the receipt inspection process is completely followed, including all requirements of the PO document. In addition, these items have not been reviewed to properly affirm that they are acceptable for use. (See **OFI-LLNS-Maint-2**)

NMTP has conducted the procurement and receipt inspections of SC HEPA filters thoroughly and fully in accordance with LLNL requirements. The inspection package for quality significant order No. 09-042, *HEPA Filters*, was performed on an order of replacement HEPA filters for the RVS. These filters were purchased from Flanders Corporation and sent to the Filter Test Facility for 100% testing as required by DOE STD-3020-2005 Section 4.1.1. The receiving inspection package criteria were taken from that standard, and also included ASME AG-1, *Code on Nuclear Air and Gas Treatment*, for requirements pertaining to filter design, fabrication, qualification, testing, labeling, packaging, shipment, and storage. In general, the receiving inspection addressed the criteria for all HEPAs in the order (100% sampling basis) and identified potential quality issues with numerous filters, even though they were manufactured by a properly qualified vendor and successfully tested by the test facility. These issues involved inadequate seals around the filter frames, frame fasteners protruding through the frame materials, and filter frame misalignments. Eleven filters out of the 100-filter order were rejected based on the receiving inspection, and one of the 11 replacements was also rejected. The receiving inspection package adequately documented the compliance of the accepted filters with DOE-STD-3020-2005, and the documentation was indicative of a rigorous inspection process. LLNS has taken a leadership role in addressing these quality issues by working with vendors and the test facility staff. NMTP quality engineers also actively participate in the DOE HEPA Filter Working Group.

NMTP has implemented a thorough process to guard against S/CI. NMTP-PD-03-059, *DNT/NMTP Suspect/Counterfeit Items Program*, July 2007, defines a program that includes detection of potential S/CI, verification, reporting, and disposition/disposal. The program also addresses prevention of

introducing S/CI during the procurement process. The program is implemented through procedure NMTP-PRO-0096-01, *Suspect/Counterfeit Items*, which contains requirements to address elements of the S/CI program and includes training requirements for all personnel who procure, inspect, test, design, install, and/or operate SSCs at LLNL in 1) safety applications, 2) other applications that create potential hazards, and 3) non-safety applications to prevent future use in safety applications. The training requires completion of an initial training course covering the basics of S/CI, and re-training every three years. Training materials were found to be acceptable, and the sampled training records were complete.

Maintenance Summary

Overall, the RVS and the FHFS are well maintained. Acceptable maintenance processes for the RVS and FHFS systems are in place for corrective, preventive, and predictive maintenance, and the processes are consistent with the systems' SC designation. During the review, the systems were fully operable, with no out-of-service equipment and no active temporary modifications, and all system instrumentation requiring calibration was current. NMTP NMMP and implementing procedures applicable to Building 332 are consistent with the requirements of DOE Orders 433.1B and 430.1B, and they are adequate to maintain acceptable levels of RVS and FHFS system operability, availability, and reliability. Further, observed performance and reviewed procedures, work documents, and records demonstrated an acceptable maintenance program with no significant performance problems. Plutonium Facility (Building 332) maintenance activities were properly planned, scheduled, and performed. Additionally, historical records for the last three years indicated no functional failures of SC equipment in the selected systems, no backlog of CM or PM, and no temporary modifications. The PM programs for the RVS and FHFS are acceptable and are properly planned and scheduled. Management attention is needed to ensure that the technical basis for maintenance of the RVS is adequately maintained. Management attention is also needed in the development of performance measures for the maintenance program at Building 332 and to resolve discrepancies between PO requirements and supplier-provided COCs.

5.2 Surveillance and Testing

Criteria

Surveillance and testing of the system demonstrates that the system is capable of accomplishing its safety functions and continues to meet applicable system requirements and performance criteria.

Surveillance and test procedures confirm that key operating parameters for the overall system and its major components remain within safety basis and operating limits.

The acceptance criteria from the surveillance tests used to confirm system operability are consistent with the safety basis.

Instrumentation and measurement and test equipment for the system are calibrated and maintained.

EA reviewed the surveillance requirement procedures (SRPs) and results used to meet the TSR SRs for the selected RVSs and the associated FHFS. The review included three years of records of annual SRs, one year of records for monthly SRs, and approximately ten weeks of records of weekly SRs. Additionally, EA observed performance of all weekly TSR SRs and observed tabletop simulations of selected annual SRs. EA also reviewed calibration documentation and selected results for instruments and indicators relied upon to meet the SRs.

For the most part, surveillance and testing activities for the selected systems are properly performed in accordance with TSR SRs. (Note: No TSR specific administrative controls are directly associated with

the selected systems.) SRPs are generally well written and technically accurate, and (other than the exceptions noted below and in Section 5.3, "Operations") they adequately incorporate the SRs for the selected systems, including appropriate acceptance criteria. Instrumentation and M&TE for the selected systems were adequately calibrated and maintained to support the SRPs. However, EA identified some concerns about performance of certain SRs within the prescribed frequencies and testing of system alarms, as further described in the next paragraphs.

Two annual SRs related to the RVSs were not incorporated into facility SRPs sufficiently to ensure that the operability of the RVS functions was adequately verified, tracked, and documented as required by the DSA. Specifically, SR 4.4.1.c requires verification that the lag exhaust fans for the selected systems automatically start on low flow from the lead exhaust fan. SR 4.4.1.d requires verification that the RVS supply fans for one of the selected systems trip upon loss of power to the associated lead exhaust fan. Each SR has an associated SRP that is technically accurate to adequately demonstrate the operability of the function of the initial configuration of the respective system exhaust fans (lead or lag). However, because the SRPs did not consider all possible configurations of the fans, the functions related to only one of the two fans in each system were tested and documented in accordance with the SRPs each year. Specifically, the completed SRPs for the years 2011 – 2014 only accounted for testing the fan configuration that happened to be in place at the time the SRP was performed, so in any given year, documentation of meeting the SRs was provided for only one of the two fans in each system. The SR completion of all fan configurations was not documented in any given year, and in some cases, specific configurations had not been examined since 2011. According to Building 332 TSR 5.10.3.2, failure to perform an SR within the prescribed frequency constitutes a TSR violation. Following notification of this deficiency and verification of the missed SRs, the facility performed the SRPs for the missing configurations to demonstrate continued operability of the systems in all configurations and promptly reported the failure to meet the SR in ORPS. (See **Finding-LLNS-ST-1** and **OFI-LLNS-ST-1**)

Although not a TSR SR, DOE Order 422.1, *Conduct of Operations*, Contractor Requirements Document Section 2.b.(3)e requires operators to periodically check alarm and annunciator functionality. This requirement is also contained in the LLNL and the Superblock conduct of operations matrices indicating applicability of the requirement, and the *NMTP Conduct of Operations Manual* implies that the requirement is met through the operating procedure titled *Facility Operator Daily Inspections* (OPF-B332-001). However, OPF-B332-001 does not address the requirement to periodically check alarms and annunciators to ensure satisfactory operation, and LLNS has not otherwise established a periodicity or a mechanism to ensure that these checks are made. Although a few specific alarms are verified in some SRPs, such as those tested during the annual SRPs described, operators stated they do not use the alarm test button to do alarm tests on the alarm panels for the selected safety systems (or any other alarm panels in the Plutonium Facility control room). Consequently, many individual alarms for the safety system are either never checked or are infrequently checked (i.e., annually), and the confidence in the functionality of those alarms for the selected systems is reduced. Without the reliability provided by periodic checks as required by DOE Order 422.1, safety-related alarms may not be available when actual alarm conditions arise. (See **Finding-LLNS-ST-2** and **OFI-LLNS-Ops-2**)

Surveillance and Testing Summary

Surveillance and testing activities for the selected safety systems are, for the most part, properly performed in accordance with TSR SRs. When properly administered, surveillance and testing of the system demonstrate that the system is capable of accomplishing its safety functions and continues to meet applicable system requirements and performance criteria. However, EA identified problems in the processes used to verify that SRPs are performed for all possible configurations and in periodic testing of system alarms. Although facility management addressed the specific SR deficiencies for the selected safety systems, verification of the implementation status of all TSR SRs and alarm testing requirements

beyond those selected for this review is warranted.

5.3 Operations

Criteria

Procedures are technically accurate to achieve required system performance for normal, abnormal, remote shutdown, and emergency conditions.

Operations personnel are trained on procedure use, proper system response, failure modes, and required actions involved in credible accident scenarios in which the system is required to function.

Operations personnel are knowledgeable of system design and performance requirements in accordance with the facilities safety basis.

Formal processes have been established to control safety system equipment and system status to ensure proper operational configuration control is maintained in accordance with DOE Order 422.1, Conduct of Operations.

For the most part, operations were conducted in a manner that ensures the selected safety systems are available to perform intended safety functions when required. Procedures are technically adequate to achieve required system performance except for abnormal operations procedures (AOPs), discussed below. For existing procedures such as operating procedures and SRPs, lesson plans that include training objectives have been developed and administered. Operations personnel are trained on specific operating procedures, are knowledgeable of system design and performance requirements, and demonstrated a comprehensive understanding of system operations, component locations, and operational characteristics. Several facility operators have extensive facility experience. No discrepancies were noted in the documentation of completed lessons, certification/recertification records, or qualification cards. Logbooks and round sheets are comprehensive and correctly completed. Shift routines and operating practices provide operations personnel with a current operational awareness of the selected safety systems, including verification of normal configuration of the major ventilation equipment and major flow paths.

Although operations are generally adequate, EA observed several conduct-of-operations and training deficiencies, described in the following paragraphs, that, if left uncorrected may contribute to a reduced level of confidence and reliability in the ability of the selected safety systems to perform as required.

The NMTP Conduct of Operations Manual describes the NMTP implementation of operations practices for developing and maintaining accurate, understandable written technical procedures that ensure safe facility and equipment operation. However, several AOPs have significant technical errors and human factors problems, making them cumbersome, error-prone, and in some cases, impossible to perform as written. The following bullets describe problems with the two AOPs directly related to the selected RVSs. (See **Finding-LLNS-Ops-1** and **OFI-LLNS-Ops-1**)

- AOP-B332-006, *B332 Fire Response Procedure*, contains administrative-type errors (e.g., directions to wrong page numbers, wrong reference to section for immediate actions) that make it impossible to follow exactly as written. It also contains numerous human factors problems that increase the likelihood of human error during an actual emergency. Examples include the extremely small font used in the diagnosis flow chart (pointed out by operators during the tabletop walkthrough), single steps containing several actions, notes containing action steps, action steps in the Precautions and Limitations section (including “immediate actions”), inconsistent use of equipment designations (both

names and component numbers are used), and several tables also labeled as attachments with sometimes table numbers and other times different attachment numbers providing references to the tables. In the event of a fire in one portion of the ventilation areas, the procedure requires an individual, not necessarily an operator, to continuously monitor HEPA parameters in the Plenum Equipment Building (PEB). Although unlikely, if the HEPA inlet plenum fire spray in the PEB does activate, the drain for the potentially contaminated fire water empties onto and accumulates on the PEB floor. The procedure does not mention this possibility or explain what the individual needs to do to be present in this potentially hazardous environment. Following notification of the problems with AOP-332-006, the B332 Facility Manager suspended AOP-332-006 until it can be revised and initiated actions to develop a timely order as a temporary measure to address operator actions in the event of a fire.

- AOP-B332-004, *Stack CAM Abnormal Operating Procedure*, provides sections for five different stack CAM alarms, and the first step in each section is to evaluate the alarm using the CAM Alarm Response Procedure (Reference 8.1), a health physics discipline action plan for the Plutonium Facility providing instructions for health and safety technician response to room CAM alarms, not the stack CAM alarm. When EA asked to see the CAM Alarm Response Procedure, the facility also provided HP-FO-600, *Continuous Air Monitor (CAM) Alarm Response*, which specifically states in the "Applicability" section that it applies to CAMs used for monitoring breathing zone air and does not apply to CAMs installed for process monitoring. It further states that it does not provide instructions for responding to CAM alarms that result from a larger and/or more hazardous event. AOP-B332-004 provides no other instruction on how or by whom the evaluation of the stack CAM alarm referenced in the first step in each section is to be carried out. Additionally, most steps in AOP-B332-004 contain human factors problems that would increase the likelihood of human error during an actual emergency. For example, individual steps are written in a narrative form, and most steps contain if/then statements, actions for several different individuals, and elaborating information better suited for a note of caution.

After finding problems with both AOPs directly related to the selected safety systems, EA expanded its review and found problems in all of the AOPs that were reviewed. (See **Finding-LLNS-Ops-1** and **OFI-LLNS-Ops-1**) For example:

- AOP-B332-001, *Installation/Removal of Portable Diesel Generator 332DGE08 During Abnormal Conditions*. Although it is critical from both a system functionality and worker safety perspective that the steps in the AOP be correctly performed in the order provided and the procedure contains numerous signature requirements, the AOP Level of Use is only listed as "Informational," indicating that the procedure is a low risk procedure and that the procedure does not need to be available at the job site. Further, this AOP deals with temporary high voltage power connections and actions to restore power but does not contain a "Precautions and Limitations" section or any designated cautions or notes indicating the potential hazards to workers. Like the other AOPs, many steps contain human factors problems that would increase the likelihood of human error during an actual emergency. For example, several different actions are contained in individual steps, and elaborating information better suited for a note of caution is contained within the narrative of individual steps.

- AOP-B332-002, *Loss of Automatic Transfer Switch and Associated Distribution Panels - Recovery Procedure*. Although it is critical from both a system functionality and worker safety perspective that the steps in the AOP be correctly performed in the order provided, and the procedure contains numerous signature requirements, the AOP Level of Use is listed as "General," indicating that the procedure is only a moderate risk procedure and that steps may be performed in any order. Further, this AOP deals with high voltage power connections and actions to restore power but does not contain a "Precautions and Limitations" section or any designated cautions indicating the potential hazards to

workers. Like the other AOPs, many steps contain human factors problems that would increase the likelihood of human error during an actual emergency. For example, in many cases, several different actions performed by different individuals are contained in individual steps, and elaborating information better suited for a note of caution is contained within the narrative of an individual step. Finally, many steps are written in a narrative form and do not provide specific actions and concise information for the performer.

Overall, the B332 AOPs do not meet all elements and detailed attributes of DOE Order 422.1, Section 2.p, which includes requirements for written technical procedures to be accurate, contain detail sufficient for accomplishing the operation, be capable of performance as written, be written with one action per step, and reflect human factors considerations. (See **Finding-LLNS-Ops-1** and **OFI-LLNS-Ops-1**)

In one case, facility operations and other testing personnel used an unreviewed, unapproved document to supplement completion of an SRP. During a simulated performance using SRP-B332-4.2.1.a, *Annually, HEPA Filter In-Place Leak Test, SR 4.2.1.a,* Rev. AF, facility operations personnel provided a document titled Walk-in Plenums HEPA Filter Testing Communications Plan (undated) and indicated this document has been used in conjunction with the SRP to complete the test. The document provides diagrams of safety equipment and test locations and step-by-step instructions for accessing the HEPA filters inside the bulkheads, which involves operation of the SC access doors to the system while the system is in operation. There was no evidence of any hazards review, technical accuracy review, unreviewed safety question (USQ) review, or management review and approval as required by administrative controls on development, review, and approval of technical documents and DOE Order 422.1, Section 2.p. (See **OFI-LLNS-Ops-2**)

Operator training requirements are documented in the *B332 Training Manual,* LLNL-AM-486071, Rev 1, August 2013, which states that the training objectives are based on a job analysis. This manual provides broad-based, generic objectives at the facility level but does not provide training objectives specific to individual safety systems. For example, documented objectives include:

- Ensure that the limiting condition for operation is met
- Direct the isolation/shutdown of affected systems
- Respond to system abnormalities
- Verify normal system operation.

For the selected safety systems, LLNS has no system-specific lesson plans that address fundamental and proper system response, operating characteristics, failure modes, and required actions involved in credible accident scenarios in which the selected systems are required to function. Further, DOE Order 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*, requires certified operators to be trained in fundamental operations areas including theory and principles of facility operation, general and specific facility operating characteristics, facility instrumentation and control, facility protection systems, and engineered safety features. The *B332 Training Manual* states that the operator training will meet these fundamental operations areas, but no training materials have been developed to specifically address these areas for the selected safety systems. Additionally, although the *B332 Training Manual* provides requirements for on-the-job training (OJT) and oral examinations for certification/recertification, there are minimal identified standards for what constitutes acceptable performance specifically related to the selected safety systems. A June 2013 JFLMA assessment of the NMTP training programs (performed triennially to meet an assessment requirement in DOE Order 426.2) found similar issues with some Superblock training courses, including "incomplete development packages that provide weak analysis and objectives that are not written in standard instructional design format," and "training course packages that have weak documentation of lesson plans and instructor

guides for instructor-led classes and OJTs." However, the assessment only documented these weaknesses as observations (implying that the training programs met the requirements of DOE Order 426.2) and did not specify which training program(s) had these problems. Further, none of the assessment examples related to these observations were specific to the facility operator training program, and there were minimal document reviews specific to the facility operator training program. (See further discussion in Section 5.5, Safety System Feedback and Improvement.) (See **Finding-LLNS-Ops-2** and **OFI-LLNS-Ops-3**)

The rigor of implementation and documentation of compensatory measures contained in the *Justification for Continued Operations (JCO) for the Plutonium Facility Related to Potential Inadequate Safety Analysis (PISA) Issues in the Building 332 Loft* did not fully meet the requirements of the NMTP Conduct of Operations Manual. Although the compensatory measures appeared to address the intent of the PISAs, the specific components for isolating the non-safety-related equipment and piping from the SC portions of the RVS were not uniquely identified, the isolation valves and tags were not labeled to uniquely identify components as required by DOE Order 422.1 (see labeling discussion in the next paragraph), and in some cases the tags did not contain the component information required by the LLNL procedures for administrative tags. The contractor implementation verification review for this JCO, dated August 8, 2013, documented many of these discrepancies as observations; however, because the contractor implementation review team did not document these discrepancies as findings, the facility took no action to correct them. (See **OFI-LLNS-Ops-2**)

In many cases, components within the selected safety systems are not labeled in accordance with the requirements of DOE Order 422.1, *Conduct of Operations*, Section 2.r, "Component Labeling." EA did not identify any examples of unlabeled components being operated or inspected during surveillance and testing but noted that other major components within the selected safety systems were not labeled. Additionally, as discussed above, components used to implement JCO compensatory measures were also not labeled. (See **OFI-LLNS-Ops-2**)

DOE Order 422.1, Requirement 2.m, requires defining responsibilities for the control of interrelated processes, including the actions of personnel outside the nuclear facilities who operate/control processes that can affect the operation of the safety systems. LLNS has established a memorandum of agreement (MOA) between NMTP (responsible for B332 operations), MUSD (responsible for external systems such as compressed air), Emergency Management Department (responsible for fire suppression water), and Planning and Integration Department. The MOA establishes lines of communication between these organizations to convey any process problems to the affected nuclear facilities in a timely manner so that actions can be taken to prevent adverse effects on facility safety. Although some broad lines of communication have been established, LLNS has not specifically identified the B332 interrelated processes affecting the nuclear facility or the associated responsibilities for B332 operators and operators of the interrelated processes. LLNS has also not provided training to all sets of operators covering how the interrelated processes can affect the facility. Lastly, without identifying and analyzing the interrelated processes, LLNS has not determined whether specific communications plans are needed for all groups to ensure prompt notification of system problems to allow for any urgent response by nuclear operations or process operators, as required by DOE Order 422.1. (See **OFI-LLNS-Ops-2**)

Operations Summary

Operations are largely conducted in a manner that ensures the availability of the selected safety systems to perform their intended safety functions when required. Most procedures are technically adequate to achieve required system performance. For existing procedures such as operating procedures and SRPs, lesson plans that include training objectives have been developed and administered, and operations personnel are trained on specific operations procedures and are knowledgeable of systems design and

performance requirements. Several facility operators have extensive facility experience. Shift routines and operating practices provide operations personnel with a current operational awareness of the selected safety systems, including verification of the normal configuration of the major ventilation equipment and major flow paths. However, EA noted several conduct-of-operations problems that, if left uncorrected, reduce the level of confidence in the ability of the selected safety systems to perform as required. Specific areas of concern included AOP quality, accuracy, and usability; facility operator training; component labeling; and identification of interrelated processes.

5.4 Cognizant System Engineer Program and Configuration Management

Criteria

The DOE contractor has established an effective system engineer program as defined in DOE Order 420.1B to ensure continued operational readiness of identified systems to meet their safety functional requirements and performance criteria.

Changes to system requirements, documents, and installed components are formally designed, reviewed, approved, implemented, tested, and documented.

Within the CSE element, EA reviewed the CSE program, CSE training and qualifications, CSE roles and responsibilities, VSS assessments (including the last three annual condition assessment reports for RVS and FHFS systems), operations and maintenance technical support, and some aspects of configuration management.

CSE Program

The CSE program for Building 332 is covered by the NMTP Superblock program document, *NMTP Superblock System Engineer Program Manual* (CMU09-00052). DOE Order 420.1C requires that protocols for implementing the facility CSE program must address the following elements:

- Identification of systems covered by the CSE program and identification of systems assigned for coverage
- Configuration management
- Support for operations and maintenance
- Training and qualification of CSEs.

The CSE program, as implemented in Building 332, has broadly defined the systems covered by the program and references the LLNL Defense Nuclear Facilities Vital Safety System list that provides the names of CSEs assigned to various systems. The program manual also specifically addresses configuration management, support for operations and maintenance, and training and qualification of CSEs. The program manual adequately addresses the program elements of DOE Order 420.1C.

CSE Training and Qualifications. DOE Order 420.1C also requires CSEs to be trained and qualified as *Technical Support Personnel* in accordance with DOE Order 426.2, *Personnel Selection, Training, Qualification and Certification Requirements for U.S. Department of Energy Nuclear Facilities.* The NMTP CSE program manual includes the training requirements and qualification cards for all CSEs within the Superblock. CSE qualification occurs in three levels. Level I, *CSE Technical Staff General Training*, includes documentation of the candidate's education and experience and their unescorted access to the facility. Level II, *CSE Core Training,* includes S/CI, work planning and control, RI, configuration management, and other DOE directives and LLNL procedures, as well as required reading of portions of

the facility DSA and TSRs. Level III, *CSE System-Specific Training*, is a system-specific qualification card detailing system knowledge for each assigned system. A walkdown of the system is also required with the SDD and approved drawings, and Level III final qualification is completed after a successful interview with the NMTP Facilities Engineering Manager and affirmation by the NMTP Facilities Engineering Manager or NMTP Facilities Operations, Maintenance and Engineering Manager that all required training and qualification for Level III CSE has been completed. The qualification cards and associated training requirements meet the requirements of DOE Orders 420.1C and 426.2. The training records for the CSEs confirmed that they were all appropriately selected, trained, and Level II qualified.

The CSEs assigned to the RVS and FHFS systems, as well as the CSE for the Fire Suppression System, are qualified only to Level II. The last time NMTP had a fully qualified (Level III) RVS and FHFS CSE in Building 332 was over a year ago. CSE qualifications were also identified as an issue in the HSS independent oversight review report dated December 2009. The CSE supervisor stated that no schedule is in place for completion of full CSE qualification and no specific priority has been placed on the issue, but that progress is being made as time permits. The CSE supervisor also stated that given the current status of the facility, the acting CSEs may be promoted or transferred before completing final qualification, leaving these systems without a fully qualified CSE indefinitely. One issue that hinders completion of the RVS CSE qualification is that the revised P&ID drawings showing the consolidated current configuration of the selected safety systems have remained in draft status for more than a year, so the Level III qualification walkdown would require use of older, legacy drawings of the system. (See **OFI-LLNS-CSE-1**)

CSE Roles and Responsibilities. The CSE program manual identifies CSE responsibilities in detail. Section 3.2.2.2.a of this manual identifies in detail the CSE responsibilities related to configuration management. For example, one requirement is to "Prepare and maintain an Essential Documents List for VSSs." The program document further requires the list to include essential drawings, calculations, vendor information, and other documentation necessary for safe system operation. Another example states, "Perform technical review and concur with related unreviewed safety question (USQ) determinations to ensure that the system functional requirements and performance criteria are not compromised by the proposed changes." Many of these responsibilities require full knowledge of and qualification on assigned systems. (See **OFI-LLNS-CSE-1**)

Section 3.2.2.2.b of the manual identifies CSE responsibilities related to "System Status and Performance" including, for example, "Assess, monitor, and status system performance in accordance with NMTP-FMP-0212, System Assessments, Tracking and Trending." Section 3.2.2.2.c of the program includes an extensive set of CSE duties related to "Technical Support for Operations and Maintenance Activities." Some of the CSE activities listed in the program manual are documented through the associated governing process, such as the USQ process or the condition assessments performed annually per NMTP-FMP-0212 listed above. However, for some of these duties, there is no additional guidance on how to perform the duty or how it is to be documented. (See **OFI-LLNS-CSE-2**)

NMTP-FMP-0212 also contains additional CSE responsibilities for:

- Maintaining the system notebook
- Establishing system metrics to be used in system performance, operability, and reliability tracking and trending
- Performing and documenting the results of system walkdowns and assessments
- Remaining cognizant of system-specific maintenance/operations history and any available industry operating experience.

According to the NMTP Facilities Engineering Manager and the RVS Acting CSE, the CSEs typically document items in a physical logbook, but system notebooks as described in NMTP-FMP-0212 are not used at Building 332. This procedure (which covers all nuclear facilities within the Superblock) requires all results of assessments to be entered and maintained in the system notebook, which "constitutes an informational collection of documentation on a particular system." For example, system awareness assessments, system walkdowns, selection of system metrics, and copies of annual condition assessments are required to be documented in the system notebook. In addition, the "Definitions" section of the procedure includes a detailed definition of the system notebook and the kinds of information that are to be included. The system notebook is an important aspect of the CSE program that is not being implemented; creating and maintaining a system notebook would also facilitate the qualification of new CSE candidates, since much of the pertinent system information would be in one location. (See **OFI-LLNS-CSE-3**)

In addition to the responsibilities mentioned above, the CSEs are typically the RIs for maintenance activities associated with their assigned systems. As the RIs, they are responsible for preparing the maintenance work document, presenting the proposed work document during the planning/scheduling meeting, conducting the pre-job briefing, and leading the job in the field through the post-maintenance testing and the post-job feedback. During the observed work activities associated with SC/SS systems, the CSEs were present and involved for the duration of each activity. While CSEs should be involved in maintenance activities for their systems, assigning most of the maintenance-related RI duties to the CSEs detract from the time available for engineering duties directly related to the purpose of ensuring system health and reliability. (See **OFI-LLNS-CSE-4**)

Periodic VSS Assessments. NMTP-FMP-0212, *System Assessments, Tracking and Trending*, defines additional CSE assessment activities, including three types of CSE assessments. The first assessment type is system awareness, which is basic, ongoing awareness of the condition of the system. The intent of this type of assessment is to maintain continuous awareness of the system's ability to perform its intended safety function. No formal documentation is required for these assessments, but NMTP-FMP-0212 requires observations from these assessments to be logged regularly and retained in the system notebook (which currently does not exist). (See **OFI-LLNS-CSE-3**)

The second type of CSE assessment is the monthly system walkdown. Using NMTP-FMP-0212, Attachment A, *System Walkdown Checklist*, the CSE observes the material condition, operation, and configuration control of a selected portion of the applicable system. NMTP-FMP-0212, Section 7.2.2 states that the entire system is assessed at least once a year. NMTP management stated that the scope of the system walkdowns only evaluates the SC/SS portions of the system. While these are the most important aspects of the system, other non-safety SSCs of the system can have an effect on overall system health and reliability. (See **OFI-LLNS-CSE-4**)

The third type of assessment is the system condition assessment. This is a documented evaluation of a system's health in terms of condition and operability. The object of the assessment, according to Section 7.2.3 of NMTP-FMP-0212, is to "provide a snapshot of the overall system health based on the synthesis of data from a number of diverse sources, including system metrics." These assessments are performed annually. Each of the reviewed condition assessment reports for RVS and FHFS addresses the four fundamental attributes described in Section 7.2.3.1 of the procedure (operability, reliability, material condition, and configuration control). For example, the Operability section of the most recent condition assessment report for the RVS lists the RVS performance criteria from the DSA, followed by a listing of the applicable SRs from the Building 332 TSRs and concluding with a summary of the completed SR procedures for the period; there are no objective criteria for evaluating the operating performance of the system. The Reliability section lists each of the PMs that were performed during the year, and the only comment in this section of the report is related to vibration data, suggesting that anchor points for some

fans should be moved; again, there are no objective criteria to define/determine whether the system is acceptably reliable. Material condition is solely determined based on system walkdowns conducted in accordance with SRP-B332-4.1.4/4.4.3, *Annually, Visual Inspection of the Safety-Class and Safety Significant Portions of the RVS Exhaust Ducting*, but this covers only a portion of the system condition. (See **OFI-LLNS-CSE-4**)

Each of the other annual reports was similarly broad in scope, lacked detail, and provided a very limited, subjective view of system health. The reports also lacked specific performance metrics and objective criteria related to the attributes contributing to system health and did not include scoring criteria or action plans for any attribute that was judged to be less than fully healthy. In addition, there was no evidence of analysis or trending of results. Actions are needed to improve these condition assessments as a tool for tracking system-related issues and informing senior management of system health status. (See **OFI-LLNS-CSE-4**)

Operations and Maintenance Technical Support. EA reviewed all of the CM work packages for the last three years for the RVS and FHFS systems. In each reviewed CM work package, the CSEs were involved in the development, planning, review, post-maintenance testing selection, and review of results of the completed work. As noted above, Section 3.2.2.2.c contains a detailed list of CSE responsibilities related to providing technical support for operations and maintenance activities. EA observed CSEs assisting in operational activities, including surveillance procedure performance, and in all observed maintenance activities. The performance of the CSEs in each instance was acceptable.

Configuration Management

Chapter 5, *Cognizant System Engineer Program*, of DOE Order 420.1C, Attachment 2, *Facility Safety Requirements*, requires hazard category 1, 2, and 3 nuclear facilities in operational status with SC or SS SSCs to have a documented configuration management program to ensure consistency among system requirements, performance criteria, documentation, and physical configuration. It notes that DOE-STD-1073-2003 provides an acceptable means of meeting these requirements. A similar requirement is contained in DOE Order 413.3B, which is also applicable to LLNL and states that, "A configuration management process must be established that controls changes to the physical configuration of project facilities, structures, systems and components in compliance with ANSI/EIA-649A and DOE-STD-1073-2003." In accordance with that standard, LLNS has developed a configuration management plan for the Superblock facility.

The NMTP Nuclear Facility Configuration Management Plan, Rev 5, references DOE-STD-1073-2003 and addresses the five major areas identified as elements of a configuration management program. Specifically, it states that, "configuration management teams (members of configuration management personnel within Radioactive and Hazardous Waste Management and Superblock) maintain the as-built drawings and documents for the NMTP facilities." Section 4.0 states, "The minimum level of detail in design requirements is the level of detail needed to demonstrate operability and perform required maintenance to maintain operability as determined by the System Engineer or CM SSC owner." This statement addresses immediate operating needs but should also address the minimum documentation needed to establish the design basis and demonstrate compliance with the safety basis.

The EA team limited its review of configuration management to three of the five principal areas: design control, change control, and document control. These three areas are addressed individually below.

Design Control. This area encompasses the identification and control of drawings, calculations, SDDs, specifications, and any other engineering documents designated as part of the design basis for the facility. Figure 2 on page 13 of the NMTP Nuclear Facility Configuration Management Plan identifies SDDs as

the baseline development document for configuration management Level 1 (highest level) on safety systems.
SDD-B332-013, *Building 332 System Design Description for the Room Ventilation System*, is the SDD for the RVS. This SDD describes the system, provides a summary of design requirements the system must meet, documents sources of information for the system and its components, and describes interfaces with other SSCs. Two issues were noted in this document. First, SDD Table 2-1, *RVS Component Classifications – Increment 1,* omits key system components that should be addressed in the SDD, such as pressure instrumentation necessary to ensure the proper operation of the system. Second, the SDD was issued under a single person's signature, with no evidence of checking, design verification, or approval by a second party as required by 10 CFR 830.122 and the NMTP QA Program, Section 8.2.8. (See **Finding-LLNS-CSE-1**)

SDD-B332-014, *Building 332 System Design Description (SDD) for the Final HEPA Filtration Stages*, is the SDD for the HEPA filters for the safety-related ventilations systems, including the RVS. This SDD describes the system, provides a summary of design requirements the system must meet, documents sources of information for the system and its components, and describes interfaces with other SSCs. Housekeeping filters in locations other than the HEPA plenums are not included. Although generally complete, SDD-B332-014 was not revised when the HEPA filters were changed from 1000 cubic feet per minute (cfm) to 1500 cfm using the "like-in-kind" process (the like-in-kind approach is an equivalency evaluation where key attributes are identified and compared with those of the original component when ordering a replacement component). The CSE was aware of this and plans to correct it in the next update.

A project to develop piping and instrumentation diagrams (P&IDs) for all safety systems began in 2006. Although P&IDs have been issued for most systems, including several systems of lower safety classification, the P&IDs for the RVS and FHFS remain in draft and have not been issued. Legacy drawings containing some detail about the system design, primarily electrical logic diagrams and single lines, were provided to the EA team, but they do not provide sufficient system integration to ensure effective configuration control of the systems. (See **OFI-LLNS-CSE-5**)

Change Control. Change control is the process through which changes to the facility SSCs are proposed, evaluated, approved, and implemented. A structured, procedurally controlled process is necessary to ensure that facility impacts are appropriately analyzed before a change is implemented and that affected documents are updated to reflect the configuration of the facility after a change occurs. The NMTP change control process is governed by several documents, including the Work Planning and Control Manual. This manual describes the process for creating, implementing, and closing work packages and is the process used in the Superblock to make physical changes to the facility. EA reviewed this manual to assess the requirements in place to manage the facility technical design basis during the change process.

The Work Planning and Control Manual adequately integrates the USQ process at the change request stage. USQ evaluations are generated by the Authorization Basis Group, which is the group responsible for maintaining the safety basis for the facility. Therefore, approval of changes that might result in unplanned impacts to the safety basis is highly unlikely.

Review for technical impact starts at the change request stage. Level 1 requests are simple changes that have no significant effect on the facility and do not require an engineering review. Level 2 changes are new processes or modifications to an existing process with a minor effect on the facility and are reviewed by the Facilities Operations, Maintenance, and Engineering Manager, among others, but not by the Engineering Manager. The Safety and Work Control Manager stated that the Work Planning and Control Manual is being revised to add the Engineering Manager as a required reviewer for Level 2 change requests to strengthen the process, and a draft copy of the in-process revision incorporating this change

was provided to EA. Level 3 change requests are more significant and are reviewed by the Engineering Manager, who can also designate additional reviewers.
The overall review process is intended to identify any impacts, including any calculations and drawing changes required to implement the change. Release-to-work for the work permit requires validation that the identified impacts have been addressed, calculations performed, etc. with concurrence signatures by both the Engineering Manager and the CSE. Properly implemented and with the in-process change noted above, the overall process will provide adequate assurance that impacts to the facility design basis from a proposed change are evaluated and addressed as part of the change process.

FMP-NMTP-0207, *Review and Approval of NMTP Documents Controlled in ECMS*, describes the electronic issuance process for procedures and other documents in electronic format requiring an approval process. It includes the process for electronically constructing engineering change requests and processing approvals. It does not describe processing procedures for non-electronic records. Although the procedure is generally adequate, EA noted several discrepancies. A "simple change" process is mentioned in the Definitions section but is not described or further explained elsewhere in this procedure, and no other procedures are referenced even though other procedures reference the simple change process. For example, FMP-SBK-0101, *SBK Controlled Document Distribution Processes within iCATS*, manages controlled distribution of a very limited population of documents (the DSA, TSR, and Facility Safety Plan), and it references FMP-NMTP-0207 for the simple change process. FMP-NMTP-0207 also does not contain process requirements for all types of records and lacks cross-references to other procedures. (See **OFI-LLNS-CSE-6**)

As part of this assessment, EA performed detailed reviews of two change packages for SC equipment and a receiving inspection package for SC HEPA filters in order to sample implementation of the change control process. Details associated with these packages are described below.

B332-11-D-0430, *Rewire ACU-08 Flow Switches*, is a change package/work permit developed to change the wiring for two redundant flow switches from parallel to series in order to ensure true redundancy and a single-failure-proof configuration for a safety function. The physical modification was completed in November 2011. Although new revisions to the affected drawings had not been issued, the control copies in the Document Management Center (DMC) had been updated via red-line markup to show the change. No other technical issues were identified with the approach or the package.

332-10-D-051, *Install Vibration Anchors for FFE2000*, is a change package/work permit that added supplemental anchorage to an Increment 3 exhaust fan. Vibration monitoring had revealed undesirable levels of excitation on the fan. Although no preset vibrational limits had been established, the manufacturer was contacted when measured peak vibrational velocity reached 0.4 in/sec. The manufacturer's representative suggested adding additional anchorage to the frame under the fan and motor. A Superblock work permit was developed and issued to install those vibration anchors. The modification was somewhat successful in that the measured fan vibration dropped to 0.32 in/sec. Vibration monitoring has continued since that modification, and vibration levels have remained stable.

In designing the modification, the existing concrete anchors in the fan support frame were supplemented with four additional concrete anchors, and the bolting connecting the fan shaft support column to the support frame was replaced with concrete anchors passing through the frame into the concrete. The intent was to provide additional stiffness and support and change the harmonic excitation frequencies of the skid. Epoxy-grouted 5/8" concrete anchor bolts were installed. Although the modification met the intent of reducing the vibration, EA noted several problems with the work package and supporting calculation for the anchor bolt design as follows:

- The USQ did not evaluate pullout of the anchors that replaced the frame bolting; a potential new failure mode that did not exist before.

- There was no evidence that the use of epoxy-grouted anchors in a safety-related application subject to extensive vibratory loading was evaluated in the work package or associated calculation. A report from the manufacturer was attached to the work package justifying the use of the epoxy-grouted anchors. The report stated that it did not cover the use of these anchors in fatigue applications, yet it appeared that the anchor was designed on the basis of the report. When questioned, LLNS provided a manufacturer anchor selection guide sheet from 2008 listing these anchors as suitable for high cycle fatigue applications.

- The work package replaced the original 3/4" bolts with 5/8" bolts but did not evaluate this change for impact on fan seismic qualification. The LLNL calculation addressed static loading based on measured vibratory accelerations. For an operating fan, seismic loads would be additive with vibratory loads, so those loads should have been considered in the anchorage design. Conversely, the calculation considered that the entire mass of the fan participated in the measured peak accelerations; this is a very conservative assumption. When EA identified this issue to the appropriate personnel, LLNS initiated an operability evaluation for the fans. A new calculation was performed and used as the basis for a determination that the fans remained operable. The revised calculation considered vibration loading and seismic loading but not fan belt pre-load. Where the original calculation had calculated vibratory loading based on actual measured accelerations, the new calculation used a textbook formula for loading due to eccentricity in a shaft to calculate loading due to vibration. Eccentricity was assumed to be 0.5mm based on a typical value for large rotating machinery. There was no actual technical basis for this number, and no justification was provided.

In summary, the bolt replacement resulted in a non-conservative reduction in the capacity of the fan skid to resist seismic accelerations. When the EA team identified this problem, LLNS performed a calculation using a suspect methodology without technical justification to form the basis for an operability determination. The EA team also identified deficiencies in the new calculation, along with a number of offsetting conservatisms. The LFO SSO engineer was present for briefings and discussions on this issue and will follow it to resolution. (See **Finding-LLNS-CSE-4**)

When replacement HEPA filters rated at 1500 cfm were purchased to replace existing 1000 cfm filters, a like-in-kind evaluation was performed, including a comparison of critical attributes. However, this evaluation did not consider the pressure drop across the filter as a critical characteristic. The new filters were purchased with a higher initial pressure drop limit at the higher flow rate and were tested at that flow rate. Although the actual flow rate when installed is less than that maximum, no flow resistance data is available for the normal flow rates. Using the resistance value at the 1500 cfm flow rate results in an increase in overall system resistance, which reduces the margin in the flow rate for the system. This discrepancy should have been addressed in the evaluation, and a USQ evaluation may have been warranted. (See **Finding-LLNS-CSE-3**)

Document Control. Document control is an essential aspect of configuration management. Design records must be kept up to date, and processes must ensure that the latest version reflecting as-built status of the facility is available for use. In discussing the change process, the NMTP Nuclear Facility Configuration Management Plan states that changes to baseline documents must be made before the change implementation is closed. For the most part, EA identified no significant issues; however, EA noted some ongoing practices that are not supportive of effective document control:

- Document approval requirements are not well defined. For example, when EA found that SDD-B332-013 had been issued under the signature of a single individual, it also found that facility procedures for issuing such documents do not address review and approval requirements. (See **OFI-LLNS-CSE-6**)

- No procedures define proper handling of vendor manuals and other vendor documents. Some records are maintained in the DMC as hard copies rather than as electronic records. Vendor documents, such as operation and maintenance manuals, are typically entered into the document control system embedded within receipt inspection packages rather than as stand-alone documents, making retrieval difficult. (See **OFI-LLNS-CSE-6**)

- FMP-SBK-0700, *Records Management and Document Control for Superblock Facilities,* governs storage and retention of QA records for the LLNL nuclear facilities (Superblock). Table 1 (untitled) of this procedure notes that records of different types are stored in many different locations and that storage, retention, and maintenance are the responsibility of the creating organization. In some cases, these records are forwarded to the DMC, which files and retains the hard copies. There is no time requirement for submitting records to the DMC, so, in effect, each of these other organizations is an official record keeper for QA records, and those records are not generally retrievable or available to users outside those organizations. (See **OFI-LLNS-CSE-6**)

- The work package closure process documented in the NMTP Work Planning and Control Manual does not ensure that documents such as design drawings that are affected by a change are updated to reflect the as-built status when the change is complete. Package closure is permitted without such updates. No other specific constraints are in place to ensure that such updates occur, other than an undocumented expectation for the CSE to ensure that updates are completed, (See **Finding-LLNS-CSE-2**)

Cognizant System Engineer Program and Configuration Management Summary

The CSE program for Building 332 and the reviewed implementing procedures are consistent with the requirements of DOE Order 420.1C. Engineers have been assigned to each of the SC and SS systems associated with Building 332. CSEs are knowledgeable of facility processes and their assigned systems. However, the CSEs for the RVS and FHFS systems and at least one other SC/SS system have not completed full qualification, and this condition has existed for over a year. Although the CSE program meets DOE requirements, management attention is needed in several areas of the program to improve the effectiveness of this vital role in system health and reliability. Additionally, EA found several areas of configuration management to be ineffectively implemented. Specifically, weaknesses exist in the NMTP Nuclear Facility Configuration Management Plan in the areas of design control, change control, work control, and document control that warrant LLNS management review and attention: the design basis for the SC RVS is not adequately documented through issued P&IDs; the change control process does not adequately ensure that design documents are kept current; record keeping for QA records is spread through several organizations; and vendor manuals are not readily available.

5.5 Safety System Feedback and Improvement

Criteria

The contractor's assurance system has processes in place and effectively monitors and evaluates engineering, configuration management, maintenance, surveillance and testing, operations, and operating experience, including the use of performance indicators/measures, allocation of resources and

the identification and application of lessons learned.

Formal processes are in place and effectively implemented to identify and analyze problems and issues (including operational incidents and events) related to engineering, configuration management, maintenance, surveillance and testing, and operations assurance activities and conditions; to identify, track, monitor, and close corrective actions; and to verify the effectiveness of corrective actions. Results of engineering, configuration management, maintenance, surveillance and testing, and operations assurance processes for safety systems are periodically analyzed, compiled and, as appropriate, reported or available to DOE line management as part of contract performance evaluation.

A critical aspect of ensuring VSS functionality, operability, and reliability is a feedback and improvement process incorporating monitoring and trend analysis for system operability, analysis of incidents and off-normal conditions, and lessons learned. EA evaluated the establishment and implementation of feedback and improvement programs and processes that affect nuclear safety systems at the LLNL Superblock. Specifically, EA reviewed feedback and improvement program and process documents; interviewed responsible managers and staff; and evaluated samples of process outputs, such as assessment reports, issues management documentation, trend and performance indicator reports, incident and event analysis reports, and lessons-learned publications.

LLNL feedback and continuous improvement programs and processes are described in DES-0600, *Contractor Assurance System Description*; DES-0541, *Integrated Safety Management System*; and DES-0109, *ISO 9001 Quality Management System*. The elements of the contractor assurance system (CAS) support a broader system for ensuring execution of the LLNL missions identified as the Management Assurance System. These CAS elements include requirements, performance evaluation, resolution of problems, systemic trending, and analysis and reporting of results. The CAS is administered at the institutional level through the Management Assurance Officer and Contractor Assurance Officer and support staff, reporting to the Laboratory Director. The CAS is implemented by Laboratory workers and contractors, with significant oversight and participation by line managers, organization assurance managers, and functional area and subject area managers. CAS implementation for nuclear facilities is primarily conducted by functional and subject area managers and the Weapons and Complex Integration (WCI) and Nuclear Operations Directorates.

Assessment Program

The LLNL assessment program is described in program description DES-0048, *LLNL Assessment Program*. The assessment program is implemented in accordance with a set of procedures that detail the development and maintenance of an institutional assessment plan (IAP) and the requirements and actions for planning, performing, and documenting internal independent assessments (IIAs); management self-assessments (MAs); JFLMAs; and management observations, verifications, and inspections (MOVIs). In addition to these Laboratory-wide types of assessment activities, the implementation of LLNL nuclear facility safety basis requirements and controls designed to implement facility safety bases (e.g., TSRs, safety management programs, specific administrative controls, and design features) is regularly assessed by conducting implementation verification reviews (IVRs) as described in DOE Guide 423.1-1A, *Implementation Guide for Use in Developing Technical Safety Requirements*, and Nuclear Operations procedure AB-009, *Implementation Verification Review*. The IAP procedure details the use of a structured, risk-based assessment planning tool for independent, line, and functional organizations to develop annual assessment schedules that include both mandatory (directive/regulatory driven) and discretionary assessments. Collectively, the input from Laboratory organizations forms the IAP. Managers and subject matter experts (SMEs) in LLNL nuclear facilities also conduct routine, documented facility walkthrough inspections to observe work activities, material conditions, and compliance with safety requirements in accordance with WCI-FWP.3, *Facility Walkaround Procedure*.

Many nuclear safety-related assessment activities are performed and documented to identify problems and opportunities for continuous improvement at LLNL. Nuclear safety-related processes and performance at LLNL are continuously evaluated at the institutional and facility level and through functional area program reviews and IIAs, JFLMAs, MAs, IVRs, and less-formal documented MOVIs.

EA reviewed approximately 20 formal assessment reports and five IVR reports related to nuclear safety processes and performance at LLNL in 2012, 2013, and 2014. In general, the EA team considered that most of these reports reflected comprehensive and rigorous evaluations of processes, conditions, work activities, and performance documentation. Issues requiring resolution or further evaluation were identified and input to the LLNL Issues Tracking System (ITS). While the MOVI procedure is designed to provide a mechanism for documenting less-formal field observations by management, three of the seven NMTP-generated MOVI reports reviewed by the EA team did not include any field observations but instead were comprehensive assessments of operational and work planning and control processes, activities, and documentation. In addition, one MOVI report documented a required triennial fire protection inspection activity. While these assessments were value-added evaluations of safety program elements, they were performed and documented as less-formal MOVIs rather than as management self-assessments. In addition, the WCI Directorate has not formally established standards or requirements for performing MOVIs, and no tracking mechanism is used to determine whether these observations are being performed as expected. (See **OFI-LLNS-F&I-1**)

The Laboratory contractor's corporate office also provides an independent assessment function by performing periodic "functional management reviews" (FMRs). EA reviewed an FMR conducted in May 2013 on the Laboratory's safety basis development process, focused on Superblock facilities. The FMR team was composed of three senior managers with extensive nuclear experience. The evaluation was comprehensive and thorough and was conducted in accordance with a formal plan and CRADs. The review resulted in 7 noteworthy practices and 16 observations, with 9 associated recommendations for addressing the observations.

LLNS initiated a formal assessment quality review process in 2012 (PRO-0054, *Assessment Quality Peer Review*) that involved teams of one to three reviewers from the Management Assurance organization staff, SMEs, subject area managers, and volunteer line managers. Evaluators rated reports selected by Management Assurance staff using 16 criteria addressing planning, execution, and reporting. Evaluations were provided to lead assessors as feedback for improvement of future assessments. Twenty-eight reports were peer reviewed in fiscal year (FY) 2012 and FY 2013, but these reviews were discontinued, and none have been performed in the past year. Although the LLNL assessment review process has some weaknesses as discussed below, feedback to performers on the quality of assessment activities is a valuable learning tool for both reviewers and assessors and provides ongoing performance information to assurance process owners and line managers. (See **OFI-LLNS-F&I-1**)

Despite the generally adequate LLNL assessment program, EA identified a few weaknesses: (See **OFI-LLNS-F&I-1**)

- Contrary to the requirements of PRO-0049, the assessment planning tool is not being used to document performance data, and risk analyses are not being documented to help identify and prioritize future assessments. In practice, the planning tool template is filled in only after managers have identified the type, number, and subject of assessments to be performed in the next year, based on ad hoc selection processes.

- Few IIAs of nuclear activities are planned, scheduled, or performed.

- Documentation and performance of some LLNL-related assessments lack sufficient rigor. Weaknesses included too much focus on process rather than performance, overdependence on interviews rather than examinations of objective evidence of performance, insufficient detail regarding sample selection process/rationale and size, no explanation of the basis for acceptance criteria, non-compliant conditions described as observations, and conclusions not supported by the evidence described.

Issues Management

LLNS has established an appropriate set of procedures and guides that detail the processes, requirements, and guidance for documenting, categorizing, evaluating (e.g., apparent and root cause analysis, determining extent of condition, and evaluating behavioral factors), and correcting deficiencies and OFIs; preventing recurrence; and evaluating the effectiveness of actions using a graded approach. When identified, negative or indeterminate conditions, processes, performance, and event/incident-related issues are to be documented in the LLNL ITS database. LLNL procedure PRO-0042, *Issues and Corrective Action Management*, details a comprehensive process for managing issues from identification to closure. Any issues categorized as deficiencies, observations, or strengths are to be documented in ITS, where they are then screened by management-appointed staff to determine issue type, significance, ownership, functional or subject area, and reportability (e.g., to DOE ORPS or Noncompliance Tracking System). The inclusion of issues that are not clearly deviations from requirements (i.e., observations) in the screening process is a positive approach, acknowledging that safety improvement can be achieved by evaluating and addressing all types of weaknesses in process or performance. After screening, issue information is reviewed and approved (or revised) by organizational Operations Review Boards (ORBs) composed of line managers and assurance managers to provide input to assigned owners and/or senior management for significant issues.

Issues are managed based on the significance and reporting method (e.g., DOE reportable occurrences or issues identified by LFO are processed more rigorously than those identified during a management observation). Issues are assigned a significance level from 1 (most significant) to 5 (not actionable) based on an evaluation matrix of consequences and probabilities, and the level of rigor and effort applied to evaluation, oversight, and follow-up is based on the rating. The procedure contains directions for managing each issue type and significance level, as well as guidance on decision points in the process. The ITS database provides fields for documenting evaluation and corrective/preventive action results and tracking the full resolution process. EA reviewed a variety of ITS reports and generally found that issues were adequately evaluated and resolved. EA observed the conduct of a WCI ORB meeting evaluating screened issues and determined that the review and approval process was appropriate for the issues reviewed. However, the following areas of issues management were identified as needing management attention and improvement: (See **OFI-LLNS-F&I-2**)

- NMTP tracks the resolution of workplace condition deficiencies identified during facility walkarounds (Procedure WCI-FWP.3) in a separate spreadsheet instead of using the ITS.

- FMR evaluation issues are tracked in a separate corporate database and are not managed in accordance with the LLNL issues management system; they are not evaluated for significance and management actions, such as cause determinations, ORB review and approval, action approval, and effectiveness review. Their management and tracking to closure are also not documented in ITS.

- LLNL issues management procedures do not require actions to be taken on most problems documented in ITS. Only about one third of LLNL issues approved by the ORBs require any action or follow-up, and only one half percent of issues require even "moderate" analysis and follow-up (i.e.,

a root cause analysis and an effectiveness review). In the past three years, approximately 64 percent of ORB-approved issues were categorized as significance level 3 (only "limited analysis and follow-up"). Approximately 33 percent of ORB-approved issues were categorized as significance level 4 (trended only, with actions optional), although many of these issues are formally addressed with actions.

- Although LLNL personnel may be performing some level of extent-of-condition review for some issues, LLNL procedures do not sufficiently address the determination of extent of condition in the evaluation of issues or the development of corrective actions that fosters effective recurrence controls. PRO-0042 specifies that extent-of-condition reviews are required only for issues identified by LLNL assessments that are categorized as significance level 1. However, no significance level 1 issues have been identified for the past four years. PRO-0042 does state that extent of condition reviews are required for the very few DOE reportable Noncompliance Tracking System issues or when required by LFO for issues identified by LFO, but does not promote or require graded reviews for issues of lesser significance, potentially resulting in the failure to correct or prevent similar problems in other procedures, processes, material or equipment.

Event Reporting and Analysis

LLNS has established well-defined processes for identifying, investigating, and reporting reportable events and periodically analyzing performance trends for events and safety issues as required by DOE directives. The ITS data and event analysis reports reviewed by EA adequately evaluated the data for trends. EA's review of nuclear facility event and critique reports indicated that LLNS is identifying and formally addressing incidents that do not rise to a level requiring reporting to DOE by means of critiques or investigations to identify and correct process or performance deficiencies and weaknesses. The NMTP critique reports include generally comprehensive documentation of the incidents (detailed incident descriptions and timelines and identification of participants and work activities and actions taken), as well as an analysis of apparent causes and suggested corrective/preventive actions. However, the critique reports do not include or attach a list of critique attendees and written personal statements. Further, the inclusion of cause analysis and corrective action identification in the critique process and practice at LLNL warrants management review. Procedure PRO-0072, *Conducting a Critique*, appropriately states that critiques should be held promptly, preferably within the same shift. However, this procedure also specifies an exception, stating that "when it is known that an event will be analyzed for causes," the critique should be integrated with the causal analysis process, with an appointed causal analysis team conducting the critique. This exception and the practice of identifying causes and corrective actions during the critiques conflicts with step 6 in Section 5.2 of the procedure, which cautions the critique leader to avoid digressing into causal factors or corrective actions during the critique. Trying to determine causes during a fact finding effort with a group, rather than with selected and trained analysts, not only detracts from the fact finding process but could adversely affect or present conflicts with subsequent cause analysis efforts performed as part of the issues management process. The level of analysis (i.e., apparent cause or root cause) is not addressed, and the methods used and persons performing the analysis are not documented in the critique reports. The EA review team notes that LLNL Form-0672, referenced for use in the critique procedure, does not contain fields for documenting causes or corrective actions. (See **OFI-LLNS-F&I-3**)

Lessons Learned

LLNS has established and implemented a generally robust, structured operating experience/lessons-learned program that identifies, evaluates, and provides for appropriate application of lessons learned from external operating experience and internal activities, conditions, and events. Lessons learned are being generated and put into a local database. Lessons learned are identified, distributed, and addressed

by NMTP management and staff.

An institutional operating experience program description and implementing procedures adequately detail the roles, responsibilities, and action steps to identify, communicate, and apply internally and externally generated lessons learned. Environment, Safety, and Health (ES&H) Manual Document 2.2, *LLNL Institution-Wide Work Planning and Control Process*, specifically addresses the inclusion of past experience and lessons learned in the work planning process and includes requirements for performing post-job reviews to identify lessons learned for future work. The NMTP Work Planning and Control Manual establishes additional requirements for technical and administrative reviews, approvals, and authorizations for work performed in nuclear facilities, including review and input from system engineers, the facility engineering manager, the configuration management representative, and the ES&H team. The NMTP manual requires the assigned RI to complete the lessons-learned/feedback and improvement section of each NMTP work permit prior to closure and provide it to the NMTP Safety Officer for review. While the NMTP safety staff stated that issues identified in the feedback and improvement section of the permit are provided to appropriate individuals for resolution and cited an anecdotal example where actions were taken, there is no formal record or tracking mechanism to identify the resolution of documented feedback issues. (See **OFI-LLNS-F&I-4**)

The institutional lessons-learned coordinator screens operating experience/lessons-learned data sources (i.e., DOE ORPS reports and published lessons learned, as well as non-DOE sources) daily for applicability to LLNL processes and activities, enlisting the help of technical SMEs and knowledgeable organization staff as needed, and determines appropriate actions (e.g., distribution for sharing and application or requiring a formal response). The WCI and NMTP assurance managers and technical staff in NMTP and in the Nuclear Operations Directorate subscribe to operating experience/lessons-learned sources and also screen lessons for applicability and further evaluation or action. The LLNS lessons-learned coordinator maintains a comprehensive spreadsheet of operating experience documents reviewed, applicability reviews conducted, actions taken, and feedback from end users.

Safety System Feedback and Improvement Summary

Overall, LLNS has established and implemented the feedback and improvement programs and processes necessary for evaluation of nuclear safety processes and performance at LLNL. Feedback and improvement processes are described in program description documents and procedures at the institutional and NMTP level. Many assessment-like activities are planned and scheduled for evaluating programs and performance at LLNL nuclear facilities using a structured process and are performed and documented as scheduled and in a generally comprehensive and rigorous manner. Safety issues are identified, evaluated and resolved using a graded approach. Incidents and events, including those below DOE occurrence reporting thresholds, are formally documented and investigated, and recurrence controls are identified and implemented. Internal lessons learned are identified, documented, shared, and, along with external lessons learned, screened for inclusion in work documents and training. Knowledgeable, engaged performance assurance staff and WCI/NMTP assurance managers provide management with guidance, oversight, and analytical feedback concerning processes and performance, and communicate facility and institutional assurance activities and results. Process and performance weaknesses in the areas of assessment and issues management warrant review and attention by LLNS management.

5.6 LFO Safety Oversight Program

Criteria

DOE field element line management has established and implemented oversight processes that evaluate contractor and DOE programs and management systems, including site assurance systems, for

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

DOE field element line oversight program includes written plans and schedules for planned assessments, focus areas for operational oversight, and reviews of the contractor's self-assessment of processes and systems. (DOE Order 226.1B 4b(2))

The DOE field element has an issues management process that is capable of categorizing findings based on risk and priority, ensuring relevant line management findings are effectively communicated to the contractors, and ensuring that problems are evaluated and corrected on a timely basis. For issues categorized as high significance findings, the issues management process ensures that:

- *A thorough analysis of the underlying causal factors is completed;*
- *Corrective actions that will address the cause(s) of the findings and prevent recurrence are identified and implemented;*
- *After completion of a corrective action or a set of corrective actions, the conduct of an effectiveness review using trained and qualified personnel that can verify the corrective action/corrective action plan has been effectively implemented to prevent recurrences;*
- *Documentation of the analysis process and results described in (a) and maintenance tracking to completion of plans and schedules for the corrective actions and effectiveness reviews described in (b) and (c) above, in a readily accessible system.(DOE Order 226.1B 4b(4)).*

Oversight processes are tailored according to the effectiveness of contractor assurance systems, the hazards at the site/activity, and the degree of risk, giving additional emphasis to potentially high consequence activities. (DOE Order 226.1B 4b(5))

DOE line management has established and communicated performance expectations to contractors through formal contract mechanisms. Such expectations (e.g., safety performance measures and commitments) are established on an annual basis, or as otherwise required or determined appropriate by the field element. (DOE Order 226.1 B 4c)

DOE line management has in place effective processes for communicating oversight results and other issues in a timely manner up the line management chain, and to the contractor as appropriate, sufficient to allow senior managers to make informed decisions. (DOE Order 226.1B 4d)

Field elements have developed and implemented an Operating Experience (OE) Program and identified and designate an OE Program Coordinator. The OE Program uses a graded approach when addressing the applicability of requirements and the basis for this approach is documented based upon the review and analysis of the hazards and risks for the program and its operational activities. (DOE Order 210.2A, 4a)

DOE field element line management reviews and approves the initial contractor assurance system program.

In addition to the focused review of the LFO SSO program, EA performed a broader evaluation of the establishment and implementation of LFO nuclear facility oversight programs and processes for conducting oversight of the management and operation of nuclear safety systems and LFO internal feedback and improvement systems and performance. Specifically, EA reviewed program and process documents, interviewed responsible managers and staff, and evaluated samples of process outputs, such as assessment schedules; assessment, surveillance, and operational awareness (OA) reports; issues management data; and contract performance-based evaluations.

LFO SSO Program

LFO has established and implemented processes and procedures to implement the SSO program in accordance with DOE Order 426.1, *Federal Technical Capability, Appendix D*. The roles, responsibilities, qualifications, and LFO management's expectations of LFO SSO engineers are adequately defined in LFO Process (P) 426.1C, *Safety System Oversight Program.* Implementation of the SSO program is supported through a suite of additional LFO processes, work instructions, and mechanisms, discussed later in this report. The personnel currently assigned to the SSO roles for the selected systems are appropriately trained and qualified in accordance with LFO requirements. LFO SSO engineers routinely perform periodic assessments of system performance, equipment configuration, and material condition of assigned systems through system walkdowns and program/document reviews, such as design change packages, modification packages, and safety basis revisions, in accordance with LFO P 426.1C. System reviews are formally identified and scheduled in accordance with LFO procedures. LFO SSO engineers also routinely assess LLNL's CSE program to ensure the operability, reliability, material condition, and performance of assigned systems. EA's review of the most recent functional area reviews (FARs) of RVS and FHFS systems found no substantive observations and/or findings requiring Laboratory corrective action.

Although the overall suite of SSO assessments generally meet minimum LFO requirements for frequency and scope, the depth and breadth of some assessments are not sufficient to fully ensure the SSO program's effectiveness. Based on this EA review, SSO assessments have not fully addressed and verified that operations are conducted in a manner that ensures the availability of safety systems to perform their intended safety functions when required. In particular, the assessments do not always ensure that procedures are technically accurate to achieve required system performance for normal, abnormal, remote shutdown, and emergency conditions. This problem may result from the CRADs used in performing FARs, which do not specifically include evaluation of operational aspects of safety systems. Additionally, this area has not been sufficiently assessed through other types of LFO oversight activities. Some SSO FAR system assessments and/or other LFO oversight activities have not been conducted at sufficient depth to confirm key operating parameters for all major components (e.g., verifying that acceptance criteria in surveillance tests confirm system operability in all possible system configurations) or sufficiently focused on change control to ensure that system modifications are appropriately addressed through configuration management. Consequently, these assessments sometimes fail to identify areas for improvement, such as the findings and OFIs identified during this EA assessment. (See **OFI-LFO-F&I-1**)

LFO Oversight Program

The functions, responsibilities, authorities, processes, and procedures for integrated safety management, security, and quality that LFO employs to ensure the successful execution of the NNSA mission at LLNL are described in LFO M 414.1, *Integrated Management System Manual*. The details of how those management systems and functions are implemented by LFO are provided in process description documents and work instructions (WIs). Process description LFO 226.1, *Risk-Based Oversight,*

summarizes the approach, requirements, and responsibilities for conducting comprehensive and integrated oversight of contractor programs and performance and self-assessment of the LFO oversight program. LFO WI 226.1.2, *Oversight Planning*, details the requirements and action steps for developing annual master assessment plans (MAPs) for various functional areas to establish future baseline and supplemental oversight activities. The MAPs are developed by the Assistant Managers (AMs) and staff for their assigned functional areas using a risk-based analysis of key functional area elements; they address the potential frequency and consequences of failure in the area, requirements from standards and regulations, previous oversight activities, past/recent contractor performance, the adequacy of the CAS for that area, and objectives and criteria from the annual performance evaluation plan (see detailed discussion under Contractor Performance Evaluation, below). The WI directs the AMs to develop master assessment schedules (MASs) for their assigned functional areas based on the high-level risk-ranking results reflected in the MAP and with consideration of CAS implementation and effectiveness. The WI includes guidance on how to evaluate the status of the CAS and apply the results to the selection of the number and type of future oversight activities (i.e., as the CAS process, implementation, and effectiveness mature, direct LFO oversight activities can be reduced).

LFO WI 226.1.3, *Performing Oversight*, defines and prescribes the requirements for transactional/ systems-based oversight (direct observation and evaluation of processes and performance, including OA and assessment activities) and CAS element oversight. Seven types of oversight activities are identified: walkthroughs, activity observations/surveillances, functional area assessments, shadow assessments, CAS element assessments, team assessments, and contract/programmatic performance awareness activities. The WI identifies the responsibilities and actions steps for performing and documenting each of these types of oversight and the requirements for managing any resulting process or performance issues. Oversight activities, issues, and corrective actions are documented and managed using the ePegasus database in accordance with LFO WI 226.1.1, *Writing and Managing Contractor Assessments, Issues and Corrective action Plans in ePegasus.*

Other WIs provide additional details related to nuclear safety oversight processes, including the Facility Representative (FR) program and OA activities, issues management, contractor performance monitoring and evaluation, work authorization activities (such as restart of facilities and review and approval of safety basis documents), and LFO self-assessment.

Although LFO has defined a comprehensive, risk-based oversight program and established implementing procedures for developing formal oversight plans and schedules, the implementing procedures do not fully reflect a LFO integrated approach to operational awareness of safety systems, and the documentation and performance of oversight planning activities lack sufficient rigor. The following sections of this report further discuss these shortcomings. (See **OFI-LFO-F&I-2**)

Assessment and Operational Awareness Activities

As described above, LFO has established processes for planning and conducting transactional and CAS element oversight activities. EA reviewed the oversight planning risk ranking sheets and MAPs for FY 2013 and FY 2014 and the MASs for FY 2012, FY 2013, and FY 2014. EA selected a sample of 30 completed assessment and OA reports for review. Many planned, opportunistic, routine, and reactive assessment, surveillance, and OA activities are performed and documented by FRs and SMEs. These oversight activities have identified contractor process and performance issues and opportunities for continuous improvement. Self-assessments are being planned, scheduled, and performed. In general, many of the reports reviewed were appropriately comprehensive, substantive, and well documented. LFO has established a multi-disciplinary program for coordinating and integrating oversight activities and providing ongoing communication between functional area owners and SMEs, FRs, and safety basis staff in the form of operations teams. With a line manager as team leader, the nuclear operations team meets

approximately every two weeks to update members on facility status and activities and planned oversight activities, and to identify any new issues or the current status of ongoing issues.

Notwithstanding the overall adequacy of the oversight being performed by LFO, EA identified several shortcomings in oversight planning and performance that warrant management attention. Interviews with LFO staff indicated that FRs have mainly relied on informal input to the planning activities of other elements of the nuclear safety functional area. Nuclear safety functional area oversight plans and schedules do not reflect any teaming activities with FRs from other facilities or with other functional area/element SMEs. Process description LFO 226.1 specifically addresses the potential for reducing transactional oversight in favor of systems-level oversight for non-nuclear facilities, but the oversight planning implementing WI LFO 226.1.2 and the actual planning process used by LFO make no distinction between nuclear and non-nuclear facility planning and include "confidence in the LLNL Contractor Assurance System" as a key factor in oversight planning. The risk ranking sheets for each element of the nuclear safety functional area for FY 2014 oversight planning include a section on CAS oversight results and a proposed balance of CAS and transactional analysis. However, discussion with LFO staff and review of CAS-related assessments indicated that the use of CAS evaluation is a work in progress and is not grounded in timely, complete data. The adequacy and status of the LLNL CAS for each element of the nuclear safety area were formally assessed in 2012, and various individual CAS assessments have also been performed in some areas. However, the 2012 collective assessment evaluated the CAS for "implementation" but not for "effectiveness and efficiency" in accordance with, and as defined in, NNSA CRADs and LFO 226.1.2. "Implementation" means simply the existence of a program and performance of assurance activities, with no indication of compliant or effective assurance. The evaluations documented in the FY 2014 risk ranking sheets generally focus on any CAS evaluations done in the previous year or reference the 2012 review, with only a limited and general discussion of CAS status. In addition, there is no evidence of any formal LFO collective status determination or tabulation of CAS status for functional area elements. Although much of the oversight for LLNL nuclear facilities is transactional, many LFO planned oversight activities are shadow reviews of contractor assessment activities. These should provide a set of data for evaluating the LLNL CAS, but discussions with LFO staff indicated that shadow assessment results are not intended to be used for that purpose. Approximately half of the shadow assessment reports reviewed by EA included a checklist with nine criteria with four possible ratings from "unacceptable" to "exceeds expectations." The existence of and expectations for using this checklist are not referenced in LFO WIs, and the checklists have not been used to collectively evaluate CAS status. (See **OFIs-LFO-F&I-2** and **3**)

EA also observed some weaknesses in the documentation of assessments in ePegasus. In some cases, the text of the report does not identify the specific negative performance that resulted in a rating of "partially meets" for CRAD assessment criteria. Some reports did not specifically identify issues with a problem statement, did not identify whether negative text discussion constituted an issue, or did not identify a category for apparent issues (i.e., observation, weakness, or deficiency). One recent CAS element assessment provided a description of the contractor's process, but no evaluation of its implementation or effectiveness. In another example, an observation of a TSR surveillance activity (inspection of Glovebox Exhaust System ducting in B332) identified that missing bolts had been noted on the data sheets, but the assessors did not take the next step and discuss the evaluation or resolution of missing bolts in SC or SS ductwork. In some cases, the text of the report did not adequately describe the results of the assessment in an understandable manner. These documentation shortcomings indicate a need for more rigorous review by assessment authors and by management approvers. (See **OFI-LFO-F&I-4**)

Facility Representative Program

The responsibilities and requirements for managing and implementing the FR program are described in LFO process description LFO 1063.1, *Facility Representative Program*. LFO currently has two fully

qualified FRs assigned to nuclear facilities. Training records reviewed by EA were complete and in order. In interviews, the FRs demonstrated knowledge of DOE requirements and facility-specific knowledge of the Superblock. As noted above in the discussion of assessment and OA activities and as observed by the EA review team in field activities related to the RVS and FHFS systems, the nuclear facility FRs are active in monitoring facility work activities and conditions. EA reviewed approximately 15 biweekly oversight activity reports issued by nuclear facility FRs; these reports formally document and communicate a summary of plant activities and associated FR oversight to senior management.

Management of Safety Issues

Requirements and action steps for managing issues identified by LFO are contained in LFO WI 226.1.4, *Issues Management*, and LFO WI 226.1.1. Issues are categorized as observations, weaknesses, or deficiencies. By WI definition, observations can be positive or negative, and negative observations can be failures to meet DOE, contract, or regulatory requirements. Weaknesses are defined as "significant" failures to meet DOE, contract, or regulatory requirements. Deficiencies are defined as "systemic" failures to meet DOE, contract, or regulatory requirements and to establish and/or implement an adequate program such that there is a potential for major impact to mission, security, or safety or a need for significant senior management attention to correct. Per LFO WIs, negative observations are not formally communicated to the contractor, weaknesses and deficiencies are formally transmitted to the contractor for action and require LFO follow-up, and deficiencies require a contractor corrective action plan with LFO follow-up. When entered into ePegasus, observations are automatically closed, and no fields are provided for documentation of any follow-up, even for negative observations (condition, process or performance issues). When weaknesses and deficiencies are entered into ePegasus, fields are open for follow-up, approval of the corrective action plan, and verification and management approval of corrective action effectiveness.

Approximately monthly, the LFO senior management team meets to review new issues identified by oversight activities to determine which ones merit formal issuance of a letter called the Periodic Issue Report (PIR) to the contractor for action. EA attended a PIR meeting and noted that all issues, including observations, were discussed in sufficient detail to identify significance and that various managers in attendance and issue owners were engaged and provided input. Several observations, which by definition do not need to be conveyed to the contractor, were determined to require an extent-of-condition review and thus were identified to be included in a PIR to LLNL. In addition, EA randomly reviewed 9 of the monthly PIRs between January 2013 to April 2014 that collectively included ePegasus reports for one deficiency (non-nuclear work control issue), 13 weaknesses (none tied directly to nuclear facilities, but two fire protection program and two CAS issues), and 4 strengths. Thus, for the 9 monthly reports, the contractor was only required to provide a formal corrective action plan addressing the one identified issue. EA attempted to extract issue data from ePegasus related to nuclear facilities/nuclear functional areas and found that analysis of ePegasus data is complicated by incomplete entry of information (such as entries of "all affected facilities" instead of listing specific facilities) and by changes in LFO organization names and movement of functional areas between LFO organizations. A report for seven subject areas with nuclear operations/safety responsibilities for three years from June 2011 to June 2014 revealed no deficiencies, 26 weaknesses (23 in fire protection, many or most of which may not apply to nuclear facilities), and 120 observations (requiring no formal notification to the contractor). A search for issues linked to the Superblock (B331 and B332) for two years from June 2012 to June 2014 identified 42 non-transmitted observations, one deficiency, and no weaknesses. In comparison to the EA findings and OFIs identified during this review, the data reflects an insufficient level of rigor of LFO oversight for these facilities.

EA reviewed a sample of data documented in ePegasus and considered that the LFO issue owner's follow-up documentation for closure was adequately detailed and reflected appropriate engagement of the

issue owner in evaluating the actions taken.

Although issues are being identified, documented, and in some cases transmitted formally to the contractor, the process and practice of describing deviations from requirements as "observations" may not be adequately communicating DOE's expectations for contractor compliance or fostering continuous improvement. In addition, because observations are automatically closed in ePegasus, there is not a field in ePegasus for documenting LFO staff follow-up review to verify contractor corrective actions or to verify that these deviations are included in the PIR (as was the case in the PIR meeting witnessed by EA). In addition, the LFO WIs lack definitions, guidance, or examples for the terms "significant" and "systemic," which are used as characteristics for categorizing issues. (See **OFI-LFO-F&I-5**)

Contractor Performance Evaluation

LFO evaluates the Laboratory contractors' performance on their contracts with DOE using NNSA Policy NAP-4A, *Corporate Performance Evaluation Process for Management and Operating Contractors*. This "strategic performance evaluation" process is described in LFO P 540.2, *Contractor Performance Evaluation Process*, and three implementing WIs for developing annual performance evaluation plans (PEPs), conducting performance monitoring, and preparing the year-end performance evaluation report (PER). EA reviewed the FY 2013 and FY 2014 PEPs, the FY 2013 PER, and several quarterly feedback reports for FY 2014. The annual PEPs provide the criteria for determining the amount of award fee earned for managing and operating the Laboratory. Five broad performance objectives (e.g., Managing the Nuclear Weapons Mission, Operations and Infrastructure, and Leadership) are defined with a set of associated and increasingly specific "contributing factors" and site-specific outcomes. Criteria with a possible direct relationship to nuclear safety are a part of the Operations and Infrastructure and Leadership objectives, each with 20 percent of at-risk fee. For example, the 2014 PEP identified a contributing factor in Operations and Infrastructure to "deliver effective, efficient, and responsive ES&H management and processes." Two associated site-specific outcomes were cited and discussed i.e., continuing to strengthen and demonstrate continuous improvement in institutional QA and software QA and continuing to demonstrate improvement in work control implementation. Contributing factors with relevance to nuclear safety in the Leadership objective for FY 2014 included promoting a culture of critical self-assessment and transparency and demonstrating performance results through the institutional use of the Management Assurance System. However, the PEP did not identify any site-specific outcomes for this objective. The quarterly feedback reports provide brief narrative summaries of overall performance, specific initiatives or activities, and issues or areas needing contractor attention for each performance objective. The FY 2013 PER, a collaborative effort between LFO and NNSA Headquarters program offices, contains a more detailed narrative discussion of performance for each objective and the contributing factors and site-specific outcomes. The result was a single recommended reduction in award fee related to a potential violation of 10 CFR 851 where a worker was injured in an acid splash event.

LFO performs structured, monthly, quarterly, and annual contractor safety performance evaluations and regularly interacts with the Laboratory management and staff regarding periodic LFO ratings and issues and the Laboratory's self-assessment. This performance analysis information is used for future oversight planning.

LFO Safety Oversight Program Summary

LFO has established many formal processes, procedures, and guidance describing the requirements and expectations for oversight of the contractor's management and operation of its nuclear facilities and for self-assessment of the LFO oversight program. Many safety oversight activities are adequately planned, performed, and documented by LFO technical staff, including formal surveillances, assessments, and safety-related document reviews. In addition to formal assessments, LFO FRs and SSO engineers

provide continuous, routine OA and surveillance feedback to the contractor and DOE management. These oversight activities identify contractor process and performance issues that are communicated to the contractors for resolution. Notwithstanding the defined oversight program and generally effective implementation, management attention is recommended to address shortcomings in oversight program planning, assessment documentation, and issues management. Several changes in leadership in the past several years and a recent major reorganization that relocated staff and changed managers' functional areas within the AMs, as well as revised management expectations, present some challenges to the oversight program. LFO management and staff are aware of most of the oversight process shortcomings described in this report, and in some cases evaluation or corrective actions are ongoing.

6.0 CONCLUSIONS

Overall, the RVSs and the FHFS are well maintained. Procedures, work documents, and records associated with the systems provide evidence of an acceptable maintenance program. Surveillance and testing activities for the selected safety systems are, for the most part, properly performed in accordance with technical TSR SRs. Operations are largely conducted in a manner that ensures the availability of the selected safety systems to perform their intended safety functions when required, and most procedures are technically adequate to achieve the required level of system performance. Several facility operators have extensive facility experience. The CSE program for the Plutonium Facility and the reviewed implementing procedures meet the requirements of DOE Order 420.1C, *Facility Safety*, and the CSEs are knowledgeable of facility processes and their assigned systems, however, several areas of the program needed improvement to strengthen the effectiveness of this vital role in system health and reliability. Although EA identified a few areas of needed enhancements in feedback and improvement processes in both the laboratory and field office organizations, in general, LLNS has established and implemented the feedback and improvement programs and processes necessary for evaluation of nuclear safety processes and performance at LLNL. LFO has established and implemented a compliant oversight program. For the most part, LFO FRs and safety system oversight personnel provide effective continuous, routine operational awareness and surveillance feedback to the contractor and DOE management, although improvement in rigor of SSO assessments and operational awareness is needed for optimum oversight effectiveness.

Although LLNL's programs and processes for ensuring safety system capability are, for the most part, effectively implemented, EA identified several significant areas of weaknesses that warrant management attention:

- Reviewed preventive maintenance procedures (task codes) do not provide an adequate technical basis for maintenance of the RVSs and other safety-class and safety-significant systems. These documents lack sufficient detail to ensure that preventive maintenance activities can be performed consistently and as intended, and they do not require analysis of collected vibration data. Also, as noted in an independent oversight report from 2009, preventive maintenance for new safety-class or safety-significant equipment procured as "like-for-like" is not adequately correlated with vendors' recommendations or the evaluation and basis for deviation is not documented.
- Annual SRPs did not address all possible safety system configurations required by the TSR SRs, resulting in a TSR violation lasting several years. Further, facility procedures do not include periodic testing of system alarms as required by DOE Order 422.1. Although facility management has addressed specific deficiencies in SRs for the safety systems reviewed by EA and appropriately reported the TSR violation, the implementation status of all TSR surveillance and alarm testing requirements, beyond those selected for this review, warrants verification.
- Some conduct-of-operations problems, if left uncorrected, could reduce the level of confidence in the selected safety systems' ability to perform as required. The most significant areas of concern include

the quality, accuracy, and usability of abnormal operations procedures and the lack of a systems approach to training, as required by DOE order, for facility operator training.

- The NMTP Nuclear Facility Configuration Management Plan and its implementation have shortcomings in the areas of design control, change control, work control, and document control. Specifically, the design basis for the safety-class room ventilation system is not adequately documented in approved essential systems piping and instrumentation diagrams; the change control process does not adequately ensure that design documents are kept current; record keeping for quality assurance records is spread through several organizations; and vendor manuals were not readily available.

Overall, the reviewed LLNL safety systems are capable of performing their safety functions, and many aspects of operations, testing, and maintenance are performed in accordance with DOE requirements. Also, essential assurance processes, such as the CSE program and the site office FR and SSO programs, are in place and contribute to safe operations by monitoring conditions and identifying improvements. However, the overall reliability of and confidence in the system performing as designed is reduced by a number of weaknesses and shortcomings in various aspects of analysis, maintenance, testing, conduct of operations, and configuration management. If not corrected, these problems could result in operational errors during an event or components that do not function when needed and could result in inoperable or degraded safety system performance. To increase confidence in the safety of the system, the identified problems warrant management attention by LLNS and LFO, including more emphasis on performance based assessments, with a particular focus on processes that support the nuclear safety basis.

7.0 FINDINGS

As defined in DOE Order 227.1, *Independent Oversight Program*, findings are significant deficiencies or safety issues 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. Findings may identify aspects of a program that do not meet the intent of DOE policy or Federal regulation. Corrective action plans must be developed and implemented for EA independent oversight appraisal findings. Cognizant DOE managers must use site- and program-specific issues management processes and systems developed in accordance with DOE Order 227.1 to manage these corrective action plans and track them to completion.

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None.

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

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

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

Finding-LLNS-Ops-1: LLNS has written several 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.

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.

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 QA program.

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.

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.

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.

8.0 OPPORTUNITIES FOR IMPROVEMENT

This EA independent oversight review identified 21 OFIs. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are suggestions offered by EA that may assist site management in implementing best practices, or provide potential solutions to minor issues identified during the review. In some cases, OFIs address areas where program or process improvements can be achieved through minimal effort. It is expected that the responsible line management organizations will evaluate these OFIs and accept, reject, or modify them as appropriate, in accordance with site-specific program objectives and priorities.

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OFI-LFO-F&I-1: Focus on performance-based assessments within the SSO program. Specific actions to consider include:

- Increase the focus of assessments on operational aspects of safety systems to include reviews of surveillance and test results. Specifically address flowdown of operational assumptions and requirements from the safety basis in normal, abnormal, and emergency operating procedures.
- Consider the potential for legacy configuration control problems, and include reviews of previous system modifications on a sampling basis to ensure that current operations and assumptions are valid.

OFI-LFO-F&I-2: Improve the formality and documentation of the oversight planning process. Specific actions to consider include:

- Establish procedural requirements and mechanisms for better documenting the process used and the rationale/justification for the identification of functional area elements, risk ranking, and the number and types of oversight activities selected in the oversight planning process.
- Formalize (document) the integration of FR input to oversight planning for functional areas.
- Increase the teaming of FRs and SMEs in conducting oversight, and the teaming of FRs from other facilities with nuclear facility FRs in conducting targeted oversight activities.

OFI-LFO-F&I-3: Fully establish and implement CAS implementation, effectiveness determinations, and data to fully support oversight planning efforts. Specific actions to consider include:

- Review LFO WI 226.1.2 and LFO WI 226.1.3 and better define the requirements and process for evaluating and rating CAS performance both collectively and for individual areas to ensure consistent, accurate, and useful data and analysis for input to the oversight planning process.
- Incorporate direction and mechanisms for the use of the results data from shadow assessments in evaluating CAS implementation and effectiveness.
- Perform formal baseline assessments of CAS effectiveness for each functional area.

OFI-LFO-F&I-4: Improve documentation of assessment activities. Ensure that conclusions are clearly aligned and supported in the text of the report. Reinforce expectations for detailed, accurate reporting through briefings regarding the key criteria for quality reports and thorough management reviews before approval of the completed reports.

OFI-LFO-F&I-5: Improve the issues management processes, procedures, and performance. Specific actions to consider include:

- Formally evaluate the definitions for issues and the appropriateness of categorizing issues of noncompliance with requirements that are not classified as "significant" as "observations" rather than "weaknesses" to avoid the potential for minimizing the importance of compliance by both LFO and contractor staff.
- Define and provide examples and guidance for the terms "significant" and "systemic" in LFO WI 226.1.1.
- Conduct training and reinforce expectations to LFO staff and management reviewers on the importance of accurate and consistent documentation of assessment and issue data in ePegasus, especially with regard to buildings affected, organization name changes, and functional area realignments. Determine whether this information can be entered in a way that facilitates effective data extraction and analysis.
- Work with NNSA Headquarters to improve the functionality of ePegasus, especially with regard to extraction of collective data for performance analysis. Identify standard data sorts, and train managers and functional area owners and provide them with guidance on how to run such reports.

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OFI-LLNS-Maint-1: Revise the NMMP to fully address DOE Guide 433.1-1A, Section O, "Performance Measures." Consider including the following aspects:

- How performance indicators are established, measured, trended, and analyzed to identify organizational conditions that are impacting mission goals, including safety and the reliability of SSCs that are part of the safety basis.
- Goals for each performance measure.
- Metrics that do not achieve their goal should be analyzed to determine causal factors for this performance.

- Routine management review of the status of performance measures.
- How the performance measures are included in the LLNL self-assessment program.

OFI-LLNS-Maint-2: Review all SC/SS spare part receipt inspections to identify inconsistencies between PO COC requirements and the COCs received with the items procured. Any discrepancies should be properly dispositioned in accordance with existing requirements.

OFI-LLNS-ST-1: Review the approach used by all TSR SRPs to ensure that SC equipment is adequately tested in all configurations required by the associated limiting condition for operation.

OFI-LLNS-Ops-1: Review the approach used for AOPs and ensure that existing AOPs meet management expectations for readability, usability, and avoidance of human performance errors in the performance steps of the AOPs. Consider the following aspects:

- Better define the purpose and scope of AOPs as a procedure type. Ensure that AOPs address initial operations and communication actions for all initiating events described in the safety basis.
- Ensure that AOPs address verification of expected SC and SS system responses to abnormal conditions within the scope of the procedures.
- Better integrate AOPs into the emergency response plans and procedures for identified events.
- Ensure that AOPs meet the minimum requirements for procedure content required by DOE Order DOE Order 422.1, 2.p, and consider fully implementing the DOE expectations provided by DOE-STD-1029-92, *Writer's Guide for Technical Procedures*, as a standard of excellence for all NMMP technical procedures, including AOPs.

OFI-LLNS-Ops-2: Ensure that all new DOE Order 422.1 conduct of operations requirements established in the transition from the guidelines of the old DOE Order 5480.19 have been translated into requirements in implementing procedures. The review should include verifying that the implementing documents listed in the current Conduct of Operations Applicability Matrix have been changed from guidelines ("should" statements) into implementation requirements ("shall" statements).

OFI-LLNS-Ops-3: Better identify needed training improvements to ensure that the specific training and certification programs (facility operator training and others) meet the requirements of DOE Order 426.2. Consider calling out the specific deficiencies of each certification program in future assessments of NMMP training program assessments.

OFI-LLNS-CSE-1: Improve the CSE training and qualification program as necessary to address timely training, qualification, and maintenance of qualified CSEs. Consider implementing a goal of achieving Level III qualification within one year of assignment to a system.

OFI-LLNS-CSE-2: Develop and implement additional guidance for the implementation of CSE duties, including the documentation of associated results of those duties, to improve the effectiveness of the program.

OFI-LLNS-CSE-3: Establish system notebooks for use at Building 332 to capture important system information in accordance with NMTP-FMP-0212, *System Assessments, Tracking and Trending*.

OFI-LLNS-CSE-4: Improve various aspects of the CSE program. Specific actions to consider include:

- Review CSE responsibilities against DOE Order 420.1C and the NMTP CSE program to ensure that CSEs are not overloaded with duties that do not directly support the CSE function.
- Expand CSE walkdowns of SC/SS components to include all elements of the system.

- Apply an objective evaluation process to periodically examine and report on SC and SS system health through condition assessments at least quarterly.

OFI-LLNS-CSE-5: Increase management priority and attention to ensure that P&IDs for the RVS are issued.

OFI-LLNS-CSE-6: Improve document control processes supporting the configuration management program. Specific actions to consider include:

- Revise FMP-NMTP-0207 to define and explain the "simple change" process.
- Revise procedures for development and issuance of quality-related documents, including design basis documents, to specifically address review and approval requirements.
- Develop a system to track and retain vendor manuals and other vendor documents independent of the receipt inspection packages to improve retrievability.
- Implement a process in which all QA records are submitted to a central recordkeeping organization immediately upon generation and approval. Retention of official records by individual organizations should not be permitted unless those organizations meet all requirements for storage and retrieval.

OFI-LLNS-F&I-1: Strengthen assessment performance at LLNL. Specific actions to consider include:

- Evaluate whether the MOVI process is being appropriately applied to ensure that less-formal MOVIs are not being scheduled and performed instead of MAs.
- Formalize WCI/NMTP management expectations for the conduct, tracking, and oversight of MOVIs, and establish and maintain a tracking system to ensure that expectations are met and to provide a means of characterizing, trending, and reporting performance to management.
- Resume the conduct of formal reviews that evaluate and grade the quality of completed assessment reports to provide feedback to performers and their managers. Review and revise the process to have a single reviewer for each report to increase the number of reports evaluated, and ensure appropriate training and qualification to foster more consistent and rigorous reviews.
- During development of assessment reports, focus on review of objective evidence and observation of activities vs. process reviews and reliance on interview explanations of how work is performed; include more details on sample and criteria selection, size, and rationale; and ensure that stated conclusions are consistent with the assessment text and that issues are accurately and adequately characterized.
- The Management Assurance organization and Laboratory senior management need to better engage with line managers and organizational assurance managers to determine why the assessment planning tool is not being used for assessment risk analysis. Make needed changes to the process and/or communicate the value of structured data and risk ranking as an effective and required assessment planning element, and hold line management accountable for implementation.

OFI-LLNS-F&I-2: Strengthen issues management processes and performance. Specific actions to consider include:

- WCI/NMTP should ensure that all issues, including those generated during management/safety walkarounds and MOVIs, are documented in ITS.
- Ensure that safety issues identified by corporate assessments are managed with the same rigor and formality as any other safety issues in accordance with the LLNL issues management program.
- Conduct an independent review of issue significance ranking to ensure that issues are properly categorized as defined in the LLNL issues management program documents and that issues receive the level of analysis and oversight/follow-up appropriate to the substance of the issues.

- Incorporate expectations for evaluating and documenting extent of condition into the PRO-0042 processes for managing the various types and significance levels of issues. A graded approach should be used to determine the level of effort necessary to promote the identification of other areas where similar problems may exist and effect any needed corrective/preventive actions.

OFI-LLNS-F&I-3: Determine whether performing and documenting the results of causal analysis and developing corrective actions during fact finding/critique meetings adversely affect subsequent analysis and management of the issue in accordance with the LLNL issues management program. Specific actions to consider include:

- Review critique procedure PRO-0072 and current critique practices regarding the appropriateness of attempting to determine causes and preventive actions during the fact finding process and in the format of critiques.
- Revise and clarify the critique procedure as necessary. Clarify that any actions and identified causes documented on the critique report are preliminary and for use by issue owners and cause analysts during the LLNL issues management process. Ensure that the expectations and requirements of the issues management procedure and associated causal analysis procedures are not in conflict with the determination and documentation of causes during critiques and that cause determinations are performed by appropriately trained individuals in a structured manner, with the methodologies and the bases for cause determinations properly documented.

OFI-LLNS-F&I-4: Document and formally track resolution of issues and lessons learned identified in the feedback and improvement section of NMTP work permits. Specific actions to consider include:

- Establish and implement a method to ensure and document that lessons learned and issues identified in the feedback and improvement section of completed nuclear facility work packages are formally evaluated and resolved with feedback to the responsible individual(s).
- Revise the NMTP Work Planning and Control Manual as necessary. Ensure that lessons learned and issues are evaluated for applicability to other work activities.

9.0 ITEMS FOR FOLLOW-UP

EA will continue to follow up on actions and satisfactory closure of the findings identified in this report. In particular, because EA has concerns about the observed number and variety of problems regarding compliance with conduct-of-operations requirements, EA will plan to conduct a follow-on onsite assessment of implementation of conduct-of-operations requirements detailed in DOE Order 422.1, *Conduct of Operations*.

Appendix A
Supplemental Information

Dates of Review

Scoping Visit: May 6-8, 2014

Onsite Review: June 2-13, 2014

Office of Enterprise Assessments Management

Glenn S. Podonsky, Director, Office of Enterprise Assessments
William A. Eckroade, Deputy Director, Office of Enterprise Assessments
Thomas R. Staker, Director, Office of Environment, Safety and Health Assessments
William E. Miller, Director, Office of Nuclear Safety and Environmental Assessments

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Michael A. Kilpatrick

EA Site Lead

Ronald Bostic

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Appendix B
Documents Reviewed

LLNL Maintenance Management Program for Non-Reactor Nuclear Facilities, UCRL-AM-133867-VOL-5-PT-52.1-2011
Nuclear Materials Technology Program Superblock Maintenance Program Manual, CMU11-000064
PLAN-MNT-004 Maintenance Management (F&I)
LLNL-AM-479191, Nuclear Materials Technology Program Work Planning and Control Manual
NMTP-FMP-0200, Like-in-Kind Determination for NMTP Facilities
NMTP-PD-03-059, DNT/NMTP Suspect/Counterfeit Items Program July 2007
Superblock Maintenance Program Manual
HE-103, *SBK-B332 Monthly Vibration Analysis Data Collection*
HE-141, *SBK-Air Handler PM for Critical Facilities*
HE-145, *BSS-SBK-Fan Annual PM for Critical Facilities*
SRP-B332-4.2.1.a, *Annually, HEPA Filter In-Place Leak Test, SR 4.2.1.a*
SRP-B332-4.5.2, *Annual Four Hour Load Test of the Emergency Diesel Generators, SR 4.5.2*
Work Permit 332-14-D0193
PLAN-MNT-004, *Maintenance Management Plan*
PLAN-MNT-0002, *Condition Assessment Survey Program Plan*
PRO-MNT-0005, *Condition Assessment Survey*
FMP-SBK-0212, *System Assessments, Tracking and Trending*
NMTP-FMP-0701, *Calibration Program for NMTP Facilities Critical Measuring Test Equipment*
NMTP-FMP-0500, *Procure/Acceptance Process for Quality Level 1 and 2 Purchase Orders*
PO B561246 (requisition file # 06-089)
PO B569758 (requisition file # 07-061)
PO B605083 (requisition file # 13-155)
PO B606335 (requisition file # 13-251)
PO B550364 (requisition file # 05-013)
NMTP-PD-03-059, *DNT/NMTP Suspect/Counterfeit Items Program*, July 2007
NMTP-PRO-0096-01, *Suspect/Counterfeit Items*
AOP-B332-006, *B332 Fire Response Procedure*
AOP-B332-004, *Stack CAM Abnormal Operating Procedure*
HP-FO-600, *Continuous Air Monitor (CAM) Alarm Response*
AOP-B332-001, *Installation/Removal of Portable Diesel Generator 332DGE08 During Abnormal Conditions*
AOP-B332-002, *Loss of Automatic Transfer Switch and Associated Distribution Panels - Recovery Procedure*
OPF-B332-019, *Operating Procedure for Switching of the Increment 1 RVS Exhaust Fans*, Rev. AC
OPF-B332-020, *Operating Procedure for Switching of the Increment 3 RVS Exhaust Fans*, Rev. AC
ARP-B332-001, *B332 Control Room Alarm Response Procedure*, Rev. AD
SRP-B332-4.2.1.a, *Annually, HEPA Filter In-Place Leak Test, SR 4.2.1.a*, Rev. AF, including most recent 3 years data sheet results
SRP-B332-4.2.1.b, *Weekly, Check HEPA Filter Pressure Differential*, Rev. AD, including most recent 10 data sheet results
SRP-B332-4.2.1.c, Surveillance Requirement Procedure SRP-B332-4.2.1.c, *Annually, Check HEPA Filter Age*, Rev. AC, including most recent 3 years data sheet results
ACP-B332-018, *Calibration Check of Magnehelic and Photohelic Differential Pressure Gauges*, Rev. AJ
SRP-B332-4.4.1.a/4.4.1.b, *Weekly, RVS Differential Pressure Checks, SR 4.4.1.a/4.4.1.b*, Rev. AD, including most recent 10 data sheet results
SRP-B332-4.4.1.c/4.4.1.d, *Annually, Verification of the RVS Supply and Exhaust Fan Interlocks, SR 4.4.1.c/4.4.1.d*, Rev. AE, including most recent 3 years data sheet results

SRP-B332-4.4.1.e, *Weekly, Verification of the RVS Switching Panel Bottle Pressure, SR 4.4.1.e*, Rev. AF, including most recent 10 data sheet results
SRP-332-4.4.1.g, *Annually, Operational Test of the RVS Compressed Air Switching Panels to Verify Proper Positioning of Selected Dampers*, Rev. AE, including most recent 3 years data sheet results
SRP-B332-4.4.1.h, *Annually, Test of the Increment 3 RVS Supply Fan Trip Function on RVS Low Exhaust Flow*, Rev. AC, including most recent 3 years data sheet results
OPF-B332-001, Facility Operator Daily Inspections, Rev. AG, including completed data sheets from work observation
UCRL-AM-214434-REV 9, *NMTP Conduct of Operations Manual*, October 2012
B332 Training Manual, LLNL-AM-486071, Rev 1, August 2013
B332 Training Plan, FO Training Requirements Form, February 14, 2011
Joint Functional Area Manager and Line Management (JFAMLM) assessment of the NMTP training programs, June 2013
Justification for Continued Operations for Continued Operations (JCO) for the Plutonium Facility Related to Potential Inadequate Safety Analysis (PISA) Issues in the Building 332 Loft
Memorandum of Agreement (MOA) between NMTP, Maintenance and Utility Services Department, Emergency Management Department, and Planning and Integration Department
CMU09-00052 *NMTP Superblock System Engineer Program Manual*.
LLNL Defense Nuclear Facilities Vital Safety System list
NMTP-FMP-0212, *System Assessments, Tracking and Trending*
SRP-B332-4.1.4/4.4.3, *Annually, Visual Inspection of the Safety-Class and Safety Significant Portions of the RVS Exhaust Ducting*
NMTP-FMP-0207, Review and Approval of NMTP Documents Controlled in ECMS, 12/21/12
FMP-SBK-0101, SBK Controlled Document Distribution Processes within iCATS, 6/18/13
FMP-SBK-0700, Records Management and Document Control for Superblock Facilities, 3/25/14
332-10-D-051, Install Vibration Anchors for FFE2000
332-10-D-118, Install Vibration Anchors for FFE1000 & ACU8
332-10-060, Superblock Change Request, Addition of Vibration Control Anchors for FFE-1000 and ACU8
332-1-034, Superblock Change Request, Addition of Vibration Control Anchors for FHE-2000
MP-B332-002, Replacement of RVS Increment 1 Final HEPA Filtration Stage Filters, 7/19/12
NMTP Work Planning and Control Manual (WPCM), 3/30/12
NMTP Nuclear Facility Configuration Management Plan Rev 5, 10/8/13
SDD-B332-014, Building 332 System Design Description (SDD) for the Final HEPA Filtration Stages, 3/27/13
SDD-B332-013, Building 332 System Design Description (SDD) for the Room Ventilation System, 4/2/13
PLM77 332023 EB, RVS HEPA Filter Plenum Drawing
Receiving Inspection Package for Quality Significant Order No. 09-042
NMTP-QAP-06-001, Rev 3, Quality Assurance Program, 6/13