Office of Enterprise Assessments Targeted Review of the Safety-Significant Ventilation Systems at the Irradiated Fuels Examination Laboratory, Building 3525 Operated by UT-Battelle for the Oak Ridge National Laboratory Office of Science

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Office of Nuclear Safety and Environmental Assessments
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Table of Contents

Acronyms

ACTS	Assessment and Commitment Tracking System
AEP	Aging Equipment Plan
APST	Assessment Planning and Scheduling Tool
CAS	Contractor Assurance System
CGD	Commercial Grade Dedication
CM	Corrective Maintenance
CRAD	Criteria, Review and Approach Document
CSE	Cognizant System Engineer
DID	Defense-in-Depth
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EA	Office of Enterprise Assessments
EOC	Extent of Condition
ES&H	Environment, Safety, and Health
F&O	Facilities and Operations
FR	Facility Representative
FY	Fiscal Year
HCV	Hot Cell Ventilation
HEPA	High Efficiency Particulate Air
HPI	Human Performance Improvement
HVAC	Heating, Ventilation, and Air Conditioning
I&C	Instrumentation and Control
ICS	ORNL Site Services and Instrumentation and Controls
IFEL	Irradiated Fuels Examination Laboratory
M&TE	Measurement and Test Equipment
NMMP	Nuclear Maintenance Management Program
NNFD	Non-reactor Nuclear Facilities Division
OFI	Opportunity for Improvement
ORNL	Oak Ridge National Laboratory
ORPS	Occurrence Reporting and Processing System
OSO	ORNL Site Office
OSOP	OSO Procedure
PdM	Predictive Maintenance
PM	Preventive Maintenance
PMT	Post-modification Testing
PO	Purchase Order
RER	Radiological Event Report
SAR	Safety Analysis Report
SBMS	Standards-Based Management System
S/CI	Suspect/Counterfeit Item
SC	Safety Class
SDD	System Design Description
SE	System Engineer
SME	Subject Matter Expert
SMWP	Standing Maintenance Work Package
SR	Surveillance Requirement
SS	Safety Significant
SSC	Structures, Systems, and Components
STOP	DuPont STOP™ (Safety Training Observation)

TSR	Technical Safety Requirement
UR	Unintended Results
VSS	Vital Safety System
WO	Work Order
WP	Work Practice

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-significant ventilation systems at the Oak Ridge National Laboratory (ORNL) Irradiated Fuels Examination Laboratory (IFEL), Building 3525. EA also evaluated the effectiveness of Federal safety system oversight by reviewing the performance of DOE oversight at ORNL. This independent assessment, conducted during October 2014, was part of a larger targeted assessment of safety-class and safety-significant structures, systems, and components across the DOE complex.

Overall, the IFEL Hot Cell Ventilation system is 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 properly performed in accordance with technical safety requirements and surveillance requirements. Operations are conducted in a manner that ensures the availability of the selected safety systems to perform their intended safety functions when required, and procedures are technically adequate to achieve the required level of system performance. UT-Battelle's Non-reactor Nuclear Facilities Division (NNFD) operator training program is comprehensive, fully compliant, and notable in the extensive use of DOE standards, guides, and handbooks in program development and execution. The cognizant system engineer (CSE) program for the IFEL and the reviewed implementing procedures meet the majority of the CSE requirements of DOE Order 420.1C, *Facility Safety*, and the system engineers are knowledgeable of facility processes and their assigned systems. The NNFD has established and implemented the feedback and improvement programs and processes necessary for effective evaluation of nuclear safety processes and performance at the IFEL. Further, the DOE ORNL Site Office has established an oversight program that is generally implemented in accordance with DOE Office of Science policies and procedures; the site office's Facility Representatives provide continuous, routine operational awareness and surveillance feedback to UT-Battelle and DOE management.

EA identified a few deficient areas. UT-Battelle incorrectly determined that the "Control of Interrelated Processes" requirements of DOE Order 422.1, *Conduct of Operations*, were not applicable to Non-reactor Nuclear Facilities Division facilities. This area, if left uncorrected, could limit the ability of these facilities to respond to abnormal incidents involving interrelated processes that are relied upon for facility operations. Specifically, the central blowers and stack that assure negative pressure in the IFEL hot cells through the safety significant HCV system filters are managed by a separate EM contactor, UCOR, not UT Battelle. These centralized blowers also supply negative pressure to several other interrelated facilities and are not considered safety significant. Similarly the fire suppression system is dependent on the interrelated site wide water distribution infrastructure. Some additional areas within the cognizant system engineer program have not been fully implemented, which, if uncorrected, will limit the effectiveness of nuclear safety system management. Although these identified deficiencies need management attention, UT-Battelle's programs and processes for ensuring safety system capability are, for the most part, adequately implemented.

**Office of Enterprise Assessments Targeted Review of the
Safety-Significant Ventilation Systems at the Irradiated Fuels Examination Laboratory
Operated by UT-Battelle for the
Oak Ridge National Laboratory Office of Science**

1.0 PURPOSE

The U.S. Department of Energy (DOE) Office of Environment, Safety and Health Assessments, within the Office of Enterprise Assessments (EA), conducted an independent review of the safety-significant (SS) ventilation systems at the Oak Ridge National Laboratory (ORNL) Irradiated Fuels Examination Laboratory (IFEL) Building 3525, which is operated by UT-Battelle, LLC, under contract to the DOE Office of Science, ORNL Site Office (OSO). EA also evaluated the effectiveness of Federal safety system oversight by reviewing the performance of DOE oversight at ORNL. EA performed an onsite scoping and planning visit August 11-15, 2014, and the onsite data collection portion of the review during October 7-17, 2014.

2.0 SCOPE

This targeted review evaluated the effectiveness of processes for operating, maintaining, and overseeing the performance of selected safety systems at the IFEL. Specifically, EA selected the SS Hot Cell Ventilation (HCV) system. EA's review consisted of an evaluation of the procedures and processes used to demonstrate the ongoing operability and reliability of the system, and a specific evaluation of the implementation of those procedures and processes for a sample of components within that system. The review focused on the implementation of the IFEL's safety basis as it relates to the selected system, but did not evaluate the adequacy of the documented safety analysis (DSA). EA also evaluated the effectiveness of OSO safety oversight 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:

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 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 227.1, *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 these areas would be further defined in associated review plans and that the performance of DOE oversight would be evaluated during targeted reviews to provide input to the overall evaluation of DOE's Federal assurance capability. The reviews of safety systems covered several DOE sites to ensure that EA has sufficient information to provide insights into DOE-wide performance. When all selected DOE sites have been reviewed, EA will prepare a report summarizing the conclusions of the assessments regarding the overall status of safety system management throughout the DOE complex, common issues, and lessons learned.

OSO oversees UT-Battelle and is responsible for administering the contract, executing assigned DOE and Office of Science programs, and conducting oversight of work performed at ORNL in support of DOE and Office of Science requirements and priorities. ORNL's mission is to deliver scientific discoveries and technical breakthroughs that will accelerate the development and deployment of solutions in clean energy and global security, and in doing so create economic opportunity for the nation. The IFEL, Building 3525, is a Category 2 nuclear hot cell facility that was designed and constructed to permit the safe handling of increasing levels of radiation in the chemical, physical, and metallurgical examination of DOE and commercial nuclear reactor fuel elements and reactor parts.

The SS HCV system selected for this review provides passive confinement and defense-in-depth (DID) active ventilation safety functions for the IFEL. The passive confinement function is important for onsite dose mitigation, and the active portions of the HCV system and associated high efficiency particulate air (HEPA) filters are a major DID mitigative function, if available. Various structures, systems, and components (SSCs) support the function of passive confinement components within the system. These SSCs are identified as either passive engineered safety features or design features within the DSA and technical safety requirements (TSRs).

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

4.0 METHODOLOGY

EA completed the targeted review through detailed document reviews and onsite review of contractor safety system engineering, operations, maintenance, and feedback and improvement activities; system material condition; and field office oversight of the selected safety significant 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,

assessed safety system performance, and reviewed the 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, initial observations were briefed to key OSO and UT-Battelle managers. A draft independent review report identifying overall perspectives, deficiencies, and opportunities for improvement (OFIs) was prepared and made available to line management for factual accuracy verification and feedback. Finally, the results of the review were provided to key DOE managers prior to final publication of the report.

5.0 RESULTS

5.1 Maintenance

This portion of the review was to determine whether the following inspection criteria were satisfied:

- ***Inspection Criterion:*** *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.*

- ***Inspection Criterion:*** *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.*

- ***Inspection Criterion:*** *The system is periodically inspected in accordance with maintenance requirements.*

- ***Inspection Criterion:*** *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.*

- ***Inspection Criterion:*** *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 Non-reactor Nuclear Facilities Division (NNFD) maintenance program in detail, including plans and programs; corrective maintenance (CM), preventive maintenance (PM), and predictive maintenance (PdM); periodic inspections; maintenance configuration control and conduct; training; and procurement processes, including provisions for precluding introduction of suspect/counterfeit items (S/CIs). Review activities included several detailed walkthroughs of the HCV system; review of the previous three years of CM and PM records; review of the Occurrence Reporting

and Processing System (ORPS) reports for the last five years (2010-2014); observation of PM, CM, and calibration activities performed during the onsite assessment; and attendance at daily plan-of-the-day meetings and weekly plan-of-the-week meetings.

Nuclear Maintenance Management Plan and Program

Maintenance of SS SSC (which includes the HCV system) is addressed in the DOE-approved nuclear maintenance management program (NMMP) for NNFD 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 procedures, and the implementing documents adequately reflect NMMP requirements. The program receives narrow scope self-assessments (e.g., maintenance backlog, post-maintenance testing, and work plan development, aging equipment) by a single individual. These narrow scope assessments have been performed well, but UT-Battelle has not performed a programmatic self-assessment of the NMMP for NNFD facilities in the last three years. Contrary to DOE Order 433.1B, maintenance is not identified in the DSA as a safety management program and, therefore, does not receive the same level of program assessment that is given to other identified safety management programs, such as radiation protection and conduct of operations. (See **OFI-UT-Battelle-Maint-01**.)

The HCV system is in good condition and is acceptably maintained. During the review, the systems were fully operable, with no major out-of-service equipment, no active temporary modifications, and no out-of-date calibrations on any system instrumentation. Further, the system was in proper alignment. The only significant modification of the system within the last three years was the replacement of the SS HEPA filter housings. This modification's documentation and the associated work packages included proper detail and post-modification testing (PMT). Additionally, the modification was planned and executed to allow much of the system modification to occur in parallel with the existing filter housing, so that the out-of-service time for the HEPA filters was minimized. During the 11-week installation, only one day of out-of-service time was associated with the filter housing replacement, demonstrating exceptional planning and execution of this important modification. One other upgrade to the HCV system was the Hot Cell Differential Pressure instrumentation upgrade in 2014, which was performed in accordance with the NNFD work control and change control processes. No other major maintenance was performed on the system during the last three years.

At the time of the assessment, there were approximately 40 open work orders (WOs) greater than 90 days old for the IFEL, none of which were related to the HCV system. There was no backlog of PMs and PdMs, and no deferred maintenance items. No ORPS reports specifically involving performance degradation or maintenance of the HCV system have been filed in the last four years.

DOE Order 433.1B, Section 2.p, *Performance Measures*, requires a process for developing, maintaining, and communicating performance measures to identify maintenance issues requiring corrective action and lessons learned. The NNFD NMMP, Section 2.2.15, *Performance Measures*, states that NNFD has several performance measures that are routinely recorded and documented in the NNFD performance indicators and communicated to DOE. However, the NNFD maintenance program only has two currently defined and tracked performance indicators. One indicator is for total WO backlog (which includes CM, PM, PdM, calibrations, and modifications) for the entire division, which covers Buildings 7920/7930, 3525, 3047, 3025E, and 2026. The second indicator is also a divisional performance measure covering the number of overdue PMs on safety-related systems. While these indicators have some value, tracking performance at the divisional level, they have limited effect as a reported and tracked metric for identifying facility-specific maintenance issues that may require resource allocation for corrective action and continuous improvement in the conduct of maintenance. While WOs orders and overdue PMS and

maintenance issues are discussed at the facility level in monthly meetings, and those issues are not necessarily tracked in the Assessment and Commitment Tracking System (ACTS) and are not part of the defined, reported, and tracked performance indicators. Contrary to DOE Order 433.1B, the EA evaluators did not find a defined process for identifying and determining the effectiveness of performance measures for the maintenance program, nor how the performance indicators are used for prioritizing maintenance issues requiring corrective action and lessons learned. (See **OFI-UT-Battelle-Maint-02**.)

Corrective, Preventive, and Predictive Maintenance

Overall, UT-Battelle has implemented acceptable maintenance processes for the HCV system, which include CM, PM, and PdM. These processes are consistent with the systems' SS designation. Maintenance processes, including provisions for CM and PM/PdM, covering SS systems for the IFEL are addressed in the NMMP and NNFD procedures for work control and change control.

All maintenance activities are conducted under the process described in NNFD-004, *Work Control*, which properly flows down most NNFD NMMP requirements. The work control process identifies the hazards, associated controls, and parts to be used. For each non-minor CM and modification activity, a work package is generated specifically for that CM WO. All of the reviewed CM work packages were properly executed, included sufficient detail in the work steps, and required acceptable PMT to return the component to operable status. However, NNFD-004 does not require the PMT to be determined during work package development so that it can be reviewed and approved by the cognizant system engineer (CSE) and operations management prior to work authorization. DOE Guide 433.1-1A, *Nuclear Facility Maintenance Management Program Guide for Use with DOE O 433.1B*, recommends that, "During the initial processing of a work request/WO, the maintenance planner should include predefined PMTs in job instructions based on consultation with the owner/operator." For NNFD nuclear facilities, the PMT is determined during the execution of the work, prior to returning the system to operation. This practice may lead to inadequate determination of readiness for operation. This issue has also been identified by a 2014 NNFD self-assessment of the PMT program [ACTS action item #16603.2.2]. (See **OFI-UT-Battelle-Maint-03**.)

PM activities for NNFD facilities are performed by craft assigned to the facility from the Facilities and Operations (F&O) organization and are developed for certain types of facility equipment. Each of the PMs associated with the HCV system (e.g., fan belt tensioning and inspection, bearing lubrication, and vibration monitoring) are performed at varying frequencies (e.g., monthly, semiannually, annually) and are consistent with vendor recommendations and industry practice.

For PMs, calibrations, and minor maintenance WOs, a standing maintenance work package (SMWP) is used which contains multiple WOs. The SMWP is allowed to remain in open status for up to two years and even longer if the package undergoes a review and is renewed. For example, one SMWP (SMWP 3525 EXH SYS 28640) contained 100 WOs covering a wide range of activities. Other SMWPs exhibited the following weaknesses. (See **OFI-UT-Battelle-Maint-04.**)

- SMWP 028640 was opened on 4/22/2010 and closed on 5/2/2013 without a documented review (contrary to NNFD-004, Section 4.2.6.2).
- Several SMWPs (028640, 043448, and SMWP for stack pressure switch) did not contain PMTs for all associated WOs (e.g., 110 WOs in one SMWP did not have a single documented PMT).
- Issues identified during the course of conducting PMs, calibration, and routine maintenance, are documented in the work package and then the WOs are closed, leaving the SMWP open. The issues identified in the SMWP may not be addressed for two years or longer when the SMWP is closed or renewed.

- The work steps in many WOs under the SMWPs are not detailed and rely on the skill of the craft.
    - For example, replacement of an HCV SS system pressure switch included the wording "replace the switch" without any details as to which terminal points of the terminal block were needed to install the switch. Without those details, the instrument may be installed to the wrong points on the terminal block, resulting in a configuration or safety issue.
    - Additionally, during the vibration PM on K-20 exhaust fan, neither the WO nor the work package contained any steps to cover temporary lifting and subsequent reapplication of the single-source lockout of the fan power. The single-source lockout had to be temporarily lifted to allow the fan to be operated with the cover off for vibration data taking and subsequently required reapplication for replacement of the fan shaft cover. This process relies on worker memory to ensure protection is in place when it is actually needed.

The EA team observed two ventilation system PMs. The first PM was the monthly vibration PM of the glovebox exhaust system (K-20). A craft millwright obtained the vibration data, and the NNFD maintenance manager, who is a subject matter expert (SME) in the vibration analysis field, performed the analysis. The process used to analyze the data was thorough and is relied upon to predict future maintenance needs for SS SSCs. However, NNFD does not obtain and trend bearing temperatures of rotating equipment. When combined with vibration analysis, trends in bearing temperatures can be helpful in predicting the end of life for bearings. (See **OFI-UT-Battelle-Maint-05**.)

The second observed PM activity was the performance of the annual HEPA filter leak test for the K-20 HEPA filters. EA reviewed the testing documents and found them to be compliant with American Society of Mechanical Engineers (ASME) N510, *Testing of Nuclear Air Treatment Systems*. The test was successfully performed, and no issues were identified.

Periodic Inspections

Various forms of periodic inspections and assessments are required, documented, and reviewed through multiple NNFD plans and procedures, including NNFD-006, *Aging Equipment*; NNFD-008, *In-service Inspection*; safety system assessments; and NNFD-PLAN-018, *NNFD Performance Assessment Plan*. EA reviewed a sample of completed in-service inspections and NNFD performance assessments; no issues were identified. However, EA identified weaknesses in the reviewed CSE safety system assessments and aging equipment plans (AEPs).

System engineers (SEs) perform system performance assessments annually and base these assessments on monthly System Health Review Checklists and the annual system walkdown. The EA team's observation of the annual HCV system walkdown revealed that the walkdown did not cover all accessible areas of the system. The monthly System Health Review Checklists do not assess the impact to system health for various conditions identified on the checklist (e.g., the impact of overdue instrument calibrations and open modification activities on system health and reliability). (See **OFI-UT-Battelle-CSE-03**.)

NNFD-006, *Aging Equipment*, defines and establishes requirements and guidelines for maintaining designated SSC within NNFD. The HCV system has been identified as a system that requires AEPs. There are three AEPs for the HCV system, including K-15 control valves (1-4), K-15 standby exhaust fans, and North and South HEPA filter housings. Some of the recommended equipment upgrades identified in the AEPs have been implemented. For example, the recommendation to replace the HCV HEPA filter housing was completed in 2013. NNFD-006 states that the AEPs should be updated annually, but shall not exceed two years before being updated. However, all three AEPs for the HCV system have not been updated since 2005. These AEPs are credited in part for satisfying SE requirements for assessing system status and system performance. (See **OFI-UT-Battelle-Maint-06**.)

Configuration Control and Conduct of Maintenance

Maintenance is conducted in accordance with NNFD-004, *Work Control*. Work is adequately planned and controlled through the plan-of-the-day meetings and the plan-of-the-week meetings. A maintenance coordinator prepares CM work packages, conducts pre-job briefings for associated activities, and serves as the task leader.

Completed CM work packages (for non-minor work) 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.

NNFD has established a process for control of maintenance tools including calibration and measurement and test equipment (M&TE). The calibration of facility equipment is performed by the ORNL Site Services and Instrumentation and Controls (ICS) core team and is governed by ICS/AADM-1900, *Instrumentation and Controls Services Calibration Program.* Plan NNFD-PLAN-006, *Non-reactor Nuclear Facilities Division (NNFD) Plan for Control of Maintenance Tools and Equipment*, contains guidance on equipment calibration intervals and M&TE use.

Observed calibrations of HCV equipment were performed according to the established procedures, the M&TE used was in proper calibration, and those calibrations were traceable to appropriate calibration standards. No issues were identified with the calibration program or the use of M&TE.

Procurement, Receipt Acceptance, and Suspect/Counterfeit Items

The NNFD procurement process, as defined in NNFD-010, *Procurement, Receipt Inspection and Commercial Grade Dedication for NNFD Supplies*, is acceptable for obtaining SS SSCs. Other than HEPA filters (which are procured as a procurement class 1), all other HCV SSCs are obtained commercially and undergo a Commercial Grade Dedication (CGD) process. EA inspected a sample of HCV system spare parts (e.g., fan belts, magnehelic differential pressure gauges, pressure switches, and HEPA filters). In each case, the spare parts were properly stored and controlled in the NNFD climate-controlled warehouse, the purchase orders (POs) correctly identified the procurement class, and the CGD packages were comprehensive. Each of the CGD packages had properly identified/verified critical characteristics for the spare parts. However, the receipt inspection process does not require the person performing the receipt inspection (typically the SE) to verify that the Certificate of Conformance received with the part matches the requirements identified in the PO. (See **OFI-UT-Battelle-Maint-07**.)

EA also examined three spare SS HCV HEPA filters in storage in the NNFD warehouse. Although the SE was not aware of recent lessons learned at other DOE sites related to observed flaws in the manufacturing of certain HEPA filters, the types of filters used for the HCV system are not susceptible (due to different design) to the same flaws found at other DOE facilities. The filters were obtained from a qualified Nuclear Quality Assurance (NQA)-1 vendor and were receipt inspected in accordance with NNFD-010. Discussions with the systems engineer who performed the receipt inspections indicated that each individual filter is inspected to the criteria established. However, the inspection documents do not show the inspection results of individual filters, and do not clearly state whether sampling is acceptable or if full inspection is required. For example, the HEPA filters in storage observed by EA were part of a procurement order of 18 filters, but the receipt inspection document did not indicate if an individual inspection of each filter had been performed. (See **OFI-UT-Battelle-Maint-08**.)

NNFD has implemented a thorough process to guard against S/CI. NNFD-010, *Procurement, Receipt Inspection, and Commercial Grade Dedication for NNFD Supplies*, is used to implement the S/CI prevention process. In addition, all current NNFD craft and engineers have received specific S/CI

training so that, as work is performed and systems are walked down, any existing S/CI can be identified and dispositioned.

Maintenance Summary

Acceptable maintenance processes for the HCV system are in place for CM, PM, and PdM, and the processes are consistent with the systems' SS designation. During the review, the systems were fully operable, with no major out-of-service equipment and no active temporary modifications, and all system instrumentation requiring calibration was current. The NNFD NMMP and implementing procedures applicable to the IFEL are consistent with the requirements of DOE Orders 433.1B and 430.1B, and they are adequate to maintain acceptable levels of HCV 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. The IFEL maintenance activities were properly planned, scheduled, and performed. Additionally, historical records for the last three years indicated no functional failures of safety-related equipment in the selected system, no significant backlog of CM or PM, and no temporary modifications. The PM programs for the HCV system are acceptable and are properly planned and scheduled. Although EA identified some areas for improvement in implementation of work control using the SMWP process and development of a more encompassing set of maintenance performance measures on a facility level at the IFEL, overall, the HCV system is acceptably maintained.

5.2 Surveillance and Testing

This portion of the review was to determine whether the following inspection criteria were satisfied:

- ***Inspection Criterion:*** *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.*

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

- ***Inspection Criterion:*** *The acceptance criteria from the surveillance tests used to confirm system operability are consistent with the safety basis.*

- ***Inspection Criterion:*** *Instrumentation and measurement and test equipment for the system are calibrated and maintained.*

EA reviewed the procedures and results used to meet the TSR surveillance requirements (SRs) (measurements of the key operating parameters required by the safety basis) for the SS ventilation and confinement systems. The EA review included four years of records of annual SRs and approximately ten weeks of records of daily and weekly SRs (documented on round sheets). Additionally, EA observed performance of all weekly TSR SRs, the annual SR for calibration and functional testing of a safety-related pressure switch and associated alarm, and the annual SR for aerosol efficiency testing of a safety-related HEPA filter. EA also reviewed calibration documentation and selected results for instruments and indicators relied upon to meet the SRs.

Overall, 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.) Procedures implementing SRs are generally well written and technically accurate, and 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 SRs. With one exception, operations and engineering personnel performed observed evolutions in accordance with the SR procedures. In the one exception, there were some ambiguities in an SR functional test, along with an unanticipated event during the test (steam driven exhaust fan starting in the downstream facility), that contributed to some unanticipated variation in instrument readings and minor errors in performance of the SR procedures. Personnel performing the test recognized the errors and reacted appropriately by stepping back and, in conjunction with facility management, determining the path forward. In a demonstration of conservative decision-making, facility management made the decision to perform the entire surveillance again to erase any doubt of the operability of the safety-related equipment. Facility staff then performed a comprehensive post-job review, including an extensive review of the procedure for potential improvements, and initiated a procedure revision to enhance procedure compliance.

Surveillance and Testing Summary

Surveillance and testing activities for the selected safety systems are properly performed in accordance with TSR SRs. Surveillance and testing demonstrate that the systems are capable of accomplishing their safety functions and continue to meet applicable system requirements and performance criteria. Operations personnel and management response to an unexpected SR result indicate mature practices and a questioning attitude that is appropriate for understanding the systems performance and assuring system functionality.

5.3 Operations

This portion of the review was to determine whether the following inspection criteria were satisfied:

- ***Inspection Criterion:*** *Procedures are technically accurate to achieve required system performance for normal, abnormal, remote shutdown, and emergency conditions.*

- ***Inspection Criterion:*** *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.*

- ***Inspection Criterion:*** *Operations personnel are knowledgeable of system design and performance requirements in accordance with the facilities safety basis.*

- ***Inspection Criterion:*** *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.*

EA reviewed institutional- and facility-level operations related policies and administrative-level procedures, system operations procedures, alarm response procedures, and related operator log entries for the SS ventilation and confinement systems. EA observed performance of daily and facility operator rounds, including safety system equipment checks. EA also observed the operational aspects of surveillance and testing activities discussed in the previous section.

Overall, operations were conducted in a manner that ensures the selected safety systems are available to perform intended safety functions when required. Procedures, including alarm response procedures, are technically adequate to achieve required system performance. Operations personnel are extensively

trained on operational fundamentals, system design, proper system response, failure modes, and required actions for system upsets. The NNFD operator training program is comprehensive; fully compliant with DOE Order 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*; and notable in the extensive use of DOE standards, guides, and handbooks in program development and execution. Documentation of completed lessons, qualification cards, qualification/requalification records, and examinations is comprehensive and retrievable. Facility operators have extensive experience within the facility; are knowledgeable of system design and performance requirements; and demonstrated a comprehensive understanding of system operations, component locations, and operational characteristics. Logbooks and round sheets are comprehensive and correctly completed. Shift routines, operating practices, and detailed procedures (including those addressing SRs) provide operations personnel with a current operational awareness of the selected safety systems and verification of normal configuration of the major ventilation equipment and flow paths. The EA team discussed a few minor areas for improvement (verbal communications, chart recorder operation, and log keeping) with facility management. Management was proactive in addressing these areas for improvement.

Although operations are generally effective, EA observed two cases where UT-Battelle has not adequately rolled down DOE Order 422.1, *Conduct of Operations*, requirements into NNFD requirements and implementing procedures, further described below. (See **Finding-UT-Battelle-Ops-01**.)

- The DOE-approved Conduct of Operations matrix for NNFD states that the requirements specified in DOE Order 422.1, Requirement 2.m., addressing "Control of Interrelated Processes" are not applicable, although the NNFD non-reactor nuclear facilities rely on interrelated processes (e.g., 3039 stack ventilation system provides motive force for Buildings 3525 and 3025E, the ORNL electrical distribution system provides power, and the site water distribution system provides fire suppression system water). Although the current contractor operating the 3039 stack ventilation system (a DOE Office of Environmental Management facility) has identified some interrelated process actions in their procedures, the agreements for these actions were made with a previous contractor and did not meet the intent of the DOE Order 422.1, Requirement 2.m, for identification of interrelated systems, training, and communications. The ambiguity of the SR test results noted in the previous section illustrates the challenge of coordination with interrelated processes. (See **Finding-UT-Battelle-Ops-01** and **OFI-UT-Battelle-Ops-02**.)
- DOE Order 422.1, Requirement 2.p.(9)c. states that directives define applicable procedure use methods and specify when to use them. Options include reader-worker, reference, fill out steps as a checklist, and others. The DOE site office-approved Conduct of Operations matrix for NNFD provides NNFD-011, *Conduct of Operations*, as the document implementing the order requirement for directives to define applicable procedure use methods and to specify when to use them. To meet this requirement, NNFD-011 only provides a description on how to perform the "Reader/Worker Procedure Use" method, but does not provide any definitions of use methods and provides no criteria on when different use methods are to be chosen. NNFD-3525, *Facility Policies and Practices*, does provide some examples of types of use methods, but provides no specific definitions of those methods or risk-based criteria on when they are to be used. EA noted this lack of documented management expectations while observing the performance of portions of the surveillance procedure addressing TSR SRs, where some facility personnel were unsure of the procedure use expectations. (See **Finding-UT-Battelle-Ops-01** and **OFI-UT-Battelle-01**.)

Operations Summary

Overall, operations are conducted in a manner that ensures the availability of the selected safety systems to perform their intended safety functions when required. Procedures are technically adequate to achieve

required system performance. Operations personnel are extensively trained, and the NNFD operator training program is comprehensive and notable in the extensive use of DOE standards, guides, and handbooks in program development and execution. Facility operators have extensive experience and are knowledgeable of system design and performance requirements. Shift routines, operating practices, and detailed procedures provide operations personnel with a current operational awareness and verification of normal configuration of the selected safety systems. Improvements in full compliance with requirements in DOE Order 422.1 related to procedure use categories and control of interrelated processes will ensure fully effective safety system operations.

5.4 Cognizant System Engineer Program and Configuration Management

This portion of the review was to determine whether the following inspection criteria were satisfied:

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

- ***Inspection Criterion:*** *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, safety system assessments (including the last three annual condition assessment reports for the HCV system), operations and maintenance technical support, and some aspects of configuration management.

CSE Program

The CSE program for the IFEL is broadly covered by the ORNL Standards-Based Management System (SBMS) Subject Area: Systems Engineering document. This document describes the program in terms of complying with the requirements of DOE Order 420.1C and DOE Order 433.1B. Specific elements of the program are implemented in individual NNFD procedures, such as NNFD-006, *Aging Equipment Plans*, NNFD-008, *In-service Inspection and Safety System Assessment Program*, NNFD-PLAN-018, *Performance Assessment Plan*.

The CSE program for the IFEL is implemented by three assigned SEs designated as heating, ventilation, and air conditioning (HVAC) SE; instrumentation and control (I&C) SE; and electrical SE, respectively. However, contrary to ORNL SBMS Subject Area: Systems Engineering and DOE Order 420.1C, no single SE has been given the overall cognizant responsibility for assessing and monitoring the health and reliability of the HCV system. For example, the I&C SE focuses on the I&C aspects of the system and is the individual notified if any questions or concerns arise related to HCV instrumentation performance, and the HVAC SE is contacted for mechanical aspects of the system. While they generally work together as a team, none of the SEs maintains an overall cognizant view of system performance and reliability leaving potential for miscommunications at the interface of the disciplines. (See **Finding-UT-Battelle-CSE-01**.)

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.*

In 2012, NNFD revised its SE qualification from an engineering discipline-based qualification to a CSE qualification program. The CSE qualification program meets the requirements of DOE Order 426.1 and contains most of the DOE Order 420.1C training and qualification requirements; each of the current SEs have completed qualification to the revised program. However, contrary to DOE Order 420.1C, Chapter V, the qualification process does not include requirements to cover: (See **Finding-UT-Battelle-CSE-01.**)

- Existing condition of the systems.
- Existing facility operations.
- Updates related to assigned systems (e.g., vendor manuals).

The training records for the CSE qualification program were mostly complete and reflected proper documentation of the training requirements. However, the NNFD CSE Level 2 qualification requirement to perform a CGD was not documented in the training record. (See **Finding-UT-Battelle-CSE-01**.)

CSE Roles and Responsibilities

SE responsibilities are defined for ORNL divisions with Category 1, 2, and 3 nuclear facilities in ORNL SBMS Subject Area: Systems Engineering and NNFD-007, *NNFD Roles, Responsibilities, Accountabilities, and Authorities (R2A2s)*. The responsibilities listed in these documents meet the expectations of DOE Order 420.1C.

One of the responsibilities in the area of Configuration Management states, "Ensure the consistency and adequacy among the system's design basis and requirements, system documentation, and physical condition." However, the System Design Description (SDD) for the HCV system is not fully consistent with the IFEL Safety Analysis Report (SAR) in that it does not include a discussion of the SS passive confinement function of the HCV system. The use of the system as an active filtered ventilation is considered DID because the negative pressure motive force is dependent on the centralized blowers and stack that are not credited as SS and are not managed by UT-Battelle. Additionally, other penetrations to the passive confinement boundary of the hot cells are also not credited and protected as SS components. (See **OFI-UT-Battelle-CSE-01**.)

Periodic Vital Safety System (VSS) Assessments

SEs are required to perform various assessment activities on varying frequencies in accordance with NNFD-022, *Systems Performance Monitoring*, including:

- Preparing and maintaining System Logs.
- System monitoring.
- Annual system walkdowns.
- Annual system assessment.

Although the type and nature of the assessments meet current DOE Order 420.1C requirements, as implemented they are of limited effectiveness to ensure system health and reliability and could be bolstered to improve effectiveness. For example, NNFD-022, Section 4.1, requires System Logs be maintained by the CSE. Section 4.1.1 identifies the types of conditions that are to be included in the System Log. These are intended as a tool to assist in trending of issues and history for a system and communicating the condition of the system to operations and maintenance personnel. Electronic bulletin boards were established to assist with communicating system status to the operations personnel; however

these do not appear to have been maintained as system logs. Interviews with the CSEs indicated they had not established or maintained System Logs. (See **Finding-UT-Battelle-CSE-01**.)

System monitoring is implemented through a System Health Review Checklist that is prepared monthly by the SE. The checklist for the HCV system includes checks for system status, availability, system maintenance/modifications, TSR compliance, and trending of various system differential pressure indications. However, the checklist does not evaluate the impacts of concerns or issues identified that affect system health and reliability. For example, the HCV System Checklist, dated 1/28/2014, identifies two system instrument calibrations that are overdue and a modification that is open, without a determination for how these items are impacting system health. Other system conditions, such as the status of system valves V1-V4 (which assist with balancing pressure control within the system), are not within the scope of the System Health Review Checklist, yet they are degraded and affecting the overall health of the safety system. (See **OFI-UT-Battelle-CSE-02**.)

SEs perform annual safety system walkdowns, and the walkdowns are intended to cover all system components (per NNFD-022, Section 4.3). The procedure recognizes that certain components may be inaccessible and, therefore, expects that the SE should be "aware of such situations and, when opportunity (e.g., related maintenance) arises, should review the components at that time." However, during EA's observation of the annual HCV system walkdown, SEs did not observe and evaluate all accessible system components, and SEs did not identify inaccessible areas of the system (e.g., components of the system in the glove maintenance area) as needing evaluation if the area was entered for other purposes. (See **OFI-UT-Battelle-CSE-02**.)

Annual system assessments are also prepared using a checklist that includes items such as Monthly System Health Review Checklists and vibration analysis, TSR SR performance, and the annual system walkdown. However, the annual assessment report does not cover all system components and health issues such as those already mentioned above. The report also does not integrate the information in the checklist to objectively determine the health and reliability of the system. For example, the annual assessment, dated 12/17/2013, for the HCV system listed four component reliability issues with no evaluation as to how the issues affect system reliability. (See **OFI-UT-Battelle-CSE-02**.)

Operations and Maintenance Technical Support

EA reviewed a sample of non-minor CM work packages for the last three years for the HCV system. 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. EA also 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 V, *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 safety-class or safety significant SSCs to have a documented configuration management program to ensure consistency among system requirements, performance criteria, documentation, and physical configuration. In accordance with these requirements, ORNL's NNFD has developed a configuration management program.

The EA team limited its review of configuration management to the verification of SDDs to design requirements, the installed system configuration against approved drawings, and the design change process related to the HCV system. These three areas are addressed individually below.

EA reviewed the HCV SDD (NNFD-3525-SDD-001) against the SAR and found the SDD to be a mostly accurate reflection of SAR ORNL/SAR/3525, revision 5. In Section 2.1, *Safety Functions*, the SDD describes the safety function of the HCV system, "if available, is to mitigate the effects of an uncontrolled release of airborne radioactive materials from the hot cells to the outside environment." However, the IFEL SAR also discusses the HCV system as providing a confinement barrier safety function, which is not included in the SDD. EA interviewed the facility safety basis engineer, who confirmed that credit was taken in the SAR for the HCV system as SS to provide a passive confinement barrier to a lower onsite dose. The active ventilation negative pressure capability of the system cannot be ensured because of dependence on the stack blowers, which are not credited as SS. However, the passive confinement of the hot cells also cannot be assured because not all penetrations to the cells (such as the inlet filters) are credited as SS. Analyses of leak rates or potential positive pressure scenarios are not clearly defined or documented in support of the SDD or SAR. Clarification of the essential safety functions and the related SSC that must be maintained to define the system as SS should be considered. (See **OFI-UT-Battelle-CSE-01**.)

Based on walkdowns, the HCV system condition and configuration accurately reflected approved drawings, and the HCV system was maintained in the approved configuration. There were no out-of-service HCV system SSCs, no temporary modifications were in place, and all equipment was properly labeled.

EA reviewed all of the HCV system modifications implemented during the last three years against NNFD-002, *Change Control of Modifications*. Each of the modifications was properly planned, prepared, and documented. The work package steps were detailed with appropriate hold points to ensure that installation requirements were met. The PMTs contained in the completed work packages were adequate to restore the HCV system to operable status. In addition, drawings, procedures, and other documents requiring revision were appropriately revised to address the changes. The configuration of the HCV system has been adequately controlled.

Cognizant System Engineer and Configuration Management Program Summary

The CSE program for the IFEL and the reviewed implementing procedures are generally consistent with the requirements of DOE Order 420.1C. Engineers have been assigned to each of the safety-related systems associated with the IFEL and have completed the qualification program. SEs are generally knowledgeable of facility processes and their assigned systems. The current condition of the HCV system is generally healthy, and the SEs are having a positive effect on the system's health. However, the assignment of the SEs without overall cognizant responsibility does not fully meet the requirements of DOE Order 420.1C, the CSE training and qualification program does not include continuing training requirements (also contrary to DOE Order 420.1C), and documentation of required CGD performance was not contained in the qualification records. Although the CSE program meets most DOE requirements, improvement is needed in several areas of the program to improve the effectiveness of this vital role in system health and reliability including application of systems logs. EA has determined that generally changes to system requirements, documents, and installed components are formally designed, reviewed, approved, implemented, tested and documented. However, EA found the documented system safety function between the SAR and SDD for HCV (passive confinement versus active negative pressure ventilation), needs clarification.

5.5 Safety System Feedback and Improvement

This portion of the review was to determine whether the following inspection criteria were satisfied:

- ***Inspection Criterion:*** *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.

- ***Inspection Criterion:*** *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.*

- ***Inspection Criterion:*** *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, availability, and reliability is a feedback and improvement process that incorporates 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 IFEL.

UT-Battelle feedback and continuous improvement programs and processes are adequately described in SBMS documents including: Program Description for Contractor Assurance; procedures for management assessments and activity assessments; issues management; extent-of-condition (EOC) reviews; effectiveness reviews; analysis and trending; causal analysis; conducting critiques; conducting investigations; occurrence notification; evaluating, reporting, and resolving occurrences; lessons learned/operating experience; and reporting/addressing staff concerns. Additionally, NNFD has issued NNFD-PLAN-018, *Performance Assessment Plan*, which describes the process for assessment planning, the types of assessments, required training, and tracking and trending. Other NNFD documents include procedure NNFD-015, *Corrective Action Management, Trending, and Causal Analysis*, and NNFD-022, *System Performance Monitoring*. The suite of SBMS documents, augmented by the NNFD specific procedures and plans, provide an adequate framework for a feedback and improvement system.

Contract clause H-15 requires the contractor to develop a contractor assurance system (CAS), which is further described in the SBMS Program Description. Section 3.1 addresses performance management, and includes assessments, issues management, and feedback and improvement. NNFD utilizes the SBMS procedures for feedback and improvement, and to provide data that supports CAS reporting (e.g., key operational performance indicators, events, occurrences). Although the CAS is in place and being implemented, it is not fully recognized as a contract performance assessment tool by personnel at the IFEL. Based upon EA interviews, some staff members had not heard of it, and others said it was only for senior management use. The recent OSO assessment of CAS contains an observation related to CAS awareness.

Assessment Program

NNFD-PLAN-018, *Performance Assessment Plans*, describes the NNFD processes for planning, conducting, and documenting assessments. NNFD has formal processes for conducting assessments and conducts assessments as planned and scheduled. NNFD maintains an annual assessment schedule, as well as a five-year rotating assessment schedule. The NNFD procedure requires that safety management programs credited in the facility safety basis be reviewed and included in the five-year rotating assessment schedule. The list of additional programs to be reviewed includes system engineering,

configuration management, and procedures; however, these programs are not included on the NNFD five-year assessment schedule, nor are they on the annual schedule for 2015. NNFD has not conducted an assessment of its system engineering program or procedure program, although some aspects of these programs are reviewed periodically (e.g., an assessment of procedure development was conducted in 2011; ORNL Independent Oversight Services organization, a UT-Battelle internal auditing group, conducted an internal review of the ORNL system engineering program implementation, including NNFD, in 2011). (See **OFI-UT-Battelle-F&I-01**.)

The five-year assessment schedule and annual assessment schedules for 2014 and 2015 include the IFEL SAR/TSR implementation assessments, system performance assessments, nuclear criticality safety assessments, Fire Hazard Analysis reviews, reviews of emergency preparedness, training, and select areas of conduct of operations. The five-year assessment schedule includes in-service inspections for passive design features for the IFEL. NNFD-PLAN-018, *Performance Assessment Plan*, contains an outdated reference to the in-service inspection and safety system assessment procedure, and the previous process for collecting and documenting safety observations obtained through a corporate process called DuPont STOP™ (STOP).

SBMS Subject Area: *Audits and Assessments* addresses both activity assessments and management assessments. EA reviewed completed assessments for SAR/TSR implementation, maintenance and operations (M&O) assessments, conduct of operations, safety system walkdowns, system assessment reports, System Health Review Checklist, and Price Anderson Amendment Act screening log, all of which meet the expectations for activity assessments, and thus are documented with checklists or forms. Some examples of management-type assessments include the quality assessment of the configuration management process for NNFD in June 2011, EOC review for the fire barrier and building confinement structures, the effectiveness assessment of the completed corrective action plan that addressed a finding from the DOE Facility Representative (FR) review of NNFD Conduct of Operations, and the Maintenance and Operations Assessment for Post Maintenance Testing (March 2014). UT-Battelle has a robust STOP observation program, with over 1600 observations documented in fiscal year (FY) 2014. However, no NNFD management assessments have been completed specifically for the system engineering program, and no management assessments are included on the FY 2015 assessment schedule. (See **OFI-UT-Battelle-F&I-01**.)

UT-Battelle has formal processes that monitor and evaluate the IFEL SS ventilation system, as well as safety support systems. NNFD-022, *System Performance Monitoring*, specifically addresses data collection and analysis for SSCs, and includes instructions for system logs, routine monitoring (documented monthly with a System Health Review Checklist), and system walkdowns and system assessments (to be conducted on an annual basis). Per the procedure, the annual system assessment is to include a review of the system log, the System Health Review Checklists, the System Walkdown Checklist, calibration results, trending data, and system health status trends. The procedure includes the forms for documenting the system reviews, but does not provide explanatory text for completion of the reviews. EA reviewed completed system checklists, walkdowns, and system assessments for the IFEL HVAC safety systems. The checklists, walkdowns, and assessments are being performed as scheduled and documented on the forms, and issues are being identified. Documentation of the system walkdowns and assessments meets the expectations for an activity assessment. However, EA observed some deficiencies with performance of annual safety system walkdowns and assessments as previously discussed in Section 5.4 of this report.

NNFD-PLAN-018 addresses the training requirements for conducting assessments and for performing a STOP observation. Based upon interviews, overall, the staff is experienced and knowledgeable, and NNFD staff includes five qualified auditors or certified lead auditors. According to NNFD-PLAN-018, at

least one person performing an assessment must have completed, as a minimum, ORNL Assessments Overview and Issues Management Process Overview.

EA's review of the training records for 29 assigned assessors indicated that a substantial number have not completed either course (11 people), and another 9 assessors have only completed one of the courses. Regarding the STOP observation program, the requirement for conducting a STOP observation is to complete the DuPont STOP training course. UT-Battelle could not find training records for one of the assessors. (See **OFI-UT-Battelle-F&I-01**.)

In addition to the assessment processes, issues are identified during the performance of work. For example, the operators conduct daily checks of system status, as documented on the daily check sheet, NNFD-3525-FRM-002. One daily check sheet contained comments related to a small window oil leak, and facility personnel provided an ORNL WO to replace the gasket on the cell windows that were leaking oil. Also, some of the work packages included evidence of issues being identified (e.g., the PMT for the 3525 3039 stack pressure switch), but not always entered into the ORNL tracking system, ACTS. (See **OFI-UT-Battelle-F&I-01**.)

Issues Management

NNFD has an effective issues management process. SBMS Subject Area: *Issues Management and Analysis* includes procedures for issues management, causal analysis, EOC review, effectiveness reviews, and analysis and trending. Additionally, NNFD-015, *Corrective Action Management, Trending, and Causal Analysis*, addresses assessment tracking, causal analysis, corrective action management, and corrective action tracking and trending. NNFD performs event notifications and critiques; issues and corrective actions are entered into ACTS and are tracked through to closure. UT-Battelle provided several examples of issues being identified through assessments and entered into ACTS, including the safety system walkdown for K-15 HCV exhaust system; the safety system assessment of the K-15 exhaust system resulting in ACTS issue 12040.1; and numerous other environment, safety, and health (ES&H) assessments resulting in ACTS issues. EA reviewed a list of open issues for the IFEL and noted that the list included the ORPS report for the recent unplanned uptake with actions to submit the final ORPS report and perform a critique of the event. Also, non-conformance reports (e.g., Nonconformance Report/3525/14/001 - Glovebox Assembly Vendor Supplied Gasket Failure) are entered and tracked in ACTS. ACTS is an effective system for tracking and trending issues.

The SBMS procedure *Extent of Condition (EOC) Review* states that EOC reviews are required for all serious issues, and should be considered for other issues that may present substantial risk. ACTS records indicate that NNFD is performing appropriate EOCs. For example, an EOC was performed for the issue related to the addition of fissile material to the IFEL inventory that resulted in a TSR violation (categorized as a serious issue). NNFD also conducted an extent-of-condition and extent-of-cause review for the clothing contamination at Building 7920.

SBMS procedure *Effectiveness Reviews* requires that effectiveness reviews be performed following corrective actions for serious issues. EA's review found only three entries in ACTS for serious issues for the IFEL. Effectiveness reviews were performed for two of these issues, and the other issue was closed in 2006. The original effectiveness review of the 16 corrective actions associated with the fissile material TSR violation identified concerns with three of the corrective actions and a need for additional documentation for closure packages. This effectiveness review resulted in another corrective action plan, and a follow-up effectiveness review was conducted for that plan. The follow-up effectiveness review was appropriately scoped, including lines of inquiry, resulting in a rigorous, thorough, and complete review of the follow-up actions. This series of reviews are indicative of a strong effectiveness review process. NNFD also conducts effectiveness reviews for external assessments (e.g., DOE reviews). A

recent example was the *Effectiveness Assessment of the DOE Facility Representative Review of NNFD Conduct of Operations Finding FRQA-1302-A*, dated March 2014. This effectiveness review appropriately addressed the identified issues in the source document, *DOE 2nd Quarterly Assessment 2013, Conduct of Operations*.

Event Reporting and Analysis

Events related to the IFEL safety systems are appropriately reported and analyzed. Occurrences are reported, critiques are conducted, causal analyses are performed, and investigations are conducted. EA reviewed occurrences for NNFD, including the unexpected airborne radioactivity resulting in the unplanned uptake at the IFEL, personnel contamination at the IFEL, and two events at Building 3025E. Each of these events was reported through the ORPS process, and a critique was conducted and documented for each event. A formal causal analysis had been conducted for the Significance Category 3 event where the operator exceeded an expected dose limit. UT-Battelle was in the process of completing an independent investigation into the recent the IFEL unplanned uptake. EA attended an NNFD all-hands meeting, where the NNFD Director provided a summary of the IFEL unplanned uptake event and investigation, including the draft causal factors (direct and root causes) and contributing factors. EA also observed a meeting to develop a corrective action plan for the near-miss incident of the dropped glovebox at Building 7920. The meeting involved an appropriate representation of SMEs, and included a cross walk of the causal analysis, judgments of need, and potential corrective actions. Completed unreviewed safety question determinations at the IFEL were performed for design reviews; new or changed procedures; maintenance work packages; removal of equipment; reliability and risk management; NMMP description; development, review, and control of procedures; calibration, PM and/or maintenance; high pressure alarm controller; etc. Nonconformances are reported through the Nonconformance Report process, and are tracked on an NNFD Nonconformance Report log. Radiological events are reported through the Radiological Event Report (RER) process.

NNFD-PLAN-042, *Human Performance Steering Committee Charter*, describes the Human Performance Improvement (HPI) committee composition and duties. The committee reviews trending data, ORPS reports, RERs, and the Unintended Results (UR) reports. The UR process is intended to capture events where expected and intended results were not achieved, that are below reporting thresholds but could represent precursor indications. NNFD has an HPI tracking and trending tool that reviews data on a quarterly basis, analyzes for trending, and develops corrective actions as needed. Trending, UR, and HPI evaluation results are provided quarterly at a Facility Managers meeting. Trending is based upon issues entered into ACTS, which are then assigned a functional trend code. EA reviewed the FY 2014 1st Quarter Trending Summary Evaluation and supporting data, which included status of assessments, a listing of reactive issues, ORPS events by cause, numerous trend code analyses, etc. Reoccurring functional trend codes were identified, as well as the top three functional trend codes by FY quarter. Programmatic actions were taken as a result of the trending data. This information is on the NNFD Sharepoint, which is available to DOE.

NNFD prepares a performance evaluation report to document its annual performance. The NNFD FY 2013 Performance Evaluation Report included a summary of audits, oversight, and assessments, which included the safety system assessments; the maintenance and operations assessments; and ES&H assessments. The report noted that areas for improvement include re-emphasizing the UR process, re-emphasizing RERs, and performing as many infrequently performed electrical PM activities as possible. In FY 2013, two URs were documented, and in FY 2014, eight URs were documented. Of these, one UR in FY 2013 and one UR in FY 2014 were documented for the IFEL. Also, UT-Battelle prepares a monthly summary of operations as part of its Contractor Assurance Summary; these summaries include key operational performance indicators, events and occurrences, events or lessons learned at other labs, and results from external and/or lab-level assessments. These monthly reports are provided to OSO.

Through these reports and access to ORNL systems, such as ACTS, UT-Battelle provides adequate input on contract performance to OSO.

Operating Experience/Lessons Learned

Mechanisms are available for obtaining feedback from workers and work activities. NNFD-018, *Pre-Job Briefs and Post-Job Reviews*, states that either feedback or a post-job review should be performed at the conclusion of a job. EA reviewed seven work packages for NNFD, and of these, six had a documented post-job review. EA observed two post-job reviews: a HEPA filter test; and the 3039 ventilation stack pressure switch calibration and PMT. Both post-job reviews were conducted in accordance with the NNFD-018 requirements, and resulted in recommendations for enhancements and the identification of lessons learned. EA also observed a PMT that resulted in the identification of lessons learned.

SBMS Program Description, *Lessons Learned/Operating Experience*, describes the processes for the development and use of lessons learned. NNFD leads all of the other UT-Battelle divisions in the number of lessons learned views, based upon a report provided by the lessons learned manager. An example was provided for a lesson learned generated by NNFD (knowledge-based performance mode leads to failure to provide adequate lockout/tagout of electrical line 6/9/14). The pre-job brief form includes a step to review lessons learned and feedback as part of the preparation for the pre-job briefing, and some instances were noted where lessons learned were discussed during the pre-job briefings. However, frequently, this was a perfunctory review. The post-job review form includes an area to capture lessons learned, and during one post-job review, the facility supervisor solicited input from the work crew on lessons learned. NNFD has recently adopted the use of the Safety Toolbox Weekly, and the Complex Facility Manager went over the most recent issue of the Safety Toolbox Weekly at a plan-of-the-week meeting. Additionally, a recent NNFD quarterly all-hands meeting included a presentation of a lessons learned.

SBMS procedure, *Reporting/Addressing Staff Concerns*, discusses the procedure for reporting issues and concerns. Employees are encouraged to work within the line organization to resolve concerns. Alternately, they can contact SMEs or the ORNL staff concerns program. An alternate process includes the Differing Professional Opinion process.

Performance Measures

NNFD uses performance indicators to monitor the system health of VSSs. SEs routinely monitor assigned systems with the use of a System Health Review Checklist, which includes system status, availability, maintenance activities, non-conformances, modifications, procurements, configuration management, TSR surveillance status, and trending. Annually, SEs are expected to conduct system walkdowns and create a system assessment report. The SEs are expected to review the system logs, System Health Review Checklists, System Walkdown Checklist, and calibrations results trending data. This information is used to assign a trending status to system health indicators, including system unavailability, major component downtime, number of past-due preventative maintenance WOs, number of open corrective maintenance WOs, number of open non-conformances, and number of component failures. However, as discussed in Section 5.4 of this report, system logs are not being implemented, and the effectiveness of system performance monitoring could be improved. Additionally, the maintenance program performance indicators include the number of safety-related PM WOs missed and the maintenance backlog (which includes corrective, preventive, and modification WOs for the NNFD). The maintenance performance indicators are not included in the quarterly trending review discussed above, which could potentially indicate a disconnect between facility-specific issues management and organization-wide dissemination of trends and issues. (See Section 5.4 of this report)

Safety System Feedback and Improvement Summary

NNFD has formal processes for conducting assessments, and conducts assessments as planned and scheduled. NNFD maintains an annual assessment schedule, as well as a five-year rotating assessment schedule. UT-Battelle has formal processes that monitor and evaluate the IFEL HVAC safety systems, and the checklists, walkdowns, and assessments are being performed as scheduled. In addition to the assessment processes, issues are identified during the performance of work. NNFD has effective processes for issues management, causal analysis, EOC review, effectiveness reviews, and analysis and trending. Assessments, issues, and corrective actions are entered and tracked in ACTS. EOC reviews and effectiveness reviews are conducted as appropriate. Events related to the IFEL safety systems are appropriately reported and analyzed. Occurrences are reported, critiques are conducted, causal analyses are performed, and investigations are conducted. NNFD has chartered a Human Performance Steering Committee that reviews trending data, ORPS reports, RERs, and the UR reports. Mechanisms are available for obtaining feedback from workers and work activities, and NNFD actively uses the lessons learned database. NNFD uses performance indicators to monitor the system health of VSSs. However, EA identified several areas for improvement. The five-year assessment schedule did not include all of the safety management programs identified in the NNFD procedure; a management assessment has not been conducted for the system engineering program; personnel performing assessments have not completed all required training; and some issues that are identified through the performance of work and addressed promptly are not always entered into ACTS thus missing an opportunity to identify and trend potential system weaknesses. Also, some of the performance indicator information is not included in UT-Battelle's trending analysis. Notwithstanding these areas for improvement, overall, NNFD has effectively implemented feedback and improvement processes and procedures for the evaluation of the IFEL safety system performance.

5.6 OSO Safety Oversight Program

This portion of the review was to determine whether the following inspection criteria were satisfied:

- ***Inspection Criterion:*** *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))*

- ***Inspection Criterion:*** *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))*

- ***Inspection Criterion:*** *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))*

- ***Inspection Criterion:*** *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))*

- ***Inspection Criterion:*** *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)*

- ***Inspection Criterion:*** *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)*

- ***Inspection Criterion:*** *Field elements have developed and implemented an Operating Experience (OE) Program and identified and designated 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)*

- ***Inspection Criterion:*** *DOE field element line management reviews and approves the initial contractor assurance system program.*

OSO has established an oversight and assessment program that is consistent with the Office of Science model. Within this framework, there is substantial reliance on the CAS and contractor self-assessments and federal operational awareness. The oversight process for nuclear and high hazard facilities, which is defined in procedures, includes a combination of assessments partnered with the contractor, formal independent assessments that are principally performed quarterly by DOE OSO FRs, routine operational awareness activities performed by the FRs, and the annual safety basis update review and approval activities. The OSO Functions, Responsibilities, and Authorities document assigns the line management ES&H oversight and system engineering to the Operations and Oversight Division. The system engineering line management responsibilities include oversight for contractor CSE programs and the operability of associated safety systems. Since OSO does not have defense nuclear facilities, OSO is not required to assign Safety System Oversight (SSO) engineering SMEs or implement a Technical Qualification Program (TQP) conforming to DOE Order 426.1. Instead, oversight for contractor CSE programs and the operability of associated safety systems has been primarily addressed by FR-performed activities. The OSO Management System Description describes the performance assurance process, including the development of an annual performance plan and an annual assessment report. The OSO oversight process is described in OSO Procedure (OSOP) 226, *Oversight*. The processes for contractor oversight refer to field monitoring (a formal operational awareness program that is being discontinued),

periodic walkthroughs by management and SMEs, routine FR walkthroughs, contractor formal assessments, and review of contractor self-assessments. OSO Work Practice (WP) 453, *Contractor Formal Assessment Program*, addresses the elements of schedule development; assessment planning; conducting and reporting of assessments; corrective action management; training, qualification, and experience requirements; records management; assessment program status reporting; and ES&H performance trending and feedback. EA noted that the oversight policies, procedures, and practices implemented by OSO do not specify the integration of SMEs into formal assessment or review processes. OSOP 226 rev 2 references participation of SMEs with "periodic facility walkthroughs" and references WP 450, *Operational Awareness*, for details. However, WP 450 has been canceled. OSO is in the process of revising and updating its internal procedures. EA reviewed the revised draft procedures, but found no specific or detailed guidance for inclusion of SMEs into routine or formal assessment activities. (See **OFI-OSO-01**.)

A significant number of the OSO assessments are partnered assessments with substantial technical contributions from the contractor SMEs for the specific topical areas. The documented independent Federal assessments reviewed by EA were principally performed by FRs. While well trained and knowledgeable regarding their specific facilities and disciplines, FRs do not necessarily have qualifications and training similar to SMEs in all engineering disciplines, regulatory structures, or consensus codes and standards applicable to the SS SSCs or all the required Safety Management Programs. Per DOE Order 226, the field elements are required to maintain sufficient technical expertise and knowledge of the site and contractor activities to make informed decisions about hazards and risks, and resource allocations. For some specialties, OSO is dependent on the Integrated Support Center for SME support through an umbrella service agreement. This support is to be provided on request via use of task orders. A sampling of task orders reviewed by the EA assessment team noted a lack of specificity regarding the qualifications or availability of the service providers and minimal documentation of deliverable results. (See **OFI-OSO-02**.)

OSO effectively uses an Assessment Planning and Scheduling Tool (APST) to facilitate assessment scheduling. The APST includes the assessment approach (i.e., includes the regulatory driver, OSO primary assessment method, and minimum frequency), as well as input for selecting assessment topics. This input includes the OSO history of formal assessments, the history of contractor and external assessments, and a three-year planning horizon. Input to the assessment schedule includes input from staff, issues and trends, issues noted during external reviews, input from ES&H performance metrics, etc. Per the current procedures, assessments are scheduled in the OSO tracking system (ORION). However, the ORION system is no longer in service and has been replaced by e-Pegasus. (See **OFI-OSO-01**.)

A subset of the assessment schedules is included in the Integrated Assessment Schedule, which includes OSO independent oversight assessments and partnered assessments. The independent oversight assessments include quarterly FR assessments, as well as other topical reviews. OSO formally transmits the assessment program schedule to the contractor (EA was provided the submittals for the past three years). The area of system engineering is included in the FY 2014 APST. The past assessment history is documented (e.g., an OSO formal assessment of safety systems was conducted in 2006, an Independent Oversight assessment was conducted in 2008, and a partnered assessment was conducted in 2011). Also, the OSO APST has identified this EA review as a formal assessment for FY 2015. The majority of assessments are completed as scheduled.

The *Facility Representative Assessment of the Operability of Vital Safety Systems at ORNL Nuclear Facilities* was completed the second quarter of FY 2014. An issued assessment plan for this review included appropriate scope, performance criteria, assessment approach and logistics, expectations for the final report, and lines of inquiry. The issued assessment report included appropriate elements of an assessment. The lines of inquiry included surveillance and monitoring, configuration control, system

maintenance, and system engineering. The assessment team consisted of five OSO FRs. The FRs' review of surveillance and monitoring for the IFEL consisted primarily of a review of the surveillance checklists and calibration data sheets. The FRs reviewed two completed and one open change control package for the K-20 glovebox ventilation system as part of the configuration control review. Also, the FR's review of the training for SEs resulted in an observation that not all assigned CSEs had fully completed the qualification process. The FRs identified an additional finding involving the NNFD change control procedure. Although the FRs' reviews focused primarily on documents, two of the FRs assigned to NNFD facilities also participated in VSS system walkdowns with the CSEs. The findings were appropriately entered in the DOE tracking system, and the contractor developed a corrective action plan in response to the findings and observations. The FR assessment appropriately addressed the lines of inquiry. EA noted during interviews that the FRs assigned to a particular facility were the leads for performing the reviews and writing the report sections for those facilities. While this strategy assured FR familiarity with the systems and efficiency for the review, some benefit may be obtained by rotating the FR facility assignments or integrating SMEs into these types of reviews to ensure a fresh perspective.

OSO also conducted an assessment of the CAS in FY 2014, which included NNFD. The assessment was thorough and comprehensive, and resulted in three notable practices, three findings, and three observations. OSO's review of the CAS included: the program definition, management and oversight; CAS awareness; performance assurance; issues management, feedback and continuous improvement; governance; and communication, partnering, and transparency. The assessment included interviews with NNFD personnel and review of NNFD documents. In addition to formal assessments, field monitoring is another important aspect to contractor oversight. DOE FRs assigned to NNFD conduct facility walkthroughs on a frequent basis, and documented these walkthroughs in the e-Pegasus system. FRs also typically attend critiques for reportable events.

OSO Safety Oversight Program Summary

OSO has established an oversight process that conforms to the Office of Science model and regulatory requirements which depend heavily on the CAS products, contractor self-assessments, and partnered assessments. EA noted that formal OSO assessments were strongly influenced by contractor document reviews and were principally conducted by FRs with minimal reliance on federal SMEs. Routine FR operational awareness activities supplement the formal reviews to ensure oversight of contractor activities. The processes and practices generally satisfy the assessment criteria, however EA noted some concerns. Specifically, some of the existing procedures and WPs contain out of date references to organizations, processes, or systems that are no longer used. Further, the oversight process may not sufficiently integrate SMEs into specific review and assessment activities for certain types of SSCs or SMPs where vulnerabilities could more readily be identified and addressed by individuals with subject specific training, knowledge skills and abilities.

6.0 CONCLUSIONS

Overall, the IFEL SS ventilation system is well maintained and capable of performing its SS passive containment boundary function and the DID active ventilation filtration function. Procedures, work documents, and records associated with the systems provide evidence of an acceptable maintenance program. Surveillance and testing activities for the ventilation system are properly performed in accordance with 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 of the EA reviewed NNFD procedures are technically adequate to achieve the required level of system performance. Several facility operators have extensive facility experience. The CSE program for the IFEL and the reviewed implementing procedures meet most of the requirements of DOE Order 420.1C, *Facility Safety*,

and the CSEs are knowledgeable of facility processes and their assigned systems. Although EA identified a few areas of needed enhancements in feedback and improvement processes in both the contractor and site office organizations, in general, ORNL's NNFD has established and implemented the feedback and improvement programs and processes necessary for an adequate evaluation of nuclear safety processes and performance at the IFEL.

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

- NNFD has not properly implemented Section 2.m, Control of Interrelated Processes, of DOE Order 422.1, *Conduct of Operations*. During implementation of this requirement, NNFD erroneously assumed that the section did not apply to its nuclear facilities even though each nuclear facility relies on multiple processes that are not under the control of facility operators/management (e.g., shared exhaust stacks, electrical power distribution, and potable water). If left uncorrected, this area of non-compliance could result in delays in abnormal condition response by the operators of both the facility and the interrelated process.
- The implementation of the elements of the NNFD CSE program does not fully comply with DOE Order 420.1C and some internal procedures. The deployment of CSEs as engineering discipline system engineers (e.g., HVAC SEs or I&C SEs) potentially limits an overall cognizant view of safety system performance by an assigned CSE. Internal requirements for preparing and maintaining system logs and performing comprehensive annual safety system walkdowns are not being met, which limit the effectiveness of the CSE function.

OSO has established and implemented a functioning oversight program in conformance with Office of Science procedures; the OSO FRs provide continuous, routine operational awareness and surveillance feedback to the contractor and DOE management. However EA noted some potential vulnerability in the oversight processes for assuring the site manager can make informed decisions regarding hazards, risks resource allocations and evaluation of the contractor's performance.

- OSO oversight depends heavily on the FRs and safety basis reviewers who may not have detailed training, knowledge, skills, and abilities covering all specific and applicable technical disciplines relating to the VSSs and safety management programs.

- OSO has not implemented training or guidance for the FRs or safety basis reviewers to recognize issues that should appropriately be reviewed by Federal SMEs. Using the CAS model, there has been a tendency to rely on the contractor's SMEs for self-evaluation corresponding with limited technical validation by a Federal SME.

- OSO procedures do not ensure the integration of Federal SMEs into oversight and review practices addressing issues related to: modifications and maintenance, and assessments of functionality, operability, availability, and reliability of VSSs; and modifications, issues resolution, and performance assessments of the safety basis mandated safety management programs.

- Current OSO processes include references to obsolete systems. Although updated procedures are in draft, they have not yet been implemented.

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.

UT-Battelle, LLC

Finding-UT-Battelle-Ops-01: UT-Battelle has not adequately rolled down DOE Order 422.1, *Conduct of Operations*, requirements addressing procedure use categories and control of interrelated processes into NNFD requirements and implementing procedures.

Finding-UT-Battelle-CSE-1: UT-Battelle has not fully implemented DOE Order 420.1C with regard to assigning CSEs with overall cognizance of assigned systems and establishing certain training requirements. The contractor has also not implemented some requirements of NNFD system engineering program (e.g. establishing and maintaining system logs, documenting all CSE qualification requirements).

8.0 OPPORTUNITIES FOR IMPROVEMENT

This EA independent oversight review identified 15 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.

ORNL Site Office

OFI-OSO-01: OSO should continue with updates to procedures removing references to outdated procedures, programs, and reporting structures.

OFI-OSO-02: OSO should consider modifying policies, procedures, and practices to ensure teams assigned to oversight activities have the topical training knowledge skills and abilities appropriate for the specific area of review.

- Provide guidance and training to FRs and safety basis reviewers for recognition of issues where SMEs should be consulted.
- Consider updating the Functions, Responsibilities, and Accountabilities Manual and procedures documents, clarifying roles, responsibilities, authorities, and accountabilities for SMEs. Procedures should include expectations or guidance for SME participation in independent Federal assessment and review activities, such as reviewing annual safety basis updates, modifications to VSSs (including SC, SS, and DID SSCs), and independent assessments of safety management programs.

- Consider providing guidance for clear documentation of SME activities and evaluation results. This is particularly important when SMEs are provided through the Integrated Support Center in support of FR or safety basis reviewer lead activities.

- Consider ensuring that procedures and service agreement changes specify SME training, qualifications, and availability, as well as expectations for performance and documented deliverables similar to those established for FR activities.

UT-Battelle, LLC

OFI-UT-Battelle-Maint-01: Revise the IFEL SAR at the next annual update to identify maintenance as a safety management program.

OFI-UT-Battelle-Maint-02: Consider developing and tracking performance measures at the facility level using DOE Guide 433.1-1A, *Nuclear Facility Maintenance Management Program Guide for Use with DOE Order 433.1B,* Section O, *Performance Measures.*

OFI-UT-Battelle-Maint-03: Consider expediting a revision to NNFD-004, *Work Control*, to require the development of PMT in the work package prior to work authorization (e.g., using a procedure change notice).

OFI-UT-Battelle-Maint-04: Consider changes to the maintenance work control processes to address the following SMWP weaknesses:

- Failing to perform required reviews of SMWPs in a timely manner.
- Lack of adequate documentation of PMT.
- Timely action to address worker feedback and lessons learned during job execution.
- Inadequate detail in work steps for safety-related SSCs.

OFI-UT-Battelle-Maint-05: Consider implementing bearing temperature measurement and trending to complement predictive vibration analysis.

OFI-UT-Battelle-Maint-06: Consider actions to maintain the AEPs current and effective.

OFI-UT-Battelle-Maint-07: Consider revising the receipt inspection process for safety-related and DID SSCs to require comparison of the Certificate of Conformance to the PO requirements.

OFI-UT-Battelle-Ops-01: Consider establishing a process to determine and implement technical procedure use categories on a graded approach based on risk. Consider providing risk-based criteria for the current reader/worker procedure use method as described in NNFD-011, as well as providing risk-based criteria for lower-risk activities as follows:

- Reader/Worker - Required for complex and/or infrequent work activities for which the consequences of incorrect performance or omission of a step could have an immediate, possibly irreversible adverse impact on public or worker safety. This procedure use method is currently defined in NNFD-011.
- In Hand Use - Required for complex and/or infrequent work activities for which the consequences of incorrect performance or omission of a step could have an immediate, possibly irreversible adverse

impact on facility equipment and/or program mission. This procedure use method would require the worker to have the procedure in hand to perform the activity.

- Reference Use - Required for activities for which the consequences of an improper action are not immediate and are not irreversible. This procedure use method would require the worker to have easy access to and be familiar with the procedure prior to performance.

OFI-UT-Battelle-Ops-02: For each identified interrelated process, consider addressing the following areas defined in DOE Order 422.1 for both facility operations staff and interrelated process staff:

- Operator responsibilities (related to the interrelated process).
- Operator training (related to those responsibilities).
- Communication requirements (for both groups of operating staffs).

OFI-UT-Battelle-CSE-01: Consider revision of the SDDs to clarify the SS and DID purposes and safety basis credits for the HCV system.

OFI-UT-Battelle-CSE-02: Consider revising the CSE system assessment and monitoring activities to ensure that all aspects of the safety system are evaluated and that the system assessment criteria are integrated to more effectively assess system health and reliability.

OFI-UT-Battelle-F&I-01: Consider ensuring that NNFD improves its assessment process and considers the following provisions:

- Add system engineering, configuration management, and procedures to the list of safety basis programs on the five-year annual assessment schedule.
- Ensure that NNFD considers conducting a management assessment of the system engineering program, including the IFEL SS ventilation system, and a review of the engineering documentation.
- Ensure that NNFD has a process in place to verify that personnel performing assessments have completed the required training.
- Ensure that NNFD enters issues that are identified through the performance of work into ACTS.
- Update NNFD-PLAN-018, *Performance Assessment Plan*, to reflect current references for the in-service inspection and safety system assessment procedure, and the current STOP observations process.

9.0 ITEMS FOR FOLLOW-UP

EA will follow up with later inquiries into the determination and implementation of corrective actions or responses to the findings and OFIs. EA noted a lack of clarity in the safety basis and hazard analysis with respect to the critical functions of the SS ventilation system. The blowers necessary to ensure active negative pressure are not classified as SS, resulting in the HVAC system being a passive boundary for the cell confinement. However, many other penetrations, such as the inlet filters, are also not classified as SS, potentially jeopardizing the passive confinement barriers. Leak rates or impacts of a potential positive pressure situation have not been fully quantified and carried into defined safety basis control sets.

Additionally, during the EA review, the facility was performing an incident investigation into work outside the hot cell confinement that resulted in unanticipated personnel uptakes. EA will continue to follow the results of that investigation and the subsequent implementation of the corrective actions.

Appendix A
Supplemental Information

Dates of Review

Scoping Visit: August 11-15, 2014
Onsite Review: October 7-17, 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
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EA Reviewers

Timothy Mengers – Lead
Glenn Morris
Terry Olberding
Ed Stafford

Appendix B
Documents Reviewed

ACTS issue 12040.1, the safety system assessment of the K-15 exhaust system
ACTS issue 15955.1, pre-job briefings
ACTS issue 15971.1, the safety system walkdown for K-15 HCV exhaust system
ACTS issue 16559.1, Lockout/Tagout
Administrative Procedure NNFD-011, *Conduct of Operations,* Revision 4
Alarm Response Procedure NNFD-3525-ARP-300, *Building 3525 Alarm Response,* Rev. 2
Assessment, 16883, Temp Mod Review and Audit, 8/6/14
Completed Data Sheets, NNFD-3525-FRM-003, *Building 3525 Technical Safety Requirements (TSR) Status Data Sheet, R8*
CN1, OP-120 R3 CN 1, OP-127 R0 CN1, SR-200 R6 CN2, and New Procedure OP-128 R0, Rev. 0
Continuing Training Plan, *Two-Year Continuing Training Plan CY2011 - CY2012 for NNFD*
CSE training/qualification program, training records and qualification cards
Causal Analysis for Operator Exceeded an Expected Dose Limit, NTS-ORO-ORNL-X1-BOPLANT-2013-0001, 5/2013
Causal Analysis/Corrective Action Plan Crosswalk, NST-ORO-ORNL-X10REDC-2014-0001, Building 7920 Near Miss While Installing Glovebox, 8/12/2014
Conduct of Operations Assessment FY 14, 1st quarter – 3025E/3525 Logkeeping and Operations Turnover, 1/3/2014
Contract DE-AC05-00OR22725, H-15 Clause, Contractor Assurance System (Dec 2009)
Corrective Action Plan for DOE ORO FR Quarterly Assessment, Operability of Vital Safety Systems ORNL Nuclear Facilities, 2nd quarter, FY 2014
Critique Minutes, Building 3025E Cell 3 Personnel Dose, 2/5/2013
Critique Minutes, Building 3025E Clothing Contamination Event, 7/25/2013
Critique Report, Unplanned Uptake during Uranium Processing Operations, 8/27/2014
Drawing N3E020566A097, *Bldg 3525 K-15 Cell Exhaust System Flow Diagram,* Rev. I
Drawing N3E020566A261, *Bldg 3525 Hot Cell Ventilation System Instrument Control Diag.* Rev. E
Effectiveness Assessment of the DOE Facility Representative Review of NNFD Conduct of Operations Finding FRQA-1302-A, dated March 2014
Extent of Condition Review Assessment Report for the TSR Violation at Building 3525 SC-ORO-ORNL-X10Nuclear-2007-0004, 4/2008
Extent of Condition and Extent of Cause Review for SC-ORO-ORNL-X10Nuclear 2011-0004 Clothing Contamination at Building 7920, 4/2012
F&O Safety Observations, STOP, 3025E, 9/12/14
Final Critique Report, Personnel Contamination At Building 3525, 4/22/2014
Final Report for Readiness Assessment for Receipt, Storage, and Reconfiguration for Shipment of HFIR Core Assemblies at Building 3525, 12/17/2009
Follow up Effectiveness Review for the TSR Violation at Building 3525, SC-ORO-ORNL-X10Nuclear-2007-0004, 4/21/2011
FY 2013 Management Observation, Pre-job briefing observation for 3047B, 9/20/13
FY2014 Maintenance Assessments, Post Maintenance Testing
FY2013 Assessment List
IO-2011-11, System Engineering and Buildings 7920 and 7930 Technical Safety Requirements Implementation Assessment, 9/2011
Job Analysis Task Plan, *Job Analysis Task Listing NNFD 3525 Hot Cell Operator,* Rev. 0
Lesson Plan VEN 3524, *Building 3525 Ventilation Module,* Rev. 1
Lesson Plan NNFD-3525-LP-002, *Procedures Update Training ARP-300 R1 CN1, OP-102 R5*

Letter from Johnny Moore to Thomas Mason, 1/17/2014, FY 2014 Contractor Formal Assessment Program Schedule for ORNL
Letter from Johnny Moore to Thomas Mason, 1/9/2014, First Quarter FY 2014 Startup Notification Report
Letter from Johnny Moore to Thomas Mason, 12/14/2012, FY 2013 Contractor Formal Assessment Program Schedule for ORNL
Letter from Johnny Moore to Thomas Mason, 12/9/2011, FY 2012 Assessment Program Schedules for UT-Battelle, LLC
Letter from Johnny Moore to Thomas Mason, 4/18/2014, Second Quarter FY 2014 Startup Notification Report
Letter from Johnny Moore to Thomas Mason, 7/2/2014, Third Quarter FY 2014 Startup Notification Report
Letter from Mark Million to Michael Frietze, 1/19/2009, Contract No. DE-AC05-00OR22725; Modification No. 319
List of ORNL Qualified Auditors and Certified Lead Auditors, 10/10/2014
M&O Assessment, 16180, Configuration Control Lab 211 Glove Box, 8/23/13
M&O Assessment, Communications and Notifications, ACTS 16587, 16588, 16589, 5/20/2014
M&O Assessment, Nuclear Material Transport Evolution, 7/17/2013
Maintenance Work Package MWP 043449, 3025E Ante Room Filter Change, Post Job Review, 11/21/2013
Maintenance Work Package MWP 043989, 3025E HEPA Filter Change Out, Post-Job Review 7/1/2013
Maintenance Work Package MWP 044166, 3525 Steam Station Code, Post-Job Review 9/30/2014
Maintenance Work Package MWP 044356, 3525 Sprinkler Head Removal, Post-Job Review 9/18/2013
Maintenance Work Package MWP 044452, Removal of the Roots Blower, Post-Job Review 11/12/2013
Maintenance Work Package MWP 044937, 3025E Install a Notification System in the E200 Hallway, Post-Job Review 6/4/2014
Maintenance Work Package MWP 045053, Replace Fire Alarm System Device, 3025E, 8/4/2014
NNFD-PDD-075 – Nuclear Maintenance Management Description Document
NNFD-002, *Change Control of Modifications*
NNFD-004, *Work Control*
NNFD-006, *Aging Equipment*
NNFD-007, *NNFD Roles, Responsibilities, Accountabilities, and Authorities (R2A2s)*
NNFD-008, *In-service Inspection and Safety System Assessment Program*
NNFD-PLAN-006, *Non-reactor Nuclear Facilities Division (NNFD) Plan for Control of Maintenance Tools and Equipment*
NNFD-010, *Procurement, Receipt Inspection and Commercial Grade Dedication for NNFD Supplies*
NNFD-PLAN-018, *Performance Assessment Plan*
NNFD-022, *Systems Performance Monitoring*
NNFD-PDD-075 – Nuclear Maintenance Management Description Document
NNFD 2nd Quarter FY 2014 ES&H Assessments
NNFD 5 Year Assessment Schedule
NNFD All Hands Meeting handout, 10/14/2014
NNFD Assessment Schedule FY 14
NNFD Assessment Schedule FY 15
NNFD FY 2013 Performance Evaluation Report with Historical Perspective FY 2003-2013, 10/31/2013
NNFD FY 2014 1st quarter ESH Walkthrough Inspections for NSED R&D Divisions
NNFD Performance Trending Desired Outcome Support
NNFD-015, Corrective Action Management, Trending, and Causal Analysis
NNFD-022, System Performance Monitoring
NNFD-3535-FRM-0002, Daily Check Sheet, 8/11/2014
NNFD-FRM-066, Work Log, 3525 Exhaust Systems Calibration, PM and/or Maintenance, 10/10/2014

NNFD-PLAN-018, Performance Assessment Plan
NNFD-PLAN-042, Human Performance Steering Committee Charter, R0, 5/6/2011
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