Office of Enterprise Assessments
Assessment of Nuclear Reactor Facility Operations at Nevada National Security Site

September 2016

Office of Nuclear Safety and Environmental Assessments
Office of Environment, Safety and Health Assessments
Office of Enterprise Assessments
U.S. Department of Energy

Table of Contents

Acronyms

ANS	American Nuclear Society
ANSI	American National Standards Institute
CAS	Contractor Assurance System
CEF	Critical Experiments Facility
CESC	Critical Experiments Safety Committee
CFR	Code of Federal Regulations
ConOps	Conduct of Operations
CRAD	Criteria, Review and Approach Document
CSE	Cognizant System Engineer
DAF	Device Assembly Facility
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EA	Office of Enterprise Assessments
FORC	Facility Operating Review Committee
FR	Facility Representative
FY	Fiscal Year
JLON	Joint Laboratory Office – Nevada
JTA	Job Task Analysis
LANL	Los Alamos National Laboratory
LCO	Limiting Condition for Operation
M&TE	Measuring and Test Equipment
NCERC	National Criticality Experiments Research Center
NA-LA	NNSA Los Alamos Field Office
NEN-2	LANL Advanced Nuclear Technology
NEN-6	LANL Advanced Nuclear Experiments
NFO	Nevada Field Office
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
NSTec	National Security Technologies, LLC
OAA	Operational Awareness Activity
OFI	Opportunity for Improvement
OJT	On-the-Job Training
PFITS	Performance and Feedback Improvement Tracking System
QA	Quality Assurance
RCT	Radiological Control Technician
RWP	Radiation Work Permit
SDD	System Design Description
SME	Subject Matter Expert
SSM	Safety Shutdown Mechanism
SSO	Safety System Oversight
SSOR	SSO Representative
SSS	Scram Safety System
TPP	Training Program Plan
TSR	Technical Safety Requirement
USQ	Unreviewed Safety Question
VSS	Vital Safety System

Office of Enterprise Assessments
Assessment of Nuclear Reactor Facility Operations at
Nevada National Security Site

EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE) Office of Nuclear Safety and Environmental Assessments, within the independent Office of Enterprise Assessments (EA) conducted an oversight assessment of the Nevada National Security Site (NNSS) nuclear reactor facility operations, managed by National Security Technologies, LLC. This assessment was part of a targeted assessment of nuclear reactor facility operations across the DOE complex.

Nuclear reactor facility operations was identified as a targeted assessment area in a memorandum to DOE senior line management, entitled *Office of Enterprise Assessments Nuclear Safety, Worker Safety and Health, and Emergency Management Assessment Strategies and Activities*, dated February 5, 2015. The memorandum also stated that performance of DOE oversight would be evaluated during the targeted assessments to provide an input to the overall evaluation of DOE Federal assurance capability. Pursuant to this memorandum, EA assessed the effectiveness of nuclear reactor facility operations at NNSS, specifically at the National Criticality Experiments Research Center (NCERC), which is located in the Device Assembly Facility (DAF) and operated by Los Alamos National Laboratory (LANL). The review evaluated the flowdown and implementation of DOE requirements to ensure activities are conducted safely and in accordance with requirements. The review also evaluated the effectiveness of the DOE oversight of nuclear reactor facility operations.

Overall, LANL is conducting NCERC facility operations adequately, safely, and in accordance with requirements. Operators are highly experienced and well informed of conditions. NCERC has generally established adequate self-assessment and corrective action programs, and most assessment results and issues are adequately tracked to resolution in a timely manner. LANL has implemented a satisfactory certification and requalification training program for certified operators and supervisors that meets applicable DOE requirements. NCERC defined surveillances and limiting conditions for operations are adequately maintaining the operability and quality of vital safety systems within nuclear safety requirements. The cognizant system engineer program and system health reporting at NCERC are comprehensive. The experiment review and approval process, as implemented at LANL and NCERC, has been instrumental in ensuring safe operations. In summary, the NCERC staff generally meets or in some cases exceeds the DOE nuclear safety requirements for facility operations in the areas assessed.

EA identified two deficiencies in applying DOE requirements for conducting operator continuing training and for performing triennial operator training program assessments. EA also identified several opportunities for improvement for NCERC management to consider.

The Nevada Field Office (NFO) has a generally well-documented oversight program that assesses contractor program performance and provides a sound process for establishing functional area oversight activities. EA identified one deficiency in applying the requirements for performing triennial operator training program assessments. These assessments involve the NNSA Los Alamos Field Office (NA-LA) because, while NFO is responsible for implementation oversight at NCERC, NA-LA is also responsible for federal oversight of the LANL programs used at NCERC. EA also identified several opportunities for improvement for NFO and NA-LA management to consider, including a recommendation to update the memorandum of agreement between the two NNSA field offices.

Office of Enterprise Assessments
Assessment of Nuclear Reactor Facility Operations at
Nevada National Security Site

1.0 PURPOSE

The U.S. Department of Energy (DOE) independent Office of Enterprise Assessments (EA) conducted an assessment of nuclear reactor facility operations at Nevada National Security Site (NNSS), specifically at the National Criticality Experiments Research Center (NCERC)[1] located in the Device Assembly Facility (DAF). This assessment was conducted within the broader context of a series of targeted assessments to ensure systems and techniques at DOE nuclear reactor facilities are in accordance with regulatory requirements and provide acceptable protection of the health and safety of the public and workers. EA performed this targeted review at NNSS during the period of June 6–9, 2016.

2.0 SCOPE

This assessment evaluated the flowdown and implementation of DOE requirements to ensure nuclear reactor facility operations are conducted safely and in accordance with requirements. The assessment also evaluated the effectiveness of the DOE oversight of nuclear reactor facility operations.

3.0 BACKGROUND

NNSS is managed and operated by National Security Technologies, LLC (NSTec). Under contract to DOE/National Nuclear Security Administration (NNSA), NSTec is the primary operator for NNSS. The current mission of NNSS includes support for the NNSA stockpile stewardship program, which includes performing subcritical experiments in support of nuclear weapons and storing special nuclear materials. The mission of the NCERC at the DAF is to conduct experiments on critical assemblies with fissile material at or near criticality and to operate the assemblies in the region from "subcritical" through "delayed critical" to beyond "prompt critical" to explore reactivity phenomenon. While NSTec is the primary operator of NNSS and the DAF, Los Alamos National Laboratory (LANL) operates the NCERC under a secondary real estate operations permit with NSTec. The Nevada Field Office (NFO) provides DOE/NNSA oversight for NNSS and the NCERC, and the NNSA Los Alamos Field Office (NA-LA) also provides some oversight for NCERC activities under a memorandum of agreement between NFO and NA-LA.

NCERC operations at times involve the Godiva critical assembly, which is highly enriched uranium alloyed with molybdenum and comprised of eight interlocking plates, a safety block, two control rods and a burst rod. The assembled core is very nearly a right circular cylinder. The core is designed with no moderator or reflector, and is designed to have a very short neutron lifetime. These features result in a very high-power and short burst of neutrons. Godiva is designed to operate above prompt critical, unlike the other NCERC assemblies (i.e., Comet, Flat-Top, and Planet). Since Godiva is essentially a fast burst reactor, NCERC operations involving Godiva were the primary focus of this EA assessment.

EA identified nuclear reactor facility operations as an area for targeted reviews in a memorandum to DOE senior line management, entitled *Office of Enterprise Assessments Nuclear Safety, Worker Safety and*

[1] NCERC was formerly the Critical Experiments Facility (CEF) located in Technical Area 18 at Los Alamos National Laboratory; the Godiva critical assembly resumed operations in the DAF in September 2013.

Health, and Emergency Management Assessment Strategies and Activities, dated February 5, 2015. The memorandum also stated that performance of DOE oversight would be evaluated during the targeted reviews to provide an input to the overall evaluation of DOE Federal assurance capability.

4.0 METHODOLOGY

The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*. EA implements the independent oversight program through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. Organizations and programs within DOE use varying terms to document specific assessment results. In this report, EA uses the terms "deficiencies, findings, and opportunities for improvement (OFIs)" as defined in DOE Order 227.1A. In accordance with DOE Order 227.1A, DOE line management and/or contractor organizations must develop and implement corrective action plans for the deficiencies identified as findings. Other important deficiencies not meeting the criteria for a finding are also highlighted in the report and summarized in Appendix C. These deficiencies should be addressed consistent with site-specific issues management procedures.

As identified in the assessment plan, *Plan for the Office of Enterprise Assessments Targeted Review of Nuclear Reactor Facility Operations at Nevada National Security Site*, this assessment considered DOE requirements related to the criteria and lines of inquiry of EA Criteria and Review Approach Document (CRAD) 31-08, as specified above in the scope for the selected sections listed below. EA CRAD 31-08 provides additional details about each of the objectives and criteria that were assessed, as well as the approach used by EA.

EA used the following sections of EA CRAD 31-08, Rev. 0, *Nuclear Reactor Facility Operations*:

- 4.3 Operations − Operations Activities, Logs and Records
- 4.5 Operations − Self-Assessments and Reviews
- 4.6 Training and Qualification − Operator Certification and Continuing Training
- 4.7 Safety Basis − Surveillances and Limiting Conditions for Operations
- 4.9 Safety Basis − Experiments
- 4.14 DOE Field Element Oversight

EA examined key documents, such as system descriptions, work packages, procedures, manuals, analyses, policies, and training and qualification records. EA also interviewed key personnel responsible for developing and executing the associated programs, observed operating and maintenance activities, and walked down significant portions of the NCERC facility, focusing on nuclear reactor facility operations. Section 4.15, *Approach*, of EA CRAD 31-08 provides additional details about the record review, interviews, and observations. The members of the EA review team, the Quality Review Board, and EA management responsible for this review are listed in Appendix A. Appendix B provides a detailed list of the documents reviewed, personnel interviewed, and observations made during this review, relevant to the findings and conclusions of this report.

EA has not previously assessed nuclear reactor facility operations at NNSS and the NCERC. Therefore, there were no previous items for follow-up evaluated during this assessment.

5.0 RESULTS

5.1 Operations − Operations Activities, Logs, and Records

Criteria:
Reactor facility operations practices are established and implemented to ensure that operators are alert, informed of conditions, and operate equipment properly; and to ensure thorough, accurate, and timely recording of equipment information for performance analysis and trend detection. (DOE Order 422.1)

EA observed NCERC operators conducting a Godiva burst operation in accordance with CEF-EXP-003, *Experiment Plan for Godiva*, and CEF-SOP-003, *Operating Procedure for the Godiva Critical Assembly*. Observations included the pre-job briefing, control room pre-operational checks, assembly cell pre-operational checks, mode change, 70°C burst operation, and shutdown. Cell re-entry occurred the following day. This typical burst operation provided a good opportunity for EA to assess procedures, conduct of operations (ConOps), and logs. CEF-ADM-004, *NCERC Document Processing and Use*, adequately maintained NCERC procedures, and release authorization to perform operations and other work activities and to close out those activities was adequately controlled. (All DAF/NCERC work is controlled by the DAF nuclear operations manager.) NCERC ConOps and narrative logkeeping is governed by OP-DAF.FA17, *Device Assembly Facility General Use Directive*, and OP-DAF.AD38, *Device Assembly Facility (DAF) Logkeeping*, respectively, and separate scientific logkeeping for Godiva machine data is governed by CEF-ADM-006, *NCERC Experiment Log Keeping*. Both DAF and NCERC management periodically review the narrative logs, while the experiment logs are more technical and the operators and other NCERC staff use them to reference past operations and prepare for future operations. Based upon these observations, EA verified the adequacy of NCERC operational procedures, ConOps, and the maintenance and review of operational logs and records.

NCERC has a generally effective Performance and Feedback Improvement Tracking System (PFITS). PFITS is discussed in more detail in Section 5.2 below. Other than a uranium contamination event in 2014, which paused Godiva operations from August 2014 to January 2016, Godiva has not had any recent unplanned reactor SCRAMs or unplanned entries into any limiting conditions for operation (LCOs) for EA to fully evaluate how well NCERC identifies and resolves significant technical problems and events. However, in 2012, NCERC identified reactor control system anomalies in the Planet and Flat-Top critical assemblies related to digital relay components and replaced these with electro-mechanical relays in 2013. These two events, over the past four years, demonstrate that the NCERC staff adequately identify and resolve significant technical problems. Cognizant system engineers (CSEs) review control room logs and work closely with operators to evaluate machine data for trends and extent of conditions as problems arise (discussed in more detail in Section 5.4 below), and NCERC enters these problems into either the Maximo maintenance management system or the PFITS issues management system for resolution. EA reviewed PFITS data and a recent NCERC quality assurance (QA) monthly update that the QA engineer provides to NCERC management to review the status of open and overdue PFITS actions. Overall, the PFITS is a useful and adequate tool for NCERC to adequately track issues to resolution in a timely manner.

Technical safety requirements (TSR) required instrumentation measured parameters adequately meet nuclear safety requirements. EA examined the completed records of CEF-SRV-001, *Nuclear Instrumentation Annual Calibration*, and CEF-SRV-002, *Critical Assemblies SCRAM Safety System (SSS) and Safety Shutdown Mechanism (SSM) Annual Surveillance*, for Godiva for 2014 and 2015 to verify the adequacy of these procedures. EA also verified that appropriate calibration and quality control process for measurement instruments were in place per CEF-PLA-005, *NCERC Calibration Program*, and CCD-QA05.004, *NSTec Standards and Calibration Program*. NCERC uses both programs depending on whether local NSTec calibrations are used or the instrument is calibrated by LANL per P330-2, *Control*

and Calibration of Measuring and Test Equipment (M&TE). Both programs provide acceptable calibration services that ensure measurements are traceable through the National Institute of Standards and Technology or other nationally accepted measurement consensus standards. Although the surveillance procedures are adequate, EA identified some minor discrepancies between CEF-SRV-001 and the NSTec calibration report for the instrument used to perform the surveillance. Where the procedure asked for an instrument's serial number and calibration date, operators instead routinely entered the instrument's identification number and calibration due date.

EA reviewed copies of several recent 8-day look-aheads, integrated plan of the day/plan of the week schedules, Maximo daily forecasts, and minutes for a DAF execution working group meeting covering the status of ongoing DAF projects/activities. By the nature of NCERC operations, there were no shift turnover or reactor startup meetings for EA to observe other than the Godiva burst operation. However, the ongoing communication of issues, conditions, and events to NCERC personnel on a daily and weekly basis is appropriate for the small and well-integrated staff. Regarding the verification of critical communications, EA observed during the Godiva burst operation that operators used an informal repeat-back of procedure steps rather than formal reader-checker or 3-way communications. Based on the expertise of the operators and the flexibility allowed under OP-DAF.FA17 for NCERC ConOps, this is an appropriate verification technique. Overall, NCERC communications are appropriate for its small and experienced staff.

In conclusion, NCERC has adequately established and implemented facility operations activities, logs, and records. Reactor operators for Godiva are highly experienced and well informed of conditions, appropriately comply with procedures, and accurately record measured nuclear safety parameters. NCERC adequately identifies and resolves problems in accordance with an established issues management system.

5.2 Operations − Self-Assessments and Reviews

Criteria:
Managers assess their management processes and identify and correct problems that hinder the organization from achieving its objectives, including monitoring and self-assessment of reactor facility operations. (10 CFR 830.122(i), DOE Order 422.1)

NCERC has a generally acceptable self-assessment program. DAF and NCERC TSRs require the contractor to establish and implement QA programs including an assessment process in accordance with contractor assurance system (CAS) requirements. In practice, NCERC has an established QA assessment function separate from the operations function. The LANL Advanced Nuclear Experiments Group (NEN-6) reports to the Nuclear Engineering and Non-Proliferation Division Office (NEN-DO). The NEN-6 QA Engineer ensures compliance with the NCERC QA Program and the LANL institutional QA Program. The NEN-6 QA Engineer is well-integrated into and knowledgeable of on-going NCERC operational activities. NEN-6 annually develops a formal self-assessment schedule based on criteria and requirements found in DOE Orders 414.1D, *Quality Assurance*, and 420.1C, *Facility Safety*, as well as issues and concerns identified from operating experiences, incidences, and operational awareness activities. These assessments are performed using assessment-specific plans and defined lines of inquiry. EA reviewed the fiscal year (FY) 2016 NCERC assessment schedule to the completed activities. To date, five of the eight planned assessments had been adequately performed, including Criticality Safety, Inspections and Test Status (System Health Reports), and Procurement. Assessments of Maintenance, QA Programs, and ConOps were on track for completion in FY 2016 but still awaiting scheduling.

All NCERC assessment results and issues (i.e., findings and corrective actions) were adequately tracked to resolution using PFITS. Previously performed assessment reports were generally comprehensive with

clearly defined findings and opportunities for improvement. While the general structures and systems are place for an effective assessment and issues management process, EA identified an issue in the implementation of corrective actions. In June 2014, routine radiological control technician (RCT) surveys discovered contamination in the anteroom outside of the Godiva cell. Subsequent bioassay analysis identified personnel uptakes. Although the projected uptake doses were well within occupational exposure limits, at the request of the NFO Manager, the NFO Deputy Assistant Manager for Safety and Security (AMSS) called LANL to pause operations on Godiva and Comet. Based on this, LANL instituted a management pause on Flat-Top and Planet operations during August 2014, and in September 2014 LANL senior management chartered a causal analysis team that was independent of NCERC operations. In the report *Causal Analysis of the NCERC Uranium Contamination Event*, the team prepared a matrix table of facts, issues, causes and recommended short-term and long-term corrective actions. The 12 topical issues listed resulted in a total of 31 identified proximal or contributing causes. The *National Criticality Experiments Research Center Corrective Action Plan* included a cross walk between the issues and recommended corrective actions. The recommended corrective actions concentrated on the proximal cause of the contamination being uncontained spallation off the fuel plates, and immediate contributing weaknesses in the radiological control monitoring and the communications processes for sharing the associated results. The spallation issue was effectively addressed by application of the "top hat" shield covering Godiva and improved local high-efficiency particulate air (HEPA) filtered ventilation. The radiological control monitoring issues were addressed by increased frequency in contamination surveillances, improved airborne monitoring, and improved integration of RCTs with operations.

However, the causal analysis report also identified two potentially broader systemic issues. These included weaknesses in the hazard identification and recognition processes, and weaknesses in the change control processes as implemented during the transition of NCERC operations from Technical Area 18 at LANL to the DAF at NNSS. In general, systemic issues such as these represent responsive controls rather than preventive controls managed by administrative processes. For these two identified issues, the corrective action plan indicated that no further action was required, on the basis that the LANL causal analysis team did not include evaluation of local NSTec processes that NCERC follows. DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy*, Attachment 1, *Contractor Requirements Document*, Section 2.(b) states: "Timely corrective actions that will address the cause(s) of the findings and prevent recurrence are identified and implemented." The corrective action plan provides a reasonable approach to addressing the proximal cause of the event with appropriate engineered controls, and also establishes responsive radiological control practices to ensure timely recognition of an incident. However, the decision to not implement corrective actions for two systemic contributing causes indicates potential weaknesses in the LANL causal analysis and/or corrective action processes.

In conclusion, NCERC has generally effective self-assessment and corrective action programs. LANL QA personnel are well integrated into the facility and knowledgeable of on-going operational activities. NCERC assessment results and issues were adequately tracked to resolution using PFITS.

5.3 Training and Qualification − Operator Certification and Continuing Training

Criteria:
Reactor operators, senior reactor operators, and fuel handlers (or fissionable material handlers) at Hazard Category 1 and 2 nuclear reactor facilities are trained and certified to be capable of performing their assigned work. Training for reactor operators and senior reactor operators includes formal classroom-type and on-the-job training to ensure familiarity with all required aspects of reactor operation, including anticipated transients and accident conditions, and written examinations are administered to candidates for certification. Continuing training is provided to personnel to maintain their job proficiency. Continuing training programs for certified operators and supervisors consist of

preplanned classroom-type training, on-the-job training, and operational evaluations on a regular and continuing basis. (10 CFR 830.122(b), DOE Order 426.2)

LANL operator training and certification requirements were documented in NCERC-TTP-001, *National Criticality Experiments Research Center Training Program Plan*. The NCERC Training Program Plan (TPP) replaced the previous versions of the Training Implementation Matrix. LANL currently has a plan for compliance with DOE Order 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*, as well as TPPs for each of their nuclear facilities. The NCERC TPP, which was being updated and under review by NA-LA at the time of this assessment, lists the following certified operator and supervisor positions in Attachment 1 – *Facility Position Matrix*:

- Supervisors – Crew Chief and Fissionable Material Person in Charge
- Operators – Crew Member, Fissionable Material Handler, and Portable Radiographic Source Operator.

The NCERC TPP and implementing procedures include DOE O 426.2 requirements for entry-level education and experience, medical examinations, facility- and job-specific training, operation performance evaluations, and written final examination. The requirements for initial certification of operators (crew members and crew chiefs) are detailed in NHHO-NCERC-CM-QS-28, *NCERC Crew Member/Crew Chief Qualification Standard*. This standard includes a detailed description of required job specific training, operational evaluations, performance demonstrations, comprehensive written examination, and oral examination (oral board). EA verified that completed operator written exams, oral board questions, and operational evaluations and performance demonstrations adequately cover the full breadth of required topics. This included detailed descriptions of correct responses to questions, and clearly identified critical steps for performance demonstrations. EA also confirmed that medical examinations were conducted annually as part of the human reliability program and meet the requirements in DOE Order 426.2.

The NCERC crew member qualification standard states that an oral board must be convened by at least two crew chiefs as board members. The standard says that other personnel may be invited, but must be approved by the NEN-2 group leader or designee. EA reviewed completed oral examinations and noted that in all cases only the two currently qualified crew chiefs conducted the oral board for all initial crew member qualifications. DOE-HDBK-1080-97, *Guide to Good Practices for Oral Examinations*, recommended that training specialists and other line management should periodically be invited as observers during the oral board. Although this Guide has been archived (cancelled in February 2016), this specific recommendation is still a good practice for consideration.

EA reviewed the Godiva crew chief and crew member job task analysis (JTA) that identifies job-specific initial training and continuing training topics. LANL conducted the JTA using a table top approach as part of the systematic approach to training and this provided the basis for initial and continuing training topics. The JTA also identifies initial classroom training on basic reactor theory and other topics that DOE Order 426.2 requires for initial qualification. The JTA was last approved in 2009 and had not been updated to address the past six years of operating experience. Additionally, the TPP stated that the JTA identifies a list of required control manipulations for initial qualification. However, although the JTA includes a duty area to perform operation of critical assemblies from startup, at power, and shutdown, and referenced the Godiva on-the-job training (OJT) checklist as the training method, it does not list the control manipulations required by DOE Order 426.2. (**Deficiency**.)

EA reviewed the Godiva OJT checklist to verify whether completion of the checklist meets the requirement that operators must perform a minimum of five significant reactivity manipulations for initial certification, as specified in DOE Order 426.2, Attachment 1, Section 3, *Control Manipulations*. Attachment C, *Performance Evaluation*, of the Godiva OJT checklist includes several tasks in the Godiva

procedure CEF-SOP-003 that involve control manipulations. These include perform delayed critical operations, insert or remove reactivity, change power level, perform burst operations, and perform shutdown. Attachment C is intended to meet this requirement. However, as noted above, the OJT checklist does not provide a specific list of control manipulations derived from the job analysis, or a list of significant control manipulations for initial certification to clearly demonstrate and meet the applicable requirements in DOE O 426.2. (**Deficiency**.)

EA evaluated the components of continuing training and requalification for NCERC certified positions. LANL documents continuing training requirements, including the required intervals for the associated training activities in its U-Train system. The fixed component of the continuing training program includes such topics as DAF access training; fundamentals training topics, such as reactor theory and nuclear instrumentation; and training on the operation of the critical assemblies. The flexible component of the continuing training program includes changes to the safety basis and supporting procedures, and lessons learned and operating experience. The fixed component of the continuing training program includes appropriate required topics from DOE Order 426.2 on reactor fundamentals and facility specific operation, controls, and systems. Also, NCERC management was responsible for working with the NSTec training department to identify the type and mode of training to address any periodic changes to the safety basis and DAF supporting procedures. EA noted that this process was working well and that when changes were identified, NSTec was providing the necessary training. However, NCERC management recognized that the documentation for completion of some of the flexible continuing training topics, such as procedure and safety basis changes, could be improved. Additionally, NCERC management identified some needed improvements in both the flexible and fixed components of the continuing training program, such as quarterly operating experience discussions, required reading and team discussions, and periodic fundamentals seminars.

EA also evaluated whether the NCERC continuing training program addresses the specific requirements in DOE Order 426.2 related to performance of periodic control manipulations. Specifically, the Order requires that contractors specify, as part of the continuing training program, the set of control manipulations that are required to be performed annually and biennially. EA noted that the Godiva OJT checklist requiring performance of the set of control manipulations was required only for initial qualification. Although operators conducted some control manipulations as part of ensuring quarterly proficiency requirements were met, the NCERC crew chief and crew member qualification standard does not include a requirement to perform certain control manipulations annually and biennially as part of continuing training, as required by DOE Order 426.2. (**Deficiency**.)

EA evaluated whether NCERC provides training on abnormal and emergency procedures annually as part of continuing training as required by DOE Order 426.2. NCERC does not have separate abnormal operating procedures since the required action for all abnormal conditions was to place the reactor in a safe and stable condition as defined in the TSRs. As a result, the recognition of an abnormal condition and the expected operator responses are incorporated into the Godiva operating procedure CEF-SOP-003. However, the Godiva OJT checklist does not include a learning objective related to abnormal procedure response (i.e., "safe and stable" definition and required response). Additionally, the Godiva OJT checklist was only required to be completed once during initial qualification. As a result, LANL is not providing adequate initial and continuing training on abnormal operating procedures as required by DOE Order 426.2. (**Deficiency**.)

EA further evaluated the crew chief and crew member qualification standards to verify that continuing training requirements include all identified training topics, including those listed as "over train" in the applicable JTAs. For several of these "over train" tasks, the Godiva OJT checklist is listed as a method of training. However, as noted above, the Godiva OJT is required only as part of initial qualification and is not included in the continuing training requirements. EA also noted that LANL identified ConOps

training as an "over train" topic in the JTA and tracks it as part of DAF tenant-required access training; however, the LANL U-Train program does not identify ConOps as a training topic for the crew member/chief qualification standards. Additionally, NCERC has not verified that specific training activities for duties/tasks identified as over train in all the applicable JTAs are included in the continuing training requirements.

EA verified that the NCERC requalification requirements for certified operators adequately include the required components in DOE Order 426.2 such as a current medical examination, maintaining of operator proficiency requirements, and successful completion of a requalification examination. EA sampled requalification packages and verified completion of the proficiency requirements and satisfactory completion of the requalification examination. As previously noted, some of the requirements for continuing training are not adequately documented as part of requalification.

EA asked to review the latest triennial assessment of the NCERC training and qualification program required by DOE Order 426.2. The NSTEC compliance matrix states that the NCERC certified positions were not included in the NSTEC TQP since they were covered by an NNSA-approved TPP (i.e., the LANL TPP). As a result, the latest triennial assessment of the NSTEC training program completed in November 2015 did not include the LANL and NCERC operator training in the scope of the review. EA reviewed the LANL TPP and noted that it included the requirement to conduct triennial assessments of the NCERC training program using DOE-STD-1070-94, *Criteria for Evaluation of Nuclear Facility Training Programs*. However, NCERC management and LANL training personnel confirmed that the required triennial TQP assessment has not been conducted since initial startup of operations at DAF in 2011. (**Deficiency**.) The LANL training organization identified this deficiency in 2015, but the required assessment has not yet been scheduled.

In conclusion, NCERC certified operators are highly knowledgeable of the critical assemblies and displayed good formality of operations attributes during observed operations. With the exception of two deficiencies related to the requirements for conducting operator continuing training and for performing triennial TQP assessments, the requirements for initial certification and requalification of operators and supervisors identified in DOE Order 426.2 were being met.

5.4 Safety Basis – Surveillances and LCOs

Criteria:
Technical safety requirements are developed that are derived from the documented safety analysis to ensure that the necessary operability and quality of safety structures, systems, and components is maintained; that reactor operations are within safety limits; and that limiting control settings and limiting conditions for operation are met. (10 CFR 830.205(a))

LANL operates the NCERC in the DAF, but NSTec is responsible for controlling the safety basis for all activities in the DAF, including NCERC operations. There is a DAF Documented Safety Analysis (DSA) and TSR, as well as an NCERC DSA and TSR addendum, and the *NCERC-DAF Interface Plan* clearly defines the responsibilities for LANL and NSTec to ensure effective control and configuration management of vital safety systems (VSSs). NSTec is responsible for DAF facility systems such as fire protection, while LANL is responsible for the critical assemblies' safety systems such as the safety shutdown mechanism (SSM). EA reviewed the NCERC DSA addendum and system design descriptions (SDDs) to verify TSR surveillance requirements flow down to surveillance procedures and surveillance implementation. As discussed in Section 5.1 above, EA examined the records of CEF-SRV-001 and CEF-SRV-002. These surveillances acceptably verify annually the calibration of the Log-N channels, SCRAM under loss of power, and functional test of the SCRAM safety system (SSS) and SSM. These

procedures clearly identify the TSR surveillance requirements and acceptance criteria. M&TE instruments used to perform calibrations are appropriate for the task.

NCERC operators perform the surveillances, and the DAF nuclear operations manager authorizes work release for all surveillance procedures and reviews completed records to ensure acceptance criteria are met per OP-DAF.SP00. CSEs also verify acceptance criteria are met as part of the procedure. The Maximo maintenance management system schedules and tracks surveillance testing to ensure TSR requirements are maintained. EA reviewed DAF facility log records and verified surveillances and LCOs are adequately documented in the logs. Overall, NCERC surveillances effectively verify that design characteristics and safety review considerations are met.

TSR LCOs and surveillances are intended to maintain VSSs and ensure that reactor operations are within nuclear safety requirements. EA reviewed the *Godiva Assembly Amendment to the Device Assembly Facility Addendum for the National Criticality Experiments Research Center* and the flowdown of safety-significant controls into the TSRs and implementing procedures. TSR LCOs for Godiva are defined for nuclear instrumentation operability and for SSS/SSM operability. Specific administrative controls are also defined for control rods/safety block lockout, excess reactivity limit, in-cell sweep procedure, and ambient temperature requirement for burst operations. These LCOs and other controls are adequately maintained within the CEF-SOP-003 procedural requirements. The Godiva operators are well-experienced and highly knowledgeable of the LCOs and controls for the VSSs and their associated technical bases.

NCERC has an acceptable facility engineering and CSE TQP that complies with DOE Orders 420.1 and 426.2. NCERC has two qualified LANL CSEs who are full-time staff assigned in the DAF and located literally within minutes of their assigned systems, and readily available to provide oversight to ensure that safety systems can reliably perform as intended. The CSEs prepare annual system health reports (which are essentially system assessments), while LANL performs a more comprehensive VSS assessment on safety-significant systems on a five-year frequency. EA reviewed the Godiva system health reports for 2015 and 2016 for intrinsic critical assembly design, SSM, SSS and the generic nuclear instrumentation system, and also the report for the last VSS assessment (December 2012). The system health reports adequately address operability, availability, performance, maintenance and components inspection, configuration, and material condition. The VSS assessment addresses safety function definition, surveillance and testing, configuration management, and maintenance. Overall, these detailed and comprehensive safety system assessments are a strength at NCERC. In reviewing several SDDs, however, EA identified one minor issue. Although the SDD cover sheets define the effective date and a document review date three years later, LANL does not explicitly define its expectation for keeping the SDDs current as a CSE responsibility in AP-341-611, *System Design Descriptions*.

In conclusion, NCERC surveillances and LCOs effectively maintain the operability and quality of nuclear safety structures, systems, and components within TSR safety requirements. Reactor operators are highly knowledgeable of the LCOs and their technical bases, and the full-time CSEs inside the facility provide timely and effective oversight of their assigned systems. The working relationship between operations and engineering is very effective in ensuring nuclear safety requirements are met. The system health reports and safety system assessments at NCERC are comprehensive and effective.

5.5 Safety Basis − Experiments

Criteria:
Experiments are reviewed according to a DOE approved unreviewed safety question process. (10 CFR 830.203(d)(3))

LANL generally has established and implemented an adequate experiment safety review process in accordance with 10 CFR 830.203, and the DAF/NCERC TSRs and administrative procedures. The NCERC critical assemblies are principally designed to provide bare fission (fast) spectrum neutron irradiations for studying experimental materials properties or responses. Some of these are for high flux pulsed irradiations, such as on Godiva, while others are for lower flux steady-state irradiations on Godiva and the other critical assemblies.

Typical experimental samples or apparatus include criticality accident alarm system components (electronics and detectors), dosimeters, and small sample reactor component material prototypes for fuels, reflectors, absorbers, and moderators, etc. Experiment data that LANL needs for its reviews include measurements or determinations of:

- k_{eff} – (critical and/or sub-critical configurations)
- Deep Transport – (shielding, criticality accident alarm systems, etc.)
- Reaction Rates – (spectral indices, spatial profiles, dosimetry, etc.)
- Spectrum – (neutron, gamma)
- Reactivity Worths – (small sample, Doppler temperature coefficients, material replacement, control rods, void or insertion, etc.)
- Kinetic Parameters – (β_{eff}, delayed neutron fractions, α_i's and λ_i's, etc.)

The LANL Nuclear Criticality Safety Program's multi-tiered process for review and approval of experiment proposals includes:

- Justification of Integral Experiment Need (CED-0)
- Integral Experiment Preliminary Design (CED-1)
- Integral Experiment Final Design (CED-2)
- Approval to Conduct the Integral Experiment (CED-3)
- Publication of Data (CED-4)

Experiment proposals are submitted via a website application (*ncsp.llnl.gov*) that includes applications for experiments to be performed at NCERC and other DOE facilities. The NNSA Nuclear Criticality Safety Program reviews the proposals with consideration of the value of the data quality objectives, feasibility of performance, cost of performance, selection of the appropriate DOE facility best suited for the experiment, conformance to the recommended facility safety basis, and safety of performing the experiment. If, through the CED-0 phase, it is determined that the proposed experiment is justified and best suited for the facilities at the NCERC, the proposal is forwarded to the LANL Advanced Nuclear Technology (NEN-2) staff who work with the experimenters to draft an experiment plan in accordance with CEF-ADM-001, *Experiment Plan Preparation Procedure.* If NEN-2 determines that the proposed experiment lies outside the bounds of previously approved experiment plans, the draft experiment plan is forwarded to the LANL Criticality Experiments Safety Committee (CESC) for review. Since most experiment proposals fall within the bounds of previously approved plans, the CESC typically reviews less than five experiment plans per year.

In accordance with its charter, the CESC provides an independent safety review and makes recommendations to NCERC line management for experiments and activities having safety significance. The CESC is composed of several subject matter experts (SMEs) who review the proposals based on their areas of expertise. The CESC uses the consensus standards of American National Standards Institute (ANSI)/American Nuclear Society (ANS)-1-2000, *Conduct of Critical Experiments*, and/or ANSI/ANS-14.1-2004, *Operation of Fast Pulse Reactors*, as applicable as the basis for their reviews. The CESC makes recommendations to NEN-2 for modifications that may impact safe operations of the experiments. All draft experiment plans, whether they are reviewed by the CESC or are bounded by previously approved plans, are forwarded to the DAF Facility Operating Review Committee (FORC), which

conducts its own independent review in accordance with NSTec procedure OP-DAF.AD21, *Approval Process (SBI).* The principal responsibility of the FORC in this review process is to ensure NCERC experiments conform to the DAF and NCERC DSA safety basis and TSR requirements. Following the FORC review, all experiment proposals are then screened using NSTec procedure OP-NENG.040, *Review of Completed Un-reviewed Safety Question (USQ) Documents*. Any USQ requires either modifications to the experiment plan to conform to the safety basis or additional analyses and changes to the DAF/NCERC safety basis, requiring further DOE review and approval. This often results in rejections of proposed experiments or significant delays before an experiment can be approved and performed, so NCERC takes care to ensure draft experiment plans conform to the approved safety basis. If there are no USQs, the experiment plan is approved by the DAF and NCERC management, and all associated work control documents, radiation work permits (RWPs), and schedules are developed and disseminated for implementation. The Godiva operations staff are well integrated into these experiment plan development and approval processes and often serve as the principal authors of the draft plans. As such, they are well aware of the TSR requirements and LCOs associated with the plans. During interviews and observations, the Godiva operations staff demonstrated expert knowledge of the characteristics and conditions of experimental materials and apparatus that could impact the safe operations of the critical assemblies.

The current review process described above has generally been effective in ensuring safe operation of the critical experiments; however, EA identified a problem in that the review process was primarily based on expert knowledge and past experience rather than a documented system of experiment-specific evaluation criteria covering a broad range of potential hazards. During interviews with experiment plan developers and reviewers, CESC leads, and FORC members, EA asked about evaluations for potential experiment hazards, such as materials and physical properties, toxicity, chemical reactivity, pyrophoricity or flammability, induced prompt radiation, activation, heating, swelling, pressurization, cryogenics, mechanical stresses, electrical hazards, and neutronics. The staff demonstrated expert knowledge of the impacts and controls for each of these areas on experiment safety, but EA noted that with the exception of criticality safety evaluations, the procedures contain no formal checklists or criteria to ensure that all of these topics are formally analyzed and the results documented. LANL maintains a set of procedures specific to work planning and control and hazard analysis processes: P300, *Integrated Work Management*, and its supporting forms; and also the NCERC-specific procedure P511, *Work at National Nuclear Security Administration/Nevada Feld Office Managed Sites in Nevada*. However, these do not include hazards analysis processes that would cover the above listed issues as applicable to the critical experiment plans. As such, the CESC does not use them for evaluations of experiment safety. Instead, the charters and implementing procedures related to the CESC and FORC focus on the composition of the committees, SME credentials, and assigned duties and responsibilities. Documentation of CESC and FORC deliberations and meetings is at a high level, addressing facility-wide operating concerns and editorial comments. The reviewed documents did not provide details or documentation of specific experiment hazard analysis determinations. Further, the staff indicated that most of the proposed experiments fell within the bounds of previously reviewed and approved experiment controls; therefore, based on a graded approach, those did not require additional analysis. While this SME-based process has generally been effective over the years, it lacks criteria for formal systematic review and documentation of the evaluations for a broad range of potential hazards, and is therefore vulnerable to changes in personnel and SME's ability to recognize variations in experiment designs.

EA observed a typical Godiva burst operation including pre-job briefs, the isolation of the fire suppression systems, testing and preparation of monitoring systems and clearance of the critical assembly cell, safety system and reactor control system functionality checks, control system reactivity worth verifications, and performance of the burst. An air filtration system and a "top hat" shield were in place around Godiva during the observed burst demonstration. Through these observations, interviews with facility personnel, and reviews of a sample of experiment plans, RWPs and other work control

documents, EA determined that experiment setup was adequately conducted using reviewed and approved work control processes, plans, and RWPs. NCERC implemented approved experiment plans in conformance with the DAF and NCERC safety bases and TSRs. All experiment component handlers and RCTs participated in pre-job briefings that detailed the processes to be followed, activities to be performed, required training and credentialing, controls and LCOs, and discussions of potential upset conditions and responses. Briefings included review of the terms and conditions of the applicable RWPs. The operators were well integrated into the experiment plan development, and they demonstrated full awareness of all control sets and potential hazards that could be associated with the experiments. Operations included appropriate approach to critical and low power reactivity and control worth testing to evaluate the impact of any experiment on the functions and controls of the critical assemblies.

Since no experimental test was set up for the Godiva demonstration burst operation, EA observed post-irradiation experiment handling operations for other ongoing experiments on the Planet critical assembly. The critical assemblies are inside a heavily shielded cell, two assemblies each in two different cells. Each cell is posted and controlled as a contamination area and high radiation area during and after the irradiations. Access is controlled through a vestibule room and a double set of interlocked blast doors. Area radiation monitors inside the cells provide a remote indication of radiological conditions. RCTs conducted initial post irradiation entry and monitoring in accordance with RWPs. RCTs also appropriately verified contamination area and radiation area conditions during the initial entry, surveyed and contamination checked the experimental samples, and transferred the samples using appropriate containment and shielding for further processing and analysis. Before the Planet experiment sample transfer operations, RCTs calculated estimates of the induced gross activity in the irradiated foils. Pre-job briefs discussed details of the operations, expected controls, RWP conditions, personnel responsibilities, training, and qualifications. EA observed the operations for transferring the irradiation foil samples to the counting laboratories, packaging of some materials for offsite shipment, and measuring some samples with spectroscopy systems to verify the calculated activity estimates and isotopic compositions. The measurements also included comparisons with field spectroscopy and survey instruments. During these operations, EA observed close coordination between the experimenters, operators, and RCTs. As samples were unpacked, all were checked for radiation levels and contamination. Both the RCTs and experimenters handling the samples used appropriate personal protective equipment and dosimetry. All observed activities were conducted within the appropriate limitations of 10 CFR 835, the RWPs and the internal controls.

EA identified a few areas where the application of As Low As Reasonably Achievable (ALARA) principles during the handling of samples was not fully effective. The sample counting and handling area is a relatively limited open space that is used for multiple purposes, including low level radioactive waste collection for transfer, experiment sample unpacking, shipment preparations, and sample counting and analysis. Some areas in the room were appropriately designated and controlled for the various activities and processes, but there was minimal use of engineered systems, such as task exhaust or fume hoods or localized shadow shielding to minimize potential exposures from adjacent activities. RCTs performed direct dose rate and count rate measurements, as well as prompt locally-counted gross contamination monitoring, and effectively implemented local controls. However, these controls may not have been wholly appropriate or fully effective because isotope-specific analysis was not used to anticipate post-irradiation hazards and decay times. (See **OFI-LANL-1**.)

Additionally, EA observed that personnel clearance processes following entry into a contamination area or radiological buffer area consisted entirely of hand-held survey instrument hand and foot frisks performed by RCTs. While these processes satisfy the regulatory requirements and are generally effective, the clearance techniques do not provide full coverage of all parts of the body, are more susceptible to variations in background, and may be influenced by variations in scan rate or detector

proximity to the surface, resulting in a higher potential for contamination to evade detection and spread to break areas or outside the facility. (See **OFI-LANL-2**.)

In conclusion, the experiment review and approval process at NCERC has been effective for ensuring safe operations involving experiments and conformance to the DAF and NCERC safety bases and TSRs. Irradiation activities involve appropriate operational processes and engineered features to recognize and respond to anomalies in the experimental apparatus that could impact the safety of the critical assembly operations. Post-irradiation sample handling was performed using appropriate controls and good coordination between the operators, experimenters, and RCTs. However, the experiment review and approval process is dominated by SME-driven committee processes that lack formal documented hazard analyses and could be vulnerable to changes in personnel or unrecognized changes in experiment design.

5.6 DOE Field Element Oversight

Criteria:
DOE field element line management has established and implemented effective oversight processes that evaluate the adequacy and effectiveness of reactor facility operations. (DOE Order 226.1B, DOE Order 422.1)

Safety System Oversight (SSO). The DOE field element has established and implemented an effective SSO program (or comparable program involving FRs or subject matter experts) for qualifying staff to apply engineering expertise in its oversight of the assigned safety systems and to monitor performance of the contractor's CSE program.

NFO has a documented Federal oversight program that tailors oversight activities based on the effectiveness of the CAS, the facility hazards, and the degree of risk. The process includes SME input for each identified functional area that is used to develop and issue a master assessment schedule for the upcoming FY. NFO's FY 16 assessment schedule includes the required Federal assessments (i.e., those Federal assessments identified in DOE directives) but no supplemental assessments based on changes in performance, risk, or other factors. Discussions with NFO management indicated that supplemental assessments were omitted from the annual schedule to allow the functional area lead SMEs to conduct more Operational Awareness Activities (OAAs) focused on performance.

NFO O 226.X, *Federal Oversight Program*, describes two broad types of assessments and OAAs: compliance based and performance based. The compliance based approach consists of validating that applicable requirements flow down into implementing documents and then verifying that work is conducted per the implementing procedures, thereby addressing both compliance and performance. The performance based approach focuses on observations of work in progress and verifying that the work activity is being performed in accordance with applicable expectations, including requirements. In the performance based approach (assessment and oversight for both compliance and performance), any non-compliances and improvement opportunities are to be addressed in the context of a balanced performance system.

EA reviewed a sample of performance based OAA records conducted within the last six months related to Godiva and other NCERC operations. The OAA records included the scope, functional area, and requirements/objectives, and the write-ups supported the overall conclusions. The OAA records also included observations of maintenance activities, Godiva burst operations, as well as performance of TSR-required surveillances. SSO representatives (SSORs) at the DAF performed these OAAs. The assigned Facility Representative (FR) responsible for oversight of NCERC activities submitted a weekly summary of completed oversight activities that were included in the FR weekly summary report that was

documented as an OAA. The weekly summary inputs from the NCERC FR included observations related to the Godiva procedure CEF-SOP-003, surveillance procedures, and various work activity documents.

NFO functional area leads are responsible for providing monthly SME input to management based on their review of available OAAs and assessments and discussions with other SMEs who had insight into the performance in their assigned functional areas. EA reviewed a sample of these monthly inputs and verified that they were generally well written and provided a good mechanism for managers to identify and address performance issues. The ConOps functional area lead used inputs from the SSORs and the NCERC FR to provide the monthly input. NFO used to develop an annual functional area oversight plan as discussed in DOE Guide 226.1-2A, *Federal Line Management Oversight of DOE Nuclear Facilities*, outlining the approach for ensuring adequate oversight a functional area by determining the level (depth) and mix (ratio of the use of assessments and OAAs) based on program performance, CAS confidence, and inherent risk. However, NFO management stated that these functional area oversight plans were no longer being generated. Instead, the SME monthly inputs were being fed into a quarterly program brief, which in turn were used to provide input into the annual assessment plan.

NFO management plans to use the quarterly reviews inputs, together with other performance based inputs from the CAS, to help identify any need for targeted OAAs and additional assessments. This type of periodic analysis and adjustment of oversight activities is consistent with DOE Guide 226.1-2A. EA reviewed a sample of the monthly SME inputs and the associated quarterly roll up quarterly program inputs. Although some of the inputs had supporting data provided through documented OAAs, in some cases it was not clear how oversight activities (such as OAAs) were supporting a comprehensive evaluation of the overall performance of the related functional area. For example, there were no documented OAAs of the training program provided to support the training input, and it was not clear what elements of the ConOps program were evaluated through OAAs to support the ConOps program quarterly input. NFO management has not provided sufficient guidance to FRs, SSORs, and functional area leads on the breadth and depth of OAAs that should be conducted, per Section 4 of DOE Guide 226.1-2A, to ensure adequate coverage of assigned functional areas based on current program performance, confidence in CAS data, and relative importance (inherent risk) of the program. It is also important for NFO management to provide clear expectations on the breadth of OAAs because baseline compliance assessments are no longer used for most functional areas. As a result, without an adequate mix of OAAs covering key program expectations, functional area leads and managers may not be fully aware of program performance.

NFO has assigned two FRs to cover the DAF and the associated nuclear operations, including NCERC operations. Both of the assigned FRs have not fully completed qualification requirements. One of the assigned FRs has unescorted access to the DAF and was performing oversight of the DAF and NCERC activities. The other FR is awaiting unescorted access and is not providing coverage of NCERC activities. EA observed the FR with access to DAF conducting routine oversight activities such as activity pre-briefs, Godiva burst operations, and recent event follow-ups. The FR is knowledgeable of the Godiva systems, recent events and corrective actions, and formality-of-operations requirements for NCERC.

In reviewing several completed FR weekly reports, EA noted that the FR was maintaining adequate operational awareness of the status of NCERC operations and recent occurrence reports. However, NFO did not have any additional OAA records completed by the FR addressing any specific aspects of ConOps associated with any of the NCERC critical assemblies, per expectations in DOE-STD-1063-2011, *Facility Representatives*. The only evaluations of specific ConOps expectations were completed by the SSORs, not the FR. Based on this disparity, EA concluded that NFO has not provided sufficient guidance for FR coverage of specific high importance elements of ConOps through performance based OAAs.

NFO has assigned SSORs who are qualified on the NCERC safety systems and conduct assessments of the NCERC safety significant systems every five years, as directed by current NNSA oversight expectations and consistent with the guidance in DOE Guide 226.1-A2. EA reviewed a sample of the completed assessments for the NCERC nuclear instrumentation system and the SSM and discussed the results with the SSORs who performed the assessments. These assessments were completed in 2011 and 2012 and were due to be conducted again in 2016 and 2017. EA verified that the VSS assessments were sufficiently rigorous and well documented, and that identified issues were adequately resolved and closed. The next contractor assessment of a NCERC safety system required as part of the LANL CSE program was scheduled for after the next Federal assessment planned by the NFO SSORs, which will not allow NFO to tailor the breadth and depth of its required assessment based the data from the CAS and recent assessments. (See **OFI-NFO-1**.)

EA observed the SSORs performing a system walkdown and conducted interviews related to assigned duties, recent events, and overall knowledge of the TSRs and associated surveillance requirements. The assigned SSORs are well qualified and very knowledgeable of the NCERC safety systems, the associated TSRs, and their assigned systems' maintenance and configuration management requirements. The SSORs were also conducting and documenting performance based OAAs of NCERC maintenance activities and TSR surveillances. EA identified that while the SSORs had conducted a reasonable number and scope and breadth of OAAs to provide input to the maintenance program functional area lead, they also cover some aspects of integrated safety management, work planning and control, and ConOps. As noted previously, NFO has not provided sufficient guidance to the SSORs on the breadth and scope of their OAAs to ensure adequate oversight data is available to evaluate NCERC performance in applicable functional areas such as maintenance, CSE program, and safety basis implementation. (See **OFI-NFO-2**.)

EA noted that since LANL was responsible for the NCERC operations, some of the programs NCERC staff implements are based on LANL program requirements, such as the TQP (see Section 5.3 above), as well as the CSE and maintenance programs. While NFO provides general oversight for NNSS and the NCERC, NA-LA also provides oversight for some aspects of NCERC operations under a memorandum of agreement (DE-GM58-14NA25512) between the two field offices. This memorandum of agreement was last approved in 2014 and does not address all required functional areas, such as the LANL CSE program and TQP. NFO has conducted the triennial assessment on the NSTec TQP for DAF as required by DOE Order 426.2, but this did not include NCERC. NA-LA has not conducted a triennial assessment of the NCERC TQP since initial startup of operations at the DAF in 2011. (**Deficiency**.)

DOE Order 426.2 also requires that for category B reactors, the field element managers must determine whether the facility hazards and the operational complexity of the facility warrant a review of certification and recertification of certain positions. Additionally, the Order specifies the types of oversight activities, such as periodic attendance on oral boards, that must be conducted if a certification program review is determined to be required. Neither the NFO nor NA-LA manager had documented a determination of the need to review NCERC certification and recertification activities. As previously noted, NFO has not performed any periodic OAAs documenting performance of oversight activities related to the certification and recertification of NCERC operators, and the NFO-NA-LA memorandum of agreement does not specifically determine whether Federal reviews of the certification and recertification of NCERC operators are required. The deficiency identified above, along with this and possibly other gaps in Federal oversight of NCERC operations, suggests that the memorandum of agreement between NFO and NA-LA is inadequate.

In conclusion, NFO has a well-documented oversight program that considers program performance, CAS data, and the relative importance of the various functional areas with additional emphasis on high hazard areas, such as nuclear facility safety. NFO recently implemented a monthly SME input process that, with

planned improvements such as quarterly trending and analysis, provides a sound process for establishing and adjusting FR/SSO and functional area oversight activities. SSORs assigned to NCERC are well qualified and, together with the FRs in qualification, were maintaining cognizance of the status of NCERC operations and the implementation of key nuclear safety management programs. EA identified one deficiency related to the requirements for performing triennial TQP assessments.

6.0 FINDINGS

Findings are deficiencies that warrant a high level of attention from management. If left uncorrected, findings could adversely affect the DOE mission, the environment, the safety or health of workers and the public, or national security. DOE line management and/or contractor organizations must develop and implement corrective action plans for EA appraisal findings. Cognizant DOE managers must use site- and program-specific issues management processes and systems developed in accordance with DOE Order 227.1A to manage these corrective action plans and track them to completion. In addition to the findings, deficiencies that did not meet the criteria for a finding are listed in Appendix C, with the expectation from DOE Order 227.1A for site managers to apply their local issues management processes for resolution.

EA identified no findings during this assessment. Deficiencies that did not meet the criteria for a finding are listed in Appendix C of this report, with the expectation from DOE Order 227.1A for site managers to apply their local issues management processes for resolution.

7.0 OPPORTUNITIES FOR IMPROVEMENT

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

Los Alamos National Laboratory

OFI-LANL-1: Consider application of engineered controls, such as task exhaust or local shadow shielding in the sample preparation and counting areas.

- Current post-irradiation controls are primarily based on gross dose rate or count rate measurements. Isotope-specific pre-irradiation calculations may provide insights for improved control sets, including effective local shielding tailored to anticipate post-irradiation hazards and decay times.

OFI-LANL-2: Consider installing personal contamination monitors and hand and foot monitors in low background areas and making them available for all personnel who enter contamination areas or adjacent radiological buffer areas.

Nevada Field Office

OFI-NFO-1: Consider providing guidance per DOE Guide 226.1-2A to FRs and SSOs on the breadth, number, and identification and coding of issues to ensure proper coverage of key program elements during the conduct of OAAs.

OFI-NFO-2: Consider conducting a joint safety system assessment with LANL CSE personnel or rescheduling the Federal safety system assessments to follow the LANL assessment of the same systems.

Appendix A
Supplemental Information

Dates of Assessment

Onsite Assessment: June 6-9, 2016

Office of Enterprise Assessments (EA) Management

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

Quality Review Board

William A. Eckroade
William E. Miller
Gerald M. McAteer
Michael A. Kilpatrick

EA Site Lead for Nevada National Security Site

Timothy F. Mengers

EA Assessors

William A. Macon, Jr. – Lead
Timothy F. Mengers
Albert E. MacDougall

Appendix B
Key Documents Reviewed, Interviews, and Observations

Documents Reviewed

- JLON-0053, Secondary JLON Real Estate Operations Permit (REOP), *LANL NCERC Operations at DAF*, Rev. 2, 9/22/2015
- JLON CEF-ENG-SDD-0348, *Godiva Critical Assembly System Design Description*, Rev. 6, 1/30/2014
- JLON CEF-ENG-SDD-0350, *NCERC Nuclear Instrumentation System Design Description*, Rev. 6, 1/30/2014
- JLON CEF-ENG-SDD-0351, *System Design Description for the NCERC SCRAM and Operational Interlock System*, Rev. 5, 1/30/2014
- JLON CEF-PLA-005, *NCERC Calibration Program*, Rev. 3, 5/11/2016
- JLON CEF-PLA-006, *Radiation Protection and Contamination Control at NCERC*, Rev. 9, 4/2016
- JLON CEF-PLA-012, *NCERC – DAF Interface Plan*, Rev. 3, 12/10/2013
- JLON CEF-SRV-001, *Nuclear Instrumentation Annual Calibration*, Rev. 3, 9/11/2014
- JLON CEF-SRV-002, *Critical Assemblies SCRAM Safety System (SSS) and Safety Shutdown Mechanism (SSM) Annual Surveillance*, Rev. 5, 9/11/2014
- JLON PLA-800, *JLON Nuclear Operations Training and Qualification Program Plan*, 10/5/2015
- LANL AP-341-101, *Designating Vital Safety Systems and Cognizant System Engineers*, Rev. 3, 7/31/2014
- LANL AP-341-517, *Design Change Form*, Rev. 1, 4/18/2012
- LANL AP-341-611, *System Design Descriptions*, Rev. 2, 8/11/2015
- LANL AP-341-802, *System Health Reporting*, Rev. 4, 2/23/2015
- LANL AP-341-901, *Performing Vital Safety System Assessments*, Rev. 4.1, 6/16/2015
- LANL *Causal Analysis of the NCERC DAF Uranium Contamination Event*, 12/11/2014
- LANL CEF-ADM-001, *Experiment Plan Preparation Procedure*, Rev. 4, 8/21/2014
- LANL CEF-ADM-004, *NCERC Document Processing and Use*, Rev. 2, 3/24/2016
- LANL CEF-EXP-003, *Experiment Plan for Godiva*, Rev. 9, 6/30/2015
- LANL CEF-SOP-003, *Operating Procedure for the Godiva Critical Assembly*, Rev. 10, 3/26/2015
- LANL *Charter for the Critical Experiments Safety Committee*, 4/5/2016
- LANL *Crew Member Job Task Analysis*, 6/2009
- LANL *Crew Chief Job Task Analysis*, 6/2009
- LANL *Evaluation Plan for Engineering Controls Implemented to Mitigate Godiva Contamination*, 7/15/2015
- LANL LA-UR-15-27326, *Criticality Experiments Safety Committee Review of NCERC*, Rev. 1, 2015
- LANL *National Criticality Experiments Research Center Corrective Action Plan*, 2/20/2015
- LANL NCERC-TPP-001, *National Criticality Experiments Research Center Training Program Plan*, Rev. 0, 3/21/2016
- LANL NEN-2, *Lesson Plan Course Number 18353, Module 3: Criticality Safety Training for Fissionable Material Handlers*, Rev. 2, 4/2015
- LANL NEN-2, *Lesson Plan Course Number 49733, Module 7: Godiva*, Rev. 4
- LANL NHHO-NCERC-CM-QS-028, *NCERC Crew Member/Chief Qualification Standard*, Rev. 8, 4/2016
- LANL NHHO-PLAN-011, R0, *DOE Order 426.2 Compliance Plan*, 4/5/2016
- LANL P300, *Integrated Work Management*, Rev. 7, 12/9/2015
- LANL P343, *Facility Engineering Training and Qualification Manual*, Rev. 5, 7/28/2015

- LANL P511, *Work at National Nuclear Security Administration/Nevada Field Office Managed Sites in Nevada*, Rev. 3, 4/21/2015
- LANL P781-1, *Conduct of Training*, Rev. 10, 12/22/2014
- LANL U Train Report, Curriculum WQGG020A-2803-N-2, *CEF Godiva Crew Member*, 6/25/2011
- LANL U Train Report, Curriculum WQGG020A-1113-N-2, *Fissionable Material Handler*, 6/25/2011
- *Memorandum of Agreement DE-GM58-14NA25512 Between the National Nuclear Security Administration Nevada Field Office and Los Alamos Field Office*, March 2014
- NFO ASM-AMBCM-OA-15-OMGR-051, *Assessment Report for NSTEC Training and Qualification Program*, 8/2015
- NFO ASM-AMSS-10.7.2011-386611, *Assessment Report for the Nuclear Instrument System at the NCERC*, 12/2011
- NFO ASM-AMSS-10.26.2011-296359, *Assessment Report for the Scram Safety System and Safe Shutdown Mechanisms of the Godiva, Planet, Comet, and Flat-Top Critical Assembly Machines at CEF*, 9/2011.
- NFO *FY 16 Joint Assessment Schedule*
- NFO O 226.X, *Federal Oversight Program*, Rev. 2, 2/172016
- NFO PLN-OA-16-AMSS-005, *Assessment Plan for the Scram Safety System/Safe Shutdown Mechanisms of the Critical Assembly Machines at the NCERC*, 6/2016
- NFO *Safety System Oversight Representative Qualification Standard*, 12/2015
- NSTec CCD-QA05.004, *NSTec Standards and Calibration Program*, Rev. 4, 5/12/2016
- NSTec CD-NENG.019, *Unreviewed Safety Question Process*, Rev. 5, 8/27/12
- NSTec DAF-DSA-01, *Nevada National Security Site Device Assembly Facility Documented Safety Analysis*, Rev. 4, September 2015
- NSTec DAF-TSR-01, *Nevada National Security Site Device Assembly Facility Technical Safety Requirements*, Rev. 8, September 2015
- NSTec NCERC-DSA.100, *Nevada National Security Site Device Assembly Facility Documented Safety Analysis Addendum for the National Criticality Experiments Research Center*, Rev. 0, September 2015
- NSTec NCERC-TSR-01, *Nevada National Security Site National Criticality Experiments Research Center Technical Safety Requirements*, Rev. 0, September 2015
- NSTec OP-DAF.AD21, *Approval Process (SBI)*, Rev. 2, 8/11/2014
- NSTec OP-DAF.SP00, *Control and Execution of Device Assembly Facility (DAF) Activity Level Work Documents Involving Surveillance Requirements (SBI)*, Rev. 1, 8/26/2014
- NSTec OP-NENG.040, *Review of Completed Unreviewed Safety Question (USQ) Documents*, Rev. 7, 02/26/2014
- NSTec PD-NOPS.003, *Integrated Nuclear Criticality Safety Program Description*, Rev. 0, 2/20/2012

Interviews

- LANL Nuclear and High Hazard Operations Training Group Leader
- NCERC NEN-2 Group Leader/Deputy Group Leader
- NCERC NEN-2 Crew Chiefs (2)
- NCERC NEN-2 Division Training Specialist
- NCERC NEN-6 Group Leader/ Deputy Group Leader
- NCERC NEN-6 Quality Assurance Engineer
- NCERC Maintenance Manager
- NCERC Cognizant System Engineers (2)
- NSTec Radiological Control Technicians (2)
- NFO Assistant Manager for Safety and Security

- NFO Facility Representative
- NFO Safety System Oversight Representatives (2)
- NFO Functional Area Subject Matter Experts (2)
- NSTec Radiological Control Manager
- NSTec DAF Training Specialist

Observations
- Godiva Burst Operation
- Planet Experiment Handing
- FR/SSOR Walkdowns

Appendix C
Deficiencies

Deficiencies that did not meet the criteria for a finding are listed below, with the expectation from DOE Order 227.1A for site managers to apply their local issues management processes for resolution.

Los Alamos National Laboratory

The NCERC Operator OJT Checklist, as implemented, does not adequately reflect the requirements provided in DOE Order 426.2 for continuing training on normal and abnormal operating procedures and documentation of required control manipulations.

The NCERC TPP, as implemented, does not adequately reflect the requirements provided in DOE Order 426.2 for performing triennial assessments of the NCERC operator training and qualification program.

Los Alamos Field Office

The NA-LA oversight process, as implemented, does not adequately reflect the requirements provided in DOE Order 426.2 for performing Federal triennial assessments of the NCERC operator training and qualification program.