Office of Enterprise Assessments Targeted Review of the Management of the Safety-Related 480 Volt Diesel Bus Battery-Backed Power System of the Idaho National Laboratory Advanced Test Reactor at the Idaho Site

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Acronyms

ATR	Advanced Test Reactor
BBP	Battery-Backed Power
BEA	Battelle Energy Alliance, LLC
CAS	Contractor Assurance System
CM	Corrective Maintenance
CRAD	Criteria, Review and Approach Document
CSE	Cognizant System Engineer
DOE	U.S. Department of Energy
EA	Office of Enterprise Assessments
ECAR	Engineering Calculations and Analysis Report
EDMS	Electronic Data Management System
EJ	Engineering Job
EOC	Extent of Condition
ICP	Idaho Cleanup Project
ID	Idaho Operations Office
INL	Idaho National Laboratory
INPO	Institute for Nuclear Power Operations
M&TE	Measurement and Test Equipment
MRM	Management Review Meetings
NE	DOE Office of Nuclear Energy
NMMP	Nuclear Maintenance Management Program
OFI	Opportunity for Improvement
PdM	Predictive Maintenance
PHC	Plant Health Committee
PM	Preventive Maintenance
PMT	Post Maintenance Testing
SAR	Safety Analysis Report
S/CI	Suspect/Counterfeit Item
SR	Surveillance Requirement
SSC	Structures, Systems, and Components
TSR	Technical Safety Requirement
UPS	Uninterruptable Power Supply
USQ	Unreviewed Safety Question

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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 management of the safety-related 480 Volt Diesel Bus Battery-Backed Power System at the Idaho National Laboratory (INL) Advanced Test Reactor (ATR). This independent assessment, conducted during two one-week reviews (April 28-30 and June 1-4, 2015, respectively), was part of a larger targeted assessment of safety structures, systems, and components across the DOE complex.

Overall, Battelle Energy Alliance, LLC (BEA), the operating contractor for INL, has effectively implemented the required programs and processes for ensuring that the ATR 480 Volt Diesel Bus Battery-Backed Power System is well maintained. Procedures, work documents, and records associated with the system provide evidence of an acceptable maintenance program. One best practice was identified related to ATR incorporation of Human Performance Improvement error reduction tools into the work control process as a requirement for conducting work activities. From pre-job briefings to work execution and returning equipment to operable status, the workers and their management discuss and implement the error reduction tools specific to the work scope. The ATR management observation program reinforces use of the tools.

Surveillance and testing activities for the system are properly performed in accordance with technical safety requirements and surveillance requirements. Operations are conducted in a manner that ensures the availability of the system to perform its intended safety functions when required, and procedures are technically adequate to achieve the required level of system performance. The ATR 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 program for ATR and the reviewed implementing procedures meet the requirements of DOE Order 420.1C, *Facility Safety*, and the cognizant system engineers are knowledgeable of facility processes and their assigned systems. In most cases, BEA was proactive in appropriately entering EA observations into its issues management system at the time of identification. A few minor weaknesses exist in the tracking to closure of unverified assumptions in safety-related calculations, and in some aspects of feedback and improvement processes (e.g., the scope of configuration management program self-assessments). Overall, BEA has established and implemented the feedback and improvement programs and processes necessary for effective evaluation of nuclear safety processes and performance at ATR.

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1.0 PURPOSE

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA), conducted an independent review of the safety-related 480 Volt Diesel Bus Battery-Backed Power (BBP) System at the Idaho National Laboratory (INL) Advanced Test Reactor (ATR) at the Idaho Site.

EA conducted offsite planning in April 2015 and performed onsite data collection during two visits to the site, April 28-30 and June 1-4, 2015. This report discusses the scope, background, methodology, results, and conclusions of the review, as well as findings and opportunities for improvement (OFIs) identified during the review.

2.0 SCOPE

This targeted review evaluated the effectiveness of processes for operating, maintaining, and overseeing the performance of selected safety systems at ATR. Specifically, EA selected the recently installed 480 Volt Diesel Bus BBP 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 ATR safety basis as it relates to the selected system, but did not evaluate the adequacy of the documented safety analysis. EA also reviewed contractor feedback and improvement processes and procedures as they relate to the selected system. 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
- VIII. Safety System Feedback and Improvement.

3.0 BACKGROUND

The EA independent assessment 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 EA independent assessment program is described in and governed by DOE Order 227.1, *Independent Oversight Program*, and EA implements this program through 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. 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.

The Idaho Site includes INL, the Idaho Cleanup Project (ICP), and the Advanced Mixed Waste Treatment Project. The Idaho Operations Office (ID) provides direction and oversight for the design and operation of the Idaho Site nuclear facilities for the DOE Offices of Nuclear Energy (NE) and Environmental Management. NE is responsible for INL facilities and general site operations including ATR, and the Office of Environmental Management is responsible for ICP and Advanced Mixed Waste Treatment Project facilities. The ID Deputy Manager for Operations Support is ultimately responsible for the day-to-day oversight of the ATR. The NE Chief of Nuclear Safety is the safety basis approval authority and startup authorization authority for the ATR. Battelle Energy Alliance, LLC (BEA) is the primary contractor responsible for the management and operation of ATR.

ID oversees BEA and is responsible for administering the contract, executing assigned DOE and NE programs, and conducting oversight of work performed at INL in support of DOE and NE requirements and priorities. INL's mission is to lead and integrate U.S. nuclear energy research, development, demonstration, and deployment efforts and to ensure the nation's energy security with safe, competitive, and sustainable energy systems and unique national and homeland security capabilities. The ATR is one of two remaining research reactors within DOE that is classified as a Category 1 nuclear facility, as defined by DOE-STD-1027, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*. The ATR is the only U.S. research reactor capable of providing large-volume, high-flux neutron irradiation in a prototype environment, and the reactor makes it possible to study the effects of intense neutron and gamma radiation on reactor materials and fuels.

The operation of ATR relies upon several power sources. The power sources include commercial, diesel generator, and battery-backed sources. The newly installed 480 Volt Diesel Bus BBP System provides power to operate selected loads, including an emergency coolant pump, 670-M-10, for at least 30 minutes after loss of commercial power. The new BBP system replaces two continuously running diesel generators (670-M-42 and M-43), which are now only used if needed as a back-up to the existing emergency diesel generator (674-M-6).

Although this review focused primarily on the selected 480 Volt Diesel Bus BBP 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 this targeted review through detailed document reviews and onsite review of system material condition and contractor safety system engineering, operations, maintenance, and feedback and improvement activities. The review included observation of contractor personnel during facility walkthroughs, safety system walkdowns, surveillance tests, and contractor assessments or observations of maintenance on the safety system. EA 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 feedback and improvement processes, EA reviewed development, implementation, and evaluation of corrective actions as well as dissemination and review of program and process documents. EA also 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 phases, including offsite planning, onsite data collection activities, and 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. At the conclusion of onsite data collection, EA briefed key ID and BEA managers regarding initial observations. EA prepared a draft EA review report identifying overall perspectives, deficiencies, and OFIs and provided it to line management for factual accuracy verification and feedback. Finally, EA provided the results of the review 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 review criteria were satisfied:

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

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

The system is periodically inspected in accordance with maintenance requirements.

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

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

EA reviewed the following selected elements of the ATR maintenance program in detail:

- Plans and programs
- Maintenance activities
  - Corrective maintenance (CM)
  - Preventive maintenance (PM)
  - Predictive maintenance (PdM)

- Periodic inspections
- Maintenance configuration control and conduct
- Training
- Procurement processes, including provisions for precluding introduction of suspect/counterfeit items (S/CIs).

In addition, EA included the following review activities:

- Detailed walkthroughs of the 480 Volt Diesel Bus BBP System.
- Review of the previous three years of CM and PM records for all BBS systems and emergency coolant pumps.
- Review of the Occurrence Reporting and Processing System reports for the last five years (2010-2014).
- Observation of maintenance and calibration activities performed during the onsite data collection period.
- Observations of daily plan-of-the-day meetings. In addition, a Plant Health meeting was attended where equipment reliability issues were presented and discussed.

Nuclear Maintenance Management Program

Maintenance of safety-related structures, systems, and components (SSCs) is addressed in the DOE-approved nuclear maintenance management program (NMMP) for INL 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 (PDD-6000, *INL Nuclear and Non-nuclear Maintenance Management Program*) references and is supported by multiple implementing maintenance procedures, and the implementing documents adequately reflect NMMP requirements. The maintenance program is identified as a safety management program and therefore receives self-assessments triennially. Additional topical self-assessments are performed in various areas of the program (e.g., pre-job brief quality and maintenance history program). These assessments have been performed well and corrective actions for issues identified are placed into the issues management program.

The 480 Volt Diesel Bus BBP System is a new system that was declared operable on May 27, 2015. As expected, the system condition is in excellent condition, and the PM program, which is designed to maintain the system, meets vendor recommendations. All PMs are up-to-date for the system and the system was in proper alignment. During the onsite review, the 480 Volt Diesel Bus BBP System was fully operable, with no out-of-service equipment, no active temporary modifications, and no out-of-date calibrations on any system instrumentation.

Corrective, Preventive, and Predictive Maintenance

Overall, BEA has implemented acceptable maintenance processes for the 480 Volt Diesel Bus BBP System, which include CM, PM, and PdM. These processes are consistent with the system's safety-related designation. Maintenance processes, including provisions for CM, PM, and PdM that cover safety systems for ATR, are addressed in the NMMP and ATR procedures for work control and change control.

All maintenance activities at ATR are required to be conducted under the process described in the INL-wide procedure LWP-6200, *Maintenance Integrated Work Control Process*, which properly flows down INL NMMP requirements. The work control process identifies the hazards, associated controls, and parts to be used. For each activity (CM, PM, or PdM), a work package is generated specifically for that scope of work.

The commercial nuclear power industry recognizes two critical elements for successful long-term facility operation: Equipment Reliability and Human Performance Error Reduction. The Institute for Nuclear Power Operations (INPO) has good practice standards in each of these areas and includes them in its biennial reviews of each nuclear power station. Plant Health processes were instituted by nuclear utilities to address continued improvement in equipment reliability, and from operations to maintenance to engineering, human performance error reduction tools were adopted as a way of doing business throughout each facility. The result was safer, more cost-effective facility performance. Although it is not required by DOE, BEA has implemented programs to address each of these areas at ATR, and specifically requires and reinforces the use of the error reduction tools as work is conducted. EA considers the integration of the human performance error reduction tools into the work control process at ATR to be a best practice.

PM activities for ATR are performed by craft workers assigned to and managed by the ATR organization and have been appropriately developed for safety-related equipment including the 480 Volt Diesel Bus BBP System. The PMs associated with the 480 Volt Diesel Bus BBP System meet vendor recommendations and industry practice for BBP systems including Institute of Electrical and Electronics Engineers recommendations in 450-2010, *IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications.* For example, PMs include weekly pilot battery checks (i.e., pilot cell voltage, specific gravity, and temperature) as a representation of the condition of the battery bank. The pilot cell is appropriately selected as a mid-bank cell so as to not be influenced by the charger. Another PM verifies the condition of individual cells every 100 days, which provides a comparison to the weekly checks. BEA also performs an annual battery rundown test PM to verify the battery capacity to deliver at least 80 percent of rated capacity for at least 30 minutes. Finally, BEA calibrates the temperature instrument that is used to maintain system operability annually, which is a common industry frequency.

During the onsite data collection period of the assessment, no in-plant CM activities occurred. As a result, assessment of CM performance was limited to the work package review discussed later in this section. EA observed five safety-related PM activities during the onsite portion of this assessment. Two of the activities were calibration activities associated with the reactor inlet and outlet temperature instruments. EA also observed weekly and monthly checks of the 480 Volt Diesel Bus BBP System batteries and the sensitivity check of the Nitrogen-16 system performed at the beginning of each operating cycle. Each of the PMs were properly planned and scheduled, and pre-job briefings were thorough and included the hazards and associated controls for the activity. ATR management was in attendance during pre-job activities and in the case of the Nitrogen-16 PM, the shift supervisor coached the job foreman on the importance of using a particular human performance error reduction tool that was not mentioned during the pre-job briefing (i.e., procedure placekeeping). Throughout the PM activities, workers used placekeeping, three-way communication, self-checks, and peer checks to effectively reduce the potential for touching the wrong piece of plant equipment, missing a procedure step, and mis-recording information communicated verbally. Effective interaction occurred between job supervision, both during pre-job briefs and while the PMs were conducted. Craft workers were knowledgeable of plant systems and the PM tasks being performed.

EA reviewed a sample of 34 work packages conducted during the last three years for adherence to DOE Order 433.1B and the ATR work control process. The approved work scope matched the work instructions in the package using appropriately documented spare parts, and included post-maintenance testing to reestablish operability of the system/equipment. However, EA noted several minor discrepancies, which were subsequently entered into LabWay (the INL issues management system software application) as described below:

- Work steps not properly documented in the work record. (3 examples)

  Troubleshoot and Repair (TS&R) work packages require documentation of specific actions taken during the TS&R evolution to be documented on the Troubling Shooting Record Sheet. However, work packages 188209 and 210465 contained multiple steps that were not documented on the record sheet. In a third TS&R work package (183558), steps 8.2, 8.4, 8.5, 8.6, and 8.8 indicated that actions were entered into the Wire Removal/Replacement Checklist form in the back of the work package. However, no wire removal or replacements were recorded on the sheet. (LabWay CO 2015-2829)

- Work steps that were unclear. (4 examples)

  Work packages 181799, *670 M-6 PCP Pump 4 Year Inspection*, and 181914, *670 M-8 PCP Pump 4 Year Inspection*, include steps that state "Inspect alignment" with a box for "SAT" or "UNSAT." The step does not identify criteria for conducting the inspection nor what constitutes an acceptable result. Work order package (WOP) 183558 is a TS&R package for an inadvertent start that occurred on the M-11 Emergency Cooling Pump. In the work order (WO) Task Instructions section of the work package, the problem is stated; however, no task instruction is given in this section of the package. In the Description/Scope section of WOP 188209, *Replace M-6 Diesel Radiator Fan (M-8) Bearing Assembly*, the work was to include replacing the fan bearing and sending the fan hub and blades for balancing. However, as part of revision 1 to the package, troubleshoot and repair steps were added without revising the work scope section of the package. WOPs 206050, *M-6 Diesel Annual Engine Maintenance* and 209389, *670-M-11 Semi-Annual Emergency PCS Pump Inspection*, contain steps to perform various inspections and verifications. However, the criteria used for the inspection and requirements for documenting the *670 M-8 PCP Pump 4 Year Inspection* inspections are unclear. (LabWay CO 2015-2848)

- Inconsistent use of procedure placekeeping. (6 examples prior to 2013, 5 examples from 2013-2015)

  In 2013, ATR maintenance management began to enforce the use of human performance error reduction tools including procedure/work package placekeeping by all involved personnel. The examples identified prior to 2013 reflected poor use of placekeeping. In the group of examples identified since 2013, maintenance craft exhibited good use of placekeeping. However, when steps in the work package were performed by other organizations, including operations and engineering, placekeeping was inconsistent. (LabWay CO 2015-2849)

- Post Maintenance Testing (PMT) that does not include test objectives and/or acceptance criteria. (10 examples)

  LWP-6200 requires that the PMT objectives and acceptance criteria be identified in the work package. However, the work packages did not identify the objectives of the PMT but merely listed a sequence of steps to be completed or referred to a document that is not included in the work package (e.g., a department level procedure). (LabWay CO 2015-2850)

- Worker feedback identified in work packages was not addressed. (3 examples.)

> The work order packages contain worker/technical staff feedback regarding specific changes that need to occur in future maintenance activities. LWP-6200 requires the maintenance planner to "resolve any comments or feedback supplied by the Foreman, Crafts, technical professionals (e.g., Safety & health, environmental, quality assurance, Engineering, Radiation Control), or other reviewers." It also requires the planner to "contact the individuals with the resolution to the comments or feedback." Contrary to these requirements, no evidence was provided that the planner took action in these instances. (See **OFI-BEA-MAINT-01**.)

BEA management has developed an acceptable set of maintenance performance measures, which includes maintenance backlog for critical and non-critical systems and work package delays. In addition, maintenance management is developing additional metrics that are intended to improve maintenance performance. For example, metrics to track rework and work package quality are planned for a new Maintenance Program Score Card that is designed to evaluate the ongoing health of the maintenance program at ATR.

As of the end of April 2015, there were 364 open work orders and work requests for ATR. Only 2 of the 364 open items were related to CM needed on critical equipment, and none were related to the 480 Volt Diesel Bus BBP System. There was no backlog of PMs and PdMs, and no deferred maintenance items. No Occurrence Reporting and Processing System reports specifically involving performance degradation or maintenance of the 480 Volt Diesel Bus BBP System have been filed. Therefore, BEA is acceptably managing the maintenance backlog associated with safety systems.

Periodic Inspections

Various forms of periodic inspections and assessments are required, documented, and reviewed through multiple INL plans and procedures, including LWP-13740, *Performing Inspections*, and LWP-10601, *System Health Monitoring.* A third procedure, MCP-6102, *Conducting Facility Condition Assessments*, is credited in the NMMP to address aging degradation and facility condition assessments but was suspended in January 2015. A transition plan PLN-4386, *Transition Plan for INL Condition Assessment Surveys*, was established in January 2013 and stated that a new laboratory-wide procedure was to be issued to replace MCP-6102. However, no procedure has been issued and INL is now (since 2014) using a third-party contractor to perform real property asset inspections every five years. The NMMP (PDD-6000) has not been updated to reflect real property inspections performed by a third party or to correct several outdated references including MCP-6102. ATR management has initiated the LabWide Condition LabWay CO 2015-3254 in their issues management system to address this weakness.

The primary method of performing inspections/assessments of equipment performance is through the system health process. Each safety-related ATR system is covered by a monthly system health report. The process includes specific criteria to determine the health of a particular system or group of systems. The health reports, prepared by the cognizant system engineer (CSE), contain a scoring criteria and each system attribute is evaluated as green, white, yellow, or red in decreasing health order. The system health grading process is discussed further in Section 5.4, below. The results of the system health reports are presented to the ATR Plant Health Committee (PHC) chaired by the ATR Station Manager. Some of the health reports are prepared for an individual system (e.g., Primary Coolant System, Emergency Fire Water Injection System, and In-Vessel Post Accident Monitoring System) and reflect acceptable detail on system health. However, the system health report that evaluates the health of the 480 Volt Diesel Bus BBP System is the ATR Electrical Power Supply health report, which contains all electrical systems and equipment from the ATR Substation inward to the last ATR safety-related load including switch gear, motor control centers, diesel generators, and BBP systems. The report does not contain sufficient detail to determine the health of the 480 Volt Diesel Bus BBP System. For example, the ATR electrical Power Supply Report currently contains four areas of concern (grades of yellow or red). Yet, none of the concerns are associated with safety-related BBP systems. The relative health of the safety-related systems that are included under this broad health report is unclear from a review of the report. (See Section 5.4 of this report.)

A review of corrective actions for areas of the ATR Electrical Power Supply Health Report for February 2015 that are rated yellow and red confirmed that each of the actions are properly captured and tracked in the INL issues management system.

Configuration Control and Conduct of Maintenance

Maintenance is conducted in accordance with LWP-6200, *Maintenance Integrated Work Control Process*. Maintenance planners adequately plan work using a planning cycle process with the goal of all work packages prepared/approved and material and craft resources identified to execute the work by 4 weeks prior to the date of work performance. Work and plant configuration is controlled by the ATR Shift Supervisor and is coordinated with plant organizations through daily plan-of-the-day meetings. Each afternoon during the work week the daily schedule is reviewed by ATR management for adjustments in work activities scheduled for the next day. The process was determined by EA to be acceptable to properly conduct maintenance activities at ATR and maintain proper safety system configuration in all areas reviewed.

ATR has established a process for control of maintenance tools including calibration and measurement and test equipment (M&TE). The ATR instrument technicians perform calibration of facility equipment using procedures and standards that meet the requirements of International Organization for Standardization standard ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*.

Observed calibrations of ATR 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. The calibration program and the use of M&TE were adequate and effective.

Procurement, Receipt Acceptance, and Suspect/Counterfeit Items

The INL procurement process, as defined in LWP-4001, *Material Acquisitions*, is acceptable for obtaining ATR safety-related SSCs. Materials for the new 480 Volt Diesel Bus BBP System are procured as Quality Level-1 from a qualified vendor. EA viewed a sample of ten 480 Volt Diesel Bus BBP System spare parts in storage and the associated procurement and receipt inspection documentation. No issues were identified.

BEA has implemented a thorough process to guard against S/CI. LWP-13510, *Identifying and Controlling Suspect/Counterfeit Items,* implements the S/CI prevention process. In addition, all current ATR craft workers 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. The training records for all required ATR craft and engineering personnel were verified with no issues identified.

Maintenance Summary

BEA has acceptable maintenance processes for the 480 Volt Diesel Bus BBP System in place for corrective, preventive, and predictive maintenance, and the processes are consistent with the system's safety-related designation. During this EA review, the system was fully operable, with no out-of-service equipment and no active temporary modifications, and all system instrumentation requiring calibration was current. The DOE-approved NMMP and implementing procedures applicable to the ATR meet the requirements of DOE Orders 433.1B and 430.1B and are adequate to maintain acceptable levels of safety 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. One best practice was identified related to the integration of human performance error reduction tools into each work activity.

BEA workers and supervisors properly planned, scheduled, and performed observed ATR maintenance activities. No functional failures of SSCs and no backlog of CM or PM existed at the time of this review of the 480 Volt Diesel Bus BBP System. The PM programs for the 480 Volt Diesel Bus BBP System are acceptable and are properly planned and scheduled. EA identified minor weaknesses in the area of work package documentation, but overall the system selected is maintained in a condition that ensures its integrity, operability, and reliability.

5.2 Surveillance and Testing

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

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

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

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

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

EA reviewed the procedures and results used to meet the Technical Safety Requirements (TSR) surveillance requirements (SRs) (measurements of the key operating parameters required by the safety basis) for the 480 Volt Diesel Bus BBP System. The EA review included review of other BBP system SRs as well as documented weekly and monthly SRs for the 480 Volt Diesel Bus BBP System. Additionally, EA observed performance of all weekly and monthly TSR SRs for the 480 Volt Diesel Bus BBP System and other BBP systems.

Overall, BEA workers properly perform surveillance and testing activities for the selected systems in accordance with TSR SRs. 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.

ATR has conservatively determined to dedicate different hydrometers for use with two different types of lead acid batteries. The two battery types are those with lead-antimony grid material and those with lead-calcium grid material. This was done to reduce the opportunity for cross contamination of battery electrolyte solutions. Antimony contamination in lead-calcium batteries can lead to self-discharge, lowered on-charge voltage, and reduced battery life. The cases that contain the hydrometers have been labeled with the battery type to which the hydrometer has been dedicated, and the associated battery systems for which the instrument is appropriate. However, the weekly surveillance procedure (DOP-2.8.18, *ATR Weekly Battery Bank Surveillance*) does not incorporate this information, and does not specify the use of the dedicated hydrometer for the particular batteries being tested. Additionally, the procedure requires the identification number and calibration due date of the hydrometer to be recorded, but does not recognize that two separate hydrometers, each with a different identification number and calibration due date are actually required. Of the nine times the surveillance has been performed since revising the procedure to include the batteries banks for the 480 Volt Diesel Bus BBP System, only twice was the instrument information recorded on the completed procedure. Additionally, the procedure requires surveillance on spare batteries associated with the 480 Volt Diesel Bus BBP System in two different sections of the procedure, even though there is only a single bank of spare batteries for the system. EA discussed these items with the CSE for the battery systems and engineering management who have initiated an action items in BEA's issues management system (LabWay CO 2015-2501 and SG-2015-0925) to address the issue.

Surveillance and Testing Summary

Surveillance and testing activities for the 480 Volt Diesel Bus BBP System 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. The need for procedure changes to prevent electrolyte contamination has been documented in the BEA issues management system.

5.3 Operations

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

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

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

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

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

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 480 Volt Diesel Bus BBP System. 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, BEA operations personnel conducted operations 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, procedure use, proper system response, failure modes, and required actions for system upsets. The ATR operator training program is comprehensive and fully compliant with DOE Order 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*. 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 plant equipment.

EA observed effective use of Human Performance Improvement tools in accordance with MCP-9501, *ATR Programs Communications and Procedure Use*. These included three-way communications, use of the phonetic alphabet, and procedure placekeeping. Although MCP-9501 provides for a variety of placekeeping methods, EA observed that the "circle-slash" technique was consistently used by all workgroups observed.

EA observed an appropriate level of technical inquisitiveness regarding alarm response procedures for the 480 Volt Diesel Bus BBP System. The alarm for "480 V Diesel UPS Trouble" was received in the control room during a period of high winds and lightning. The shift supervisor directed response in accordance with Abnormal Operating Procedure AOP 40.5, *480 V Diesel UPS Trouble*. The alarm cleared on its own after several seconds. The operator who had been dispatched to the location of the UPS reported that the front panel was as expected for normal operations. This same sequence repeated a few minutes later, with similar results. The shift supervisor had participated in start-up testing of the UPS and recalled that certain alarms remained present on the UPS front panel display until they were acknowledged locally. Since the operator had reported that the UPS front panel was displaying no alarms, the shift supervisor demonstrated appropriate technical inquisitiveness by contacting the CSE to investigate further. The CSE performed additional research with the vendor manual and determined the method for recalling the alarm history log. The CSE and the shift supervisor noted that the alarm history log correctly recorded instances when the supplied power was temporarily outside the desired parameter, initiating the trouble alarm. However, the time logged for the events was 1 hour offset from the time the alarms were received in the control room. Further investigation revealed that the UPS clocks had not been adjusted for the time change to Mountain Daylight Time. The CSE also determined that alarm conditions that no longer exist will not be displayed on the UPS front panel. The shift supervisor later informed EA that the UPS clocks had been adjusted to reflect the correct time, and that the Daily Timely Orders had been updated with instructions for UPS alarm history retrieval in the event of a similar transient event.

Although operations are generally effective, EA observed one case where BEA had not adequately rolled down DOE Order 422.1, *Conduct of Operations*, requirements into ATR requirements and implementing procedures. The DOE-approved Conduct of Operations matrix for INL is LST-9000, *Conduct of Operations Conformance Matrix*. It correctly states that the elements specified in DOE Order 422.1, Requirement 2.m, addressing "Control of Interrelated Processes," are applicable at INL, and lists three documents: LWP-9600, *Conduct of Operations for the Idaho National Laboratory*, IAG-59, *Interface Agreement between Power Management and SMC*, and MCP-9600, *Conduct of Operations for the Materials and Fuels Complex Facilities Operations.* Of these three documents, two are limited to specific facilities (facilities at Special Materials Complex and Materials and Fuels Complex) and only LWP-9600 applies to ATR. LWP-9600 provides a description and examples of Interrelated Processes, and it assigns responsibility to the Cognizant Operations Manager for implementing each of the three specific elements of DOE Order 422.1, Requirement 2.m. At ATR, the only interrelated process not directly under the control of ATR personnel is offsite electric power. This interrelated process is recognized by IAG-54, *Interface Agreement between Power Management and Advanced Test Reactor Complex.* The interface agreement defines boundaries of responsibility for each organization and provides an adequate framework for incorporating each element of DOE Order 422.1, Requirement 2.m. However, IAG-54 does not address element 2.m.(2) "Operator training and qualification to understand interrelated processes, to interpret instrument readings, and provide timely corrective action for process-related problems." Additionally, IAG-54 addresses communications related to work management and out-year demand forecasting, but does not specifically address communications regarding emergent conditions. Although communications regarding emergent conditions occur, they are not formally addressed in IAG-54. (See **OFI-BEA-OPS-01**.)

Operations Summary

Overall, BEA operations personnel conduct operations 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 ATR operator training program is comprehensive. 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. EA noted one deficiency, i.e., BEA does not fully comply with requirements in DOE Order 422.1 related to the control of interrelated processes.

5.4 Cognizant System Engineer Program and Configuration Management

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

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

Within the CSE element, EA reviewed the CSE program, CSE training and qualifications, CSE roles and responsibilities, safety system assessments (including the last three system health reports for the selected system), operations and maintenance technical support, and some aspects of configuration management. EA also conducted interviews with engineering management and three CSEs.

CSE Program

The CSE program for ATR is defined in R2A2-10004, *Cognizant System Engineer*. R2A2-10004 describes the roles, responsibilities, accountabilities, and authorities for CSEs and adequately addresses the requirements of DOE Order 420.1B, *Nuclear Safety*, Chapter V, *Cognizant System Engineers*. In addition, the responsibilities for CSEs described in DOE Order 433.1B are also adequately addressed in R2A2-10004.

EA reviewed a BEA self-assessment performed in March 2015 in response to CSE issues identified by ID. The self-assessment report, issued on March 12, 2015, *ATR Complex Cognizant System Engineer Assignments and Qualifications*, concluded that the ATR CSE program was "marginally effective." EA agrees with this conclusion. The report identified eight issues related to implementation of the CSE program at ATR. Five of the issues were non-compliances with the ATR training program. Among these issues was, "ATR Cognizant System Engineers have not completed training as assigned on their training plan." A review of the training records for the CSE assigned to the 480 Volt Diesel Bus BBP System verified that the CSE was properly trained and qualified on this system. Another training issue identified in the self-assessment report was, "Training for system qualification has not been developed for all active safety systems." Three systems were identified but did not include the system that EA selected for review. The other CSE training issues were related to training documentation weaknesses.

The remaining three issues were related to CSE program implementation by the ATR Engineering Department. The self-assessment found that some of the ATR engineers assigned as CSEs to active safety systems had not fulfilled qualification standards, contrary to DOE Order 420.1B requirements. Another issue involved a conflict between some of the CSE responsibilities in R2A2-10004 and the CSE training program. Overall, the results of this BEA self-assessment are appropriate for the issues that ID identified. All issues identified in the self-assessment report have been entered into the INL issues management system (LabWay).

CSE Training and Qualifications

DOE Order 420.1B also requires CSEs to be trained and qualified as Technical Support Personnel in accordance with DOE Order 5480.20A, *Personnel Selection, Training, Qualification and Certification Requirements for U.S. Department of Energy Nuclear Facilities*. The ATR CSE training program is described in R2A2-10004 and includes requirements for education, experience, and initial and continuing training. These requirements align with the training and qualification requirements in DOE Order 420.1B. As discussed above, the CSE assigned to the system selected for review has completed the CSE qualification for his assigned systems. The CSE is also an experienced electrical engineer with many years of experience on BBP systems.

PDD-105, *ATR Programs Training*, includes minimum experience requirements for system engineers. The training, which covers all personnel qualification programs at ATR, requires system engineers to have 2 years of experience in areas such as “reactor physics, core measurements, core heat transfer, and core physics testing programs.” The CSE for the selected system does not meet this minimum experience requirement, which is also true for most if not all of the currently qualified and assigned CSEs. ATR engineering management acknowledged that this experience requirement was in error. EA recognized that ATR management did not intend for this requirement to be overly restrictive. (See **OFI-BEA-CSE-01**.)

Periodic Safety System Assessments

Periodic safety system assessments are conducted in accordance with SP-10.1.1.15, *ATR System Health Monitoring*. This procedure describes the methodology to perform system health monitoring by measuring designated activities using specific system performance indicators. CSEs prepare system health reports each month. Systems are given a numeric score, which is in one of four health color ranges (Green, White, Yellow, and Red) from fully healthy (Green) to significantly degraded health (Red). For each system health attribute that is yellow or red, an action plan is developed to improve the health of the system to a grade of white or green. The ATR system health process includes a PHC chaired by the ATR Station Manager. The PHC reviews and agrees with proposed actions for health improvement. During the assessment, EA attended one of the PHC meetings. The format and content of the meeting was effective in elevating concerns related to degraded system conditions.

The ATR CSE Safety System Health process is an acceptable process for conducting system assessments of operational readiness of identified systems to meet their safety functional requirements and performance criteria. However, EA identified two weaknesses, which ATR engineering management entered into the INL issues management system (LabWay).

- SP-10.1.1.15, *ATR System Health Monitoring*, procedure requires performance of system walkdowns per LI-550, *ATR Complex System Walkdown and Equipment Reliability Classification*. LI-550 requires documentation of walkdowns be “recorded” in the Configuration Information Management Database. However, CSEs are not documenting the conduct of walkdowns performed for systems being assessed for system health. In addition, the results of system walkdowns are not being factored into the monthly system health reports. (LabWay CO 2015-2805)

- The system health report for ATR Electrical Systems covers all safety-related electrical equipment including switch gear, motor control centers, and several UPS/battery systems. The health report is too broad to evaluate specific trends in system health for included components. For example, information specific to the performance of the 480 Volt Diesel Bus BBP System is not evident in the health report. (LabWay CO 2015-2804)

Although system notebooks are not currently required for the CSE assigned systems, one has been developed and maintained for the ATR Electrical Systems. The electronic notebook contains expected categories of information, is comprehensive, and appears up to date. The value of system notebooks as an important resource for current and future CSEs is understood by engineering management, and measures are being taken to develop system notebooks for other systems. (LabWay GA 2015-1226)

Operations and Maintenance Technical Support

Observed CSEs were actively involved in operations anomalies and maintenance evolutions. For example, the 480 Volt Diesel Bus BBP System CSE provided support to operations during a storm-induced power fluctuation at ATR on June 1, 2015, as discussed above. The CSE instructed operations staff regarding system alarms and how to obtain history information from the new BBP system. The CSE further assisted operations staff in the preparation of a standing order to ensure that operators could obtain a detailed history from the system at any time. EA observed evidence of CSE involvement in maintenance through the review of historical CM work packages. In each case, the CSE was an integral part of the work package preparation and implementation.

The effectiveness of assigned CSEs at ATR is generally acceptable. However, EA observed two additional weaknesses related to inconsistent implementation of the program.

- The CSE who identified an important lessons learned related to hydrometer use when testing lead-antimony and lead-calcium battery types (see Section 5.2) did not take actions to ensure that the weekly surveillance procedure was revised to prevent cross-contamination of the battery types when using the same hydrometer. EA observed the same hydrometer being used on both battery types during weekly testing. In this case, the effectiveness of the CSE was limited. (LabWay SG 2015-0925)

- R2A2-10004 includes a responsibility for CSEs to develop and maintain spare parts lists; however, these lists have not been prepared for all safety-related systems. For example, the ATR Electrical System CSE stated that he did not have a list prepared for the system but did provide a printout of available parts in inventory. The intent is to determine the spare parts and minimum quantities needed for each safety system. (LabWay CO 2015-2806)

Each of these weaknesses has been entered into the INL issues management system for resolution.

Configuration Management

The CSE has a significant responsibility in maintaining design control over assigned systems. As noted elsewhere in this section, the CSE is expected to use periodic walkdowns to establish and maintain a current awareness of the physical configuration of the system. Accountabilities in this regard are addressed in R2A2-10004, *Cognizant System Engineer*, which requires the CSE to ensure that relevant technical baseline documents, such as system design descriptions, drawings, diagrams, are complete, accurate, and up to date. The CSE is also expected to originate most design changes for proposed modifications. In a mature facility, such as the ATR, the need for system updates or modifications will generally result from system health considerations.

Although the CSE is not normally part of the design team for a planned modification, R2A2-10004 requires that the CSE review technical evaluations, analysis, and calculations affecting system SSCs. The CSE acts as the design authority, establishes and maintains design requirements, and ensures that design input documents accurately reflect the design basis for the system. PDD-10000, *Conduct of Engineering*, contains further definition of the CSE role in this area, with additional explanation of the design authority role. PDD-10000 designates the CSE as the design authority for his or her assigned SSCs. LWP-10500, *Managing the Configuration of Structures, Systems, and Components*, explains the CSE role in the CM process and provides direction for application of a graded approach and creation of a master equipment list.

EA review activities in this area included review of the procedures noted above followed by interviews with the system engineer for BBP systems, the CSE for power distribution systems, and the CSE for the primary coolant system. Information provided during the interview process supported the conclusion that the requirements of DOE Order 420.1B, with regard to the CSE role in configuration management, are being adequately implemented at ATR. EA noted CSE involvement in preparation of a purchase specification for new motor starters. Review of the Engineering Job (EJ) package for the new 480 Volt Diesel Bus BBP system indicated that the CSE performed a detailed review at issuance. The CSE also provided an approval signature at turnover and was involved in preparation of the Unresolved Safety Question (USQ) evaluation for that EJ.

Chapter V of DOE Order 420.1B, Change 1, Attachment 2, requires that hazard category 1, 2, and 3 nuclear facilities in operational status with safety class or safety significant SSCs have a documented configuration management program to ensure consistency among system requirements, performance criteria, documentation, and physical configuration. A similar requirement is contained in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, which is also applicable to INL and states that, "A configuration management process must be established that controls changes to the physical configuration of project facilities, structures, systems and components in compliance with ANSI/EIA-649A and DOE-STD-1073-2003."

In this review, EA limited its review of configuration management to four of the five principal areas: change control, work control, document control, and assessments, with work control being addressed separately under the Maintenance section of this report. The remaining areas are addressed individually below.

INL uses a complex hierarchy of documents to establish the configuration management program. The upper tier document is STD-143-104, *Idaho National Laboratory Configuration Management*. STD-143-104 references both ANSI/EIA-649A and DOE-STD-1073-2003, *Configuration Management Program*, and establishes broad requirements that meet the DOE standard by addressing the five key elements of a configuration management program.

PDD-10502, *INL Configuration Management Program*, is a more detailed program document, with a focus on accurately defining system boundaries, determining those components subject to the configuration management program, and establishing the technical baseline for that scope. It identifies the implementing procedures and establishes ownership of the configuration management program within the engineering organization.

LWP-10500, *Managing the Configuration of Structures, Systems, and Components,* is the laboratory-wide implementing procedure for configuration management. LWP-10500 focuses on the CSE role in determining an appropriate graded approach for application of configuration management requirements and on CSE input to the master equipment list. SP-10.2.4.1, *Configuration Management*, is the ATR-specific standard practice for implementing configuration management. It defines individual responsibilities for various positions and invokes the laboratory-wide procedure. In aggregate, these documents outline a program structured to meet the requirements of DOE STD-1073-2003. In practice, the individual elements of the program are accomplished through additional procedures specific to each of those areas, such as engineering change control or document control, which will be discussed in the following sections. Within the ATR engineering organization, a single individual has been designated to coordinate the change process and ensure that issued change documents comply with the configuration management process. The establishment of this coordinator function is both positive and necessary given the complexity noted above. The assigned individual was very knowledgeable about the program requirements.

Change Control

Change control is the process through which changes to the facility SSCs are proposed, evaluated, approved, and implemented. A structured, procedurally controlled process is necessary to ensure that facility impacts are appropriately analyzed before a change is implemented and that affected documents are updated to reflect the configuration of the facility after the change occurs. EA reviewed applicable INL procedures to gain understanding of the processes used at ATR. PDD-10000, *Conduct of Engineering*, is the parent document for engineering processes, defining roles and responsibilities, and providing a roadmap to implementing procedures. LWP-10000, *Engineering Initiation*, defines the process for identifying engineering inputs to design changes. This procedure is implemented as part of the design change initiation and authorization process. When an engineering task, such as a design change, is identified, it is necessary to properly document the appropriate inputs, scope, and requirements for the change, including quality classification and configuration management controls.

The ATR change control process is governed by LWP-10501, *Engineering Change Control*. This procedure describes the process for creating, implementing, and closing EJ packages and is the process used to make physical changes to the facility. LWP-10501 requires coordination with affected disciplines to identify all impacted documents for a design change early in the process. EA reviewed this procedure and interviewed key individuals within the ATR engineering organization to assess the requirements in place to manage the facility technical design basis during the change process.

The design change process utilizing the EJ form was robust. Proposed changes undergo reviews before and after approval, ensuring that impact on the system is thoroughly evaluated. CSEs in their role as design authorities for their assigned SSCs typically initiate EJs, perform technical reviews prior to implementation, and review again at closure. These reviews add rigor to the identification of impacts to upper tier and lower tier documents. USQ evaluations are generated by qualified safety basis evaluators with CSE participation. Functions and Operability Requirements documents are also prepared for major design changes. FOR-110, *ATR Transition to Commercial Power and Safety-Related Split Bus Installation*, provides a detailed set of functional requirements to guide the design of the 480 Volt Diesel Bus BBP System modification.

Individual engineering documents impacted by a design change are identified on the EJ form and, once the EJ is approved to work, are revised as necessary and placed into interim status awaiting completion of the change. New engineering documents, such as calculations required to support the change, are produced and issued in accordance with LWP-10200, *Engineering Calculations and Analysis Report (ECAR)*. In this procedure, the calculation preparer is required to “List assumptions that must be verified before the calculations and analysis results are used in the ‘Assumptions’ section of the ECAR.” This requirement is typical in nuclear safety-related applications. However, no process was found to be in place to keep track of these unverified assumptions to ensure that they are addressed and verified as required prior to “use.” (See **OFI-BEA-CSE-02**.)

Following implementation, the EJ package remains open until all impacted documents are issued and/or taken out of interim status. In this manner, the EJ becomes a tracking mechanism to ensure that all change impacts are resolved. In aggregate, the EJ process is adequate as a means of implementing change control as part of the overall configuration management program.

To sample implementation of the change control process, EA reviewed EJ 7.3.2.2-6/1163, *ATR Transition to Commercial Power*, for design and installation of the 480 Volt Diesel Bus BBP System. With respect to the design change process, EJs do not become permanent records until closure, although individual documents, which are part of an EJ, may be entered into the electronic data management system (EDMS) as separate records. EJ 7.3.2.2-6/1163 provided evidence that a substantive effort was made to identify all impacted documents including procedures. It also documented critical review by affected organizations and two final design reviews. The design change process described above was adequately implemented for this EJ at ATR.

ATR also uses a controlled process for dealing with vendor information/manuals received during the procurement process. These vendor documents are placed into a tracking system for review, and the design engineer is responsible for ensuring that the review is completed. Procurement quality assurance is charged with ensuring that all documents required from a vendor are received.

Document Control

Document control is an essential aspect of configuration management. Design records must be kept up to date, and the document control process must ensure that the latest version reflecting as-built status of the facility is available for use. EA interviewed the document management manager, who is responsible for the document control function at ATR, and a document control supervisor.

The EDMS is the electronic record keeping system. The document management group is responsible for document control, which includes creation, receipt, editing, and revision of documents, as well as scanning of those documents into EDMS. The document control group does not perform a policing function with regard to procedure compliance, because each ATR organization has a document control coordinator who reports to that organization and facilitates document control efforts within that group. Changes to individual records are accomplished using an electronic change request process. This is a document routing system that electronically controls and drives the document review and approval process. It can also be used to ensure completion of the USQ screening process. As noted, EJs remain open until it is verified that all affected documents have been revised to incorporate impacts from the change. Overall, the document control aspects of the ATR CM program meet the requirements of DOE Order 420.1B.

Assessments

DOE-STD-1073-2003 identifies five types of assessments that, in aggregate, are meant to determine the effectiveness of the configuration management program by detecting, documenting, determining the cause of, and initiating correction of inconsistencies among design requirements, documentation, and physical configuration. EA reviewed the two reports completed within the last 4 years that address design control. They are summarized below:

- Assessment Report IAS111213 was issued in February 2014 to document an assessment of ATR in three areas selected from the criteria in American Society of Mechanical Engineers NQA-1, 2000: Element 2, *Quality Assurance Program*, Element 3, *Design Control*, and Element 10, *Inspection*. The assessment of design control functions was based on review of documentation from two EJs developed to implement seismic upgrades at ATR. The assessment identified two issues that were documented in condition reports (LabWay items CO-2014-0751 and CO-2014-0760). CO-2014-0760 identified a process issue related to potential approval of drawing revisions based on unapproved field change requests. This issue affected laboratory-wide procedure LWP-10102. It is significant from a design control perspective and should be the subject of EA follow-up review to determine whether appropriate and comprehensive corrective actions were taken. Although the scope of the CO-2014-0760 assessment was limited, the issues identified were reflective of a fairly rigorous review.

- Assessment Report IAS121951 was issued in May 2012 to document an assessment of ATR in the area of operations configuration control associated with testing and maintenance. The assessment identified that procedural guidance was lacking in this area and that no formal process was in place for control of temporary modifications. The assessment also found that some operations procedures lacked adequate guidance regarding the return of equipment to the proper configuration following maintenance activities and that operations configuration control activities relied heavily on the knowledge of individuals rather than on formalized processes. BEA performed this assessment using a detailed checklist prepared in advance to guide the review process. The checklist led to identification of several issues and was an effective tool for the assessment.

Both assessments reflected adequate rigor in approach and conclusions, but were narrowly focused in scope. However, in aggregate, the two reports do not provide sufficient basis for any conclusion about the health of the overall configuration management program. Although DOE-STD-1073-2003 is not specific about timing or frequency of assessments, EA concluded that compliance with the requirements of DOE Order 420.1B in this area is acceptable. (See **OFI-BEA-CSE-03**.)

Cognizant System Engineer and Configuration Management Program Summary

BEA has established a CSE program at ATR that generally meets the requirements of DOE Order 420.1B, although some specific weaknesses detract from the effectiveness of the program. ID previously identified issues related to implementation of the CSE qualification, which led to a March 2015 BEA self-assessment, IAS15940, *ATR Complex Cognizant System Engineer Assignments and Qualifications*. The self-assessment identified eight issues and concluded that the ATR CSE program was "marginally effective." EA agrees with this conclusion and has identified additional weaknesses in some areas of the program (e.g., effectiveness of ATR Electrical Supply System health report, the documentation of system walkdowns, and integration of walkdown information into the system health report). Each issue has been entered into the INL issues management system for action.

CSE involvement in the area of configuration management was adequate, and overall, the implementation of the configuration management program was acceptable. However, EA identified two areas of weakness. The first related to the tracking to closure of unverified assumptions in safety-related calculations prior to declaring safety-related SSCs as operable. The second weakness involved performance of configuration management program assessments.

5.5 Safety System Feedback and Improvement

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

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

Formal processes are in place and effectively implemented to identify and analyze problems and issues (including operational incidents and events) related to engineering, configuration management, maintenance, surveillance and testing, and operations assurance activities and conditions; to identify, track, monitor, and close corrective actions; and to verify the effectiveness of corrective actions.

Results of engineering, configuration management, maintenance, surveillance and testing, and operations assurance processes for safety systems are periodically analyzed, compiled and, as appropriate, reported or available to DOE line management as part of contract performance evaluation.

A fundamental method of ensuring the functionality, operability, availability, and reliability of safety systems is the implementation of an effective feedback and improvement process that incorporates monitoring and trend analysis for system operability, analysis of incidents and off-normal conditions, and lessons learned. The BEA contract, DE-AC07-05-ID14517, clause H-4 requires the contractor to develop a contractor assurance system (CAS) and describes ten attributes that are consistent with the DOE Order 226.1B requirements and the above criteria. The program, which is described in PDD-171, *Contractor Assurance System*, addresses performance management and includes assessments, issues management, and feedback and improvement. Key supporting procedures are listed below. The CAS is in place and being implemented by BEA and, with ID oversight, as a means of evaluating contract performance. However, responsibilities and accountabilities are vaguely referenced to a list of candidate supporting documents that does not specify who is responsible and accountable for the various elements of the CAS. Also, Section 4.1, *Performance Analysis, Reporting & Risk Monitoring*, identifies reporting by "governance reporting tools" but does not mention the monthly CAS Grading, which is the current method used to grade CAS and its effectiveness. These opportunities for improvement are being addressed and tracked by the site through issues management system action items LabWay SG 2015-1112 and SG 2015-1113, respectively. (See **OFI-BEA-FI-01**.)

Some procedures, ancillary to the process, were well beyond the expected review cycle (e.g., some had effective dates of 2008). These overdue reviews, about 300 in total, are being trended. The concern with overdue periodic reviews of ATR procedures is being addressed and tracked through action item LabWay CO 2015-1101.

The recent November 2014 assessment of CAS, IAS141095, *Independent Assessment of the Contractor Assurance System*, contains several positive attributes found at ATR. The assessment report states that, "the Lab has not established a foundation and mindset that values Performance Improvement as a vehicle to provide reasonable assurance and confidence at all levels that safe and high quality mission accomplishment will be achieved…;" however, "at ATR, Performance Improvement behaviors and tool implementation are more mature and proactive." EA's review also found a high level of awareness and engagement by managers and personnel in the various elements of the CAS.

EA evaluated the establishment and implementation of feedback and improvement programs and processes that affect nuclear safety systems at the ATR. BEA feedback and continuous improvement programs and processes are adequately described in documents including the program description document PDD-171, *Contractor Assurance System*, which is implemented through:

- LWP-13730, *Performance Assurance and Assessment*
- LWP-13840, *Issues Management*
- LWP-13735, *INL Management Observation Program*
- LWP-13850, *Processing Lessons Learned and Operating Experience*
- LWP-9301, *Event Investigation and Occurrence Reporting*
- LWP-13820, *Identification, Reporting, and Resolution of DOE Regulatory Noncompliance*.

The above procedures contain detailed guidance or references for processes that include management assessments and independent 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. Numerous additional guides and templates are maintained to augment these procedures. For example, LWP-7205, *INL Subcontracted Work*, contains adequate detail to ensure subcontractor scope relative to CAS is incorporated through the *Subcontractor Requirements Manual*. This suite of documents provides an adequate framework for a feedback and improvement system.

Assessment Program

The INL procedure LWP-13730, *Performance Assurance and Assessment*, describes the "process for establishing performance expectations in support of the INL mission, monitoring and reporting performance information, and planning risk-informed or required assessments." INL has formal processes for conducting assessments and conducts assessments as planned and scheduled using trained and qualified assessors and leads. An annual assessment schedule is maintained using the Integrated Assessment System as a tool to schedule assessments and to identify assessments that are required to be performed by contract or other regulatory requirements. ATR has used INPO as an independent means of evaluating the fairly unique reactor operations aspects of the ATR. Semi-annual safety system interaction walkdowns are scheduled and performed in accordance with LWP-10603, *Nuclear Facility System Interaction Control Procedure*, by the ATR Program Nuclear Engineering Safety Analyst and ATR System Engineer for system interaction. The primary focus is the control of potential adverse system interaction effects to safety-class and safety-significant SSCs that provide safety functions to prevent the uncontrolled release of radioactive and other hazardous material, unplanned criticality, and unplanned loss of shielding events. As discussed in Section 5.4 above, a management assessment was also performed of IAS15940 in response to an ID issue of the same subject. The assessment was comprehensive and more fully identified the scope of issues that needed to be resolved; however, performing this assessment delayed the initiation of corrective actions for two months.

The 2015 assessment schedule includes TSR implementation assessments, system performance assessments, reactor safety assessments, Fire Hazard Analysis validation reviews, reviews of emergency preparedness, and training. EA reviewed a sample of completed assessments for a variety of topics. For Fiscal Year 2015, subjects include: TSR implementation, maintenance and operations assessments, safety system walkdowns, system health reviews, and effectiveness reviews. In general, BEA effectively planned, executed, and documented all of the reviewed assessments.

Some examples of management-type assessments include: the *Effectiveness Review for NTS-ID—BEA-ATR-2011 -0005, ICAMS IO-011403, ATR 674-M-6 Operability or Surveillance Requirements*, the *ATR Equipment Reliability (ER) Assessment Final Report*, the management assessment that addressed the findings from the DOE Safety System Oversight review of CSE training and qualification, and the

Management Self-Assessment (MSA) for 480 Volt Diesel UPS Operations In The Advanced Test Reactor (ATR) (IAS-151020). Overall, these assessments and conclusions were adequate.

BEA has formal processes that monitor and evaluate the safety systems as well as safety support systems. Assessment guide GDE-10601, *Criteria Review and Approach Document (CRAD) Guidance for Safety System Assessments*, provides adequate content and structure to ensure that the assessments confirm system operability, reliability, and material condition. Although EA identified some minor deficiencies in the safety system assessments discussed in Section 5.4 above, BEA is regularly performing the safety system assessments in accordance with SP-10.1.1.15, *ATR System Health Monitoring*, which generates the monthly system health reports.

PDD-13720, *Assessment Training and Qualification Program*, addresses the training requirements for conducting inspections, surveillances, and management and independent assessments. Overall, the Performance Assurance staff is experienced and knowledgeable and includes five qualified assessors and one lead assessor. The assessment procedure requires at least one person performing an assessment to have completed necessary training and qualification as a lead assessor. Performance assurance and assessment leadership expressed a desire to increase the staff complement to support implementation of improvement initiatives that require increased presence in organizations.

BEA/ATR actively engages INPO in performing assist visits. EA reviewed recent INPO assist visit reports in the areas of work management and operations. The reports contain the disclaimer, "INPO does not have a detailed understanding of the DOE's nuclear policies, programs, and practices. Therefore, INPO is not in a position to approve or in any way pass judgment on the implementation of programs at the DOE facilities." Although the reviews do not evaluate operations against DOE requirements, the review by personnel with commercial reactor operations experience is a positive effort to keep the level of expectations for ATR management, performance, and operations high.

Issues Management

ATR has an effective issues management process described in LWP-13840, *Issues Management*. The highlight of the process as implemented in ATR is the high level of management involvement in evaluating issues and corrective actions. Issues management requires the assignment of one of four condition levels for a graded response to issues. The procedure includes references to supporting procedures, guides, and forms that provide sufficient detail for implementation of issues management elements.

Elements that support issues management include, but are not limited to:

- Management Observations/Paired Observations
- Screening Committee
- Corrective Action Review Board
- Management Review Committee
- Daily Manager's Meeting
- Daily Department/Shop Alignment Meeting prior to starting work
- Management Review Meetings (MRM)
- Daily Focus Package (Station Manager's Message, Operating Experience, Safety Focus Topic – Nuclear, Radiological, Industrial).

These elements are well-run forums for open communication and feedback.

EA reviewed several cause analyses that varied from formal level 1 root cause analyses to less formal cause determinations. Procedures and guides establish sufficient guidance for the process, and the examples reviewed were generally of high-quality and a program strength.

EA reviewed a list of open issues for the ATR. ATR staff had a good set of metrics (discussed below), which captured concerns related to the age of the backlog of overdue actions and conditions. Though there were some different opinions among the staff, EA found the LabWay application to be an effective system for tracking and recording responses to issues. The CAS independent assessment considered the new platform to require further improvement and better usage laboratory-wide. Internal CAS grading of the issues management performance measure identified a lack of attention to detail in closure statements and objective evidence. ATR Performance Assurance reopened the affected conditions, allowing each responsible organization to incorporate additional explanation, objective evidence, or other action as necessary to improve the closures.

Issues Management procedure Appendix D, *Extent of Conditions Evaluations*, provides the steps to perform an Extent of Condition (EOC) review. Only Category A and B conditions require a more formal and rigorous EOC evaluation. With few issues categorized at these levels, few EOC were available for EA to review, but those reviewed were acceptable.

Event Reporting and Analysis

Events related to the ATR safety systems are appropriately reported and analyzed. Occurrences are reported, critiques are conducted, causal analyses are performed, and investigations are conducted. EA reviewed a selection of the 38 occurrences for 2014 and 25 through June 2015. Price Anderson noncompliance issues are reported, and then screened and tracked in LabWay.

BEA has established a Nuclear Safety Culture Monitoring Panel under the Operations Council, which uses a variety of inputs from the CAS and other sources to manage improvement. Three areas of improvement are focused on streamlining processes, simplifying change, and improving communications. Management is briefed regularly on the progress and recommended path forward.

ID has implemented the Initial Notification Reporting process to alert the local DOE office and the Laboratory's Senior Management when abnormal or unplanned operational conditions occur at the Laboratory. GDE-13818, *Initial Notification Reporting*, guides this reporting of preliminary event information by email to ID to allow rapid engagement in developing issues or events. The initial notification reports also serve to inform independent assessors and stakeholders external to Idaho Site. This process does not supplant any requirements of DOE Order 231.1B, *Environment, Safety and Health Reporting*.

Operating Experience/Lessons Learned

Appropriate mechanisms are available for obtaining feedback from workers and work activities. Event critiques, post-job reviews, and corrective action development were observed as sources of lessons learned. BEA is active in the development of lessons learned inputs to the DOE operating experience database, having input about ten in the last year.

The Program Description, LWP-13850, *Processing Lessons Learned and Operating Experience*, describes the processes for the development and use of lessons learned. The post-job review form includes an area to capture lessons learned. Internal laboratory lessons learned website use for April 2015 showed 1037 views of 119 new lessons published, 90 responses, and 9 of the lessons learned formally implemented.

Performance Measures

BEA recently established the Integrated Operations Performance Analysis Committee under the leadership of ATR's manager of Performance Assurance. The primary functions of the Integrated Operations Performance Analysis Committee are to monitor and evaluate trends across the Laboratory, inform Operations Council so they can direct action, and learn and improve across the INL. Issues are binned according to discipline codes (e.g., operations, maintenance), cause codes, Integrated Safety Management System codes, and safety culture codes. These codes are assigned and tracked in LabWay, allowing the trending of changes. The output of this analysis provides a helpful picture of performance in several key areas and a basis for initiating action to improve adverse trends.

ATR develops a monthly CAS Grading Performance Matrix that is shared with ID. Criteria are established for grading the quality of self-assessments, issues management, and event response and reporting. A Quarterly Performance Summary Executive Summary report is developed discussing the results of MRM covering about 45 individual metrics. The metrics are regularly reviewed for relevance, appropriate thresholds, and to identify additional metrics where performance visibility is needed to support driving performance improvement efforts for ATR Programs. The report for the second quarter of 2015 added "Work Delays" and "Age of Red and Yellow Systems." The MRM also ensures that actions are in place to address areas identified as needing improvement or unacceptable performance. ID uses this input along with the facility representatives' evaluations to develop monthly, quarterly, and annual performance evaluation reports. ID's reports encompass the *Strategic Performance Areas of Nuclear Safety*, i.e., Occupational Safety, Environmental Protection, Facility Operations, and the Cross Cutting Areas of ISMS/Safety Culture, Activity Level Work Planning and Control, and CAS. Ultimately, these review efforts roll up to a substantive basis for the ID annual performance review determination for BEA.

Safety System Feedback and Improvement Summary

BEA has established and is implementing feedback and improvement programs and processes necessary for evaluating nuclear safety processes and performance at ATR. Feedback and improvement processes are described in program description documents and procedures. Many assessment and assessment-like activities are planned and scheduled for evaluating programs and performance at ATR using a structured process and are performed and documented as scheduled and in a generally comprehensive and rigorous manner. Safety and improvement issues are identified and input to an issues management process using a graded approach. Sound causal analysis and corrective action development is guided by process documents and performed by trained personnel. Incidents and events, including those below DOE occurrence reporting thresholds, are formally documented and investigated, and corrective actions are identified and implemented. Internal lessons learned are identified, documented, shared, and, along with external lessons learned, screened for inclusion in work documents and training. Knowledgeable, engaged performance assurance staff and line organization issues management coordinators provide management with guidance and analytical feedback concerning processes and performance, and communicate facility and institutional assurance activities and results. BEA has chartered an Integrated Operations Performance Analysis Committee and an Operations Council that reviews a broad range of inputs and trending data to ensure visibility of significant issues at the level of management able to assign appropriate resources. BEA generates useful event reports and analysis and provides ID access to event reporting systems, e.g., LabWay, and therefore provides ID with adequate information on which to grade contract performance.

However, the performance feedback and improvement program has some deficiencies. For example, some supporting procedures are well beyond the assigned review date, and although this is being monitored through a metric, it is not yet under control. Nonetheless, these deficiencies do not substantially detract from what is a generally well-designed and effective program.

6.0 CONCLUSIONS

Overall, the ATR 480 Volt Diesel Bus BBP System is well maintained and capable of performing its safety-related UPS function for at least 30 minutes following the loss of commercial power. Procedures, work documents, and records associated with the system and other ATR BBP systems provide evidence of an acceptable maintenance program. Surveillance and testing activities for the system are properly performed in accordance with TSR SRs. Operations are conducted in a manner that ensures the availability of the selected safety system to perform its intended safety functions when required, and the reviewed ATR procedures are technically adequate to achieve the required level of system performance. Facility operators are well trained and qualified. For the systems included in this review, the CSEs are knowledgeable of facility processes and their assigned system. Both the CSE and configuration management programs for ATR, and their implementing procedures, generally meet the requirements of DOE Order 420.1B, *Facility Safety*. However, weaknesses exist in the effective implementation of the CSE program, the limited breadth of configuration management program assessments, and the tracking of unverified assumptions in safety-related calculations to closure.

Although a few minor weaknesses were identified as discussed, in most cases, BEA was proactive in appropriately entering EA observations into its issues management system at the time of identification. In general, BEA has established and implemented the feedback and improvement programs and processes necessary for an adequate evaluation of nuclear safety processes and performance at the ATR.

7.0 FINDINGS

EA identified no findings during this review.

8.0 OPPORTUNITIES FOR IMPROVEMENT

This EA review identified six 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.

OFI-BEA-MAINT-01: Consider revising LWP-6200 to strengthen requirements for worker feedback to ensure that feedback is properly addressed and tracked.

OFI-BEA-OPS-01: Consider revising ATR Interface Agreement with Power Management to ensure that it fully complies with DOE Order 422.1, Section 2.m, *Control of Interrelated Processes*.

OFI-BEA-CSE-01: Consider revising PDD-105, *ATR Programs Training*, to clarify the minimum work experience requirement for CSEs.

OFI-BEA-CSE-02: Consider revising the ECAR procedure to ensure greater control over unverified assumptions in safety-related calculations.

OFI-BEA-CSE-03: Consider implementing assessments that ensure all aspects of the configuration management program are periodically evaluated**.**

OFI-BEA-FI-01: Consider improving the Feedback and Improvement procedures by addressing the following observations:

- PDD-171, *Contractor Assurance System*, responsibilities and accountabilities are vaguely referenced to a list of candidate supporting documents that does not clarify who is responsible and accountable for the various elements of the CAS.

- PDD-171, Section 4.1, *Performance Analysis, Reporting & Risk Monitoring*, identifies reporting by "governance reporting tools" but does not mention the monthly CAS Grading, which is the current method used to grade CAS and its effectiveness.

- Some procedures are well beyond the expected review cycle.

9.0 ITEMS FOR FOLLOW-UP

- BEA expects to implement DOE Order 420.1C in October 2016. EA will conduct a follow-up review of the CSE program once BEA has implemented the revised Order.
- LabWay Item CO-2014-0760 identified a process issue related to potential approval of drawing revisions based on unapproved field change requests. This issue affected laboratory-wide procedure LWP-10102. EA will follow-up to verify that appropriate and comprehensive corrective actions taken to resolve this issue.

Appendix A
Supplemental Information

Dates of Review

Onsite Review: April 28-30 and June 1-4, 2015

Office of Enterprise Assessments Management

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

Quality Review Board

William A. Eckroade
John S. Boulden III
Thomas R. Staker
William E. Miller
Karen L. Boardman
Michael A. Kilpatrick

EA Site Lead

Aleem E. Boatright

EA Reviewers

Aleem Boatright – Lead
Charles Allen
Glenn Morris
Eric Swanson
Greg Teese

Appendix B
Key Documents Reviewed, Interviews, and Observations

Documents Reviewed

ATR Programs Design Plan for ATR Operations ATR Auxiliary Operator School at Advanced Test Reactor (ATR) Revision 3, June 11, 2014
ATR Programs Design Plan for ATR Operations ATR EPRO Experiment Operator School at Advanced Test Reactor (ATR) Revision 5, June 11, 2014
ATR Programs Training Department Training Design Plan for ATR Operations ATR EPRO Reactor Operator School at Advanced Test Reactor Complex Revision 6, February 3, 2014
Continuing Training Plan ATR Programs Training Department Two-Year Continuing Training Plan CY2014-CY2015 for EO, RO, SEO, SRO, SS Revision 0, January 14, 2014
Continuing Training Plan ATR Programs Training Department Two-Year Continuing Training Plan CY2014-CY2015 for ATR Radiological Controls Technicians Revision 1, November 20, 2013
AFTRA007, *Advanced Test Reactor Operations Reactor Auxiliary Operator (RAO) Initial Qualification Checklist,* November 28, 2012
AFRTFNSG/QLRCT001, *Site Radiological Control Technician Initial Qualification Final Signature Form,* February 2005
AFRTFNSG/QNRCT001, *INL Site RCT/Sr. RCT Initial Qualification Final Signature Form,* July 2008
AFTRA008, *ATR Operations Initial Certification Checklist, Senior Reactor Auxiliary Operator (SRAO),* March, 2011
AFTRA009, *ATR Operations Initial Certification Checklist, Lead Senior Reactor Auxiliary Operator (LSRAO) Certification OJT Checklist,* October 2009
AFTRA010, *ATR Senior Experiment Operator Initial Qualification Checklist,* March 2008
AFTRA010, *ATR Senior Experiment Operator Initial Qualification Checklist,* February 18, 2014
AFTRA010, *ATR Senior Experiment Operator Initial Qualification Checklist,* May 7, 2014
AFTRA017, *Reactor Instrument and Control Technician Initial Qualification Checklist,* October 2014
AFTRA018, *ATR Experiment Operator (EO) Initial Qualification Checklist,* September 2009
AFTRA018, *ATR Experiment Operator (EO) Initial Qualification Checklist,* February 2012
AFTRA018, *ATR Experiment Operator (EO) Initial Qualification Checklist,* December 2012
AFTRA018, *ATR Experiment Operator (EO) Initial Qualification Checklist,* February 2014
AFTRA019, *ATR Senior Reactor Operator Initial Qualification Checklist,* March 2008
AFTRA019, *ATR Senior Reactor Operator Initial Qualification Checklist,* August 2013
AFTRA021, *ATR Programs Training Demineralizer Operator Initial Qualification Checklist,* January 2013
AFTRA022, *ATR Programs Training Outer Area Operator Initial Qualification Checklist,* March 2009
AFTRA025, *ATR Reactor Operator (RO) Initial Qualification Checklist,* June 2011
AFTRA025, *ATR Reactor Operator (RO) Initial Qualification Checklist,* February 2014
AFTRA025/AFTRA433, *ATR Reactor Operator (RO) and/or ATR Operations Shift Technical Advisor (STA) Initial Qualification Checklist,* July 2013
AFTRA087, *ATR Shift Supervisor Initial Qualification Checklist,* November 2008
AFTRA185, *Radiological Control Technician Initial Qualification Checklist,* April 28, 2015
AFTRA243, *ATR Chemistry Coordinator Initial Qualification Checklist,* April 2009
ANJRFNSG/QNRCTJUN, *INL Junior/Subcontractor Radiological Control Technician Qualification Card Final Signature Form,* July 27, 2009
AOP-12.3, *Low Level in the Day Tank,* April 7, 2015
AOP-12.4, *High Level in the Day Tank,* April 7, 2015
AOP-12.6, *Diesel Generator Emergency Startup,* April 7, 2015
AOP-20.2, *Loss of H&V,* April 7, 2015

AOP-40.5, *480 V Diesel UPS Trouble*, April 7, 2015
ATR Organization Chart, March 2015
CO 014-6003, *Condition/Issue Manual ATR Scram Due To Imminent Loss of Diesel Power*, April 15, 2013
ATR Programs Quarterly Performance Indicator Report, October through December 2014
CTR-4, *ATR Corrective Action Review Board Charter*, Revision 13, TBD
CTR-277, *Advanced Test Reactor Programs Management Review Committee and Prescreen Review Committee Charter*, 04/02/15
CTR-366, *Advanced Test Reactor Programs Management Review Meeting Charter*, 04/02/15
CTR-13715, *Assessment Evaluation Board*, July 15, 2008
DOP 2.7.88, *RSS Inlet Temperature Subsystem Calibration Check and Calibration Channels A, B, and C,* June 3, 2013
DOP-2.7.166, *TI-20-72, Laydown Area Temperature Indication Calibration Check and Calibration,* April 7, 2015
DOP-2.8.3, *Utility Battery Bank 670-E-58 Battery Rundown Test Using the UPS 670-E-116*, July 31, 2013
DOP-2.8.18, *ATR Weekly Battery Bank Surveillance,* September 16, 2014
DOP-2.8.18, *ATR Weekly Battery Bank Surveillance,* April 7, 2015
DOP-2.8.23, *ATR Monthly Battery Bank Surveillance,* August 3, 2010
DOP-2.8.23, *ATR Monthly Battery Bank Surveillance,* April 7, 2015
DOP-2.8.31, *Diesel Battery Bank 670-E-1665 Rundown Test Using the 670-E-1576 UPS1*, April 7, 2015
DOP-2.8.32, *Diesel Battery Bank 670-E-1667 Rundown Test Using the 670-E-1576 UPS2*, April 7, 2015
DOP-2.8.33, *Diesel Battery Bank 670-E-1665 Equalizing Charge Using the 670-E-1576 UPS1,* November 4, 2014
DOP-2.8.34, *Diesel Battery Bank 670-E-1667 Equalizing Charge Using the 670-E-1576 UPS2,* November 4, 2014
DOP-2.8.35, *Diesel Battery Bank 670-E-1665 100-Day Surveillance*, April 7, 2015
DOP-2.8.36, *Diesel Battery Bank 670-E-1667 100 Day Surveillance*, April 7, 2015
DOP-7.0, *ATR Detailed Operating Procedures,* April 16, 2015
DOP-7.5.9, *480 V Diesel Bus UPS Operation,* April 7, 2015
DOP-7.7.12, *N16 Chamber Sensitivity Check,* January 11, 2012
DWG-418586, *ATR Electrical Power Distribution One Line Diagram*, January 28, 2015
EARM-RCR-4E, *Annunciator Board 4, Row E,* April 7, 2015
ECAP-0, *Loss of All Commercial and Diesel Power*, April 7, 2015
ECAR 2444, *ATR Transition to Commercial Power Single Failure Evaluation*, January 31, 2014
ECAR 2462, *ATR Transition to Commercial Power UPS DC Arc Flash Hazard Analysis,* March 28, 2014
ECR No. 627994, *Electronic Change Request for MCP-9600 Conduct of Operations for Materials and Fuels Complex Facility Operations*, December 16, 2014
EDF-5614, *Summary of Interim Safety Basis Supporting Advanced Test Reactor Operation Pending Full Resolution of Unreviewed Safety Questions TRA-USQ-2004-214 Revision 1, TRA-USQ-2004-396, and TRA-USQ-SE-2003-145,* Revision 4
GDE-9001, *Conduct of Operations Guidance for Training and Qualification*, May 19, 2011
GDE-9101, *Laboratory Instruction Writing Guide*, July 21, 2014
GDE-9102, *Emergency, Abnormal Operating, and Alarm Response Procedure Writing,* March 30, 2009
GDE-13818, *Initial Notification Reporting*, September 19, 2011
GDE-574, *Issues Management Program Trending Analysis Guidance,* March 20, 2014
GDE-10601, *Criteria Review and Approach Document (CRAD) Guidance for Safety System Assessments,* 03/17/08
IAG-54, *Interface Agreement Between Power Management and Advanced Test Reactor Complex,* August 20, 2009

IAG-59, *Interface Agreement Between Power Management and SMC,* August 27, 2009
IAS111213, *Assessment Report*
IAS121951, *Assessment Report*
IAS-141323, *Effectiveness Review for NTS-ID—BEA-ATR-2011-0005, ICAMS IO-011403, ATR 674-M-6 Operability or Surveillance Requirements,* April 14, 2015
IAS-141748, *Review Visit for US Department of Energy's (DOE) Advanced Test Reactor (ATR) at the Idaho National Laboratory (INL) July 14-16, 2014,* July, 2014
IAS-141790, *Review Visit for US Department of Energy's (DOE) Advanced Test Reactor (ATR) at the Idaho National Laboratory (INL) September 29 - October 2, 2014,* October 2014
IAS-151020, *Final Report: Management Self-Assessment (MSA) for 480 Volt Diesel UPS Operations In The Advanced Test Reactor (ATR),* April 9, 2015
IAS15940 *ATR Complex Cognizant System Engineer Assignments and Qualifications*, March 12, 2015
IAS111845 *ATR Programs diesel engine readiness assessment of existing operation, and Maintenance procedures for compliance with the 40 CFR 63 Subpart ZZZZ*, 4/17/2013
IAS 131376 *ATR Equipment Reliability Assessment Final Report* 9/29/2014
IAS141095 *Independent Assessment of the Contractor Assurance System*, November 19, 2014
IAS-151020 *Management Self-Assessment (MSA) for 480 Volt Diesel UPS Operations In The Advanced Test Reactor (ATR),* April 9, 2015 IAS141323, *Effectiveness Review for NTS-ID—BEA-ATR-2011 -0005, ICAMS IO-011403, ATR 674-M-6 Operability or Surveillance Requirements, April 14, 2015*
INL/INT-12-24476, *Level 2 Cause Analysis Report Positive Unreviewed Safety Question (USQ) ATR Complex – USQ-2011-550, Diesel Generator 674-M-6 Operability and Surveillance Requirements Document # INL/INT-12-24476, NTS-ID--BEA-ATR-2011-0005, NE-ID--BEA-ATR-2011-0013,* January 11, 2012
INL/INT-12-25855, *Level 1 Cause Analysis Report Advanced Test Reactor SCRAM due to Loss of Diesel Power, NE-ID--BEA-ATR-2012-0013, ICAMS IO-018527*, June 2012
INL/MIS-13-29870, *Level 2 Cause Analysis Report Manual Advanced Test Reactor Scram Due to Imminent Loss of Diesel Generator 674-M-6, ORPS # NE-ID--BEA-ATR-2013-0012, ICAMS # IO 26705,* July 2013
INL/INT-14-32483, *Apparent Cause Analysis Report for Unplanned High PCS Pressure ESF Actuations During Testing, Rev. 1*, October 16, 2014
INL/INT-14-32938, Apparent Cause Analysis Report for Potential Inadequacy in the Safety Analysis (PISA) ATR Loop 1C-W Overstressed Bellows, September 4, 2014
IO-011403, *Issue/Observation Long Term Corrective Actions NTIS INR (09-12-2011): Diesel Generator 674-M-6 Does Not Have TSR Level Operability of Surveillance Requirements,* January 5, 2015
IO-018527, *Issue/Observation ATR SCRAM Due to Loss of Diesel Power/ATR Building Confinement Negative Pressure/Airborne Contamination Inside Buffer Area,* July 10, 2013
IO-026705, *Issue/Observation Manual ATR Scram due to Imminent Loss of Diesel Power,* December 23, 2014
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EJ # 7.3.2.2-6/1163, *ATR Transition to Commercial Power*
FOR-128, *INL Configuration Management Database Requirements*
LI-550, *ATR Complex System Walk-Down & Equipment Reliability Classification,* August 28, 2012
LST-100, *INL Safety Basis List for Advanced Test Reactor Facility, April 7, 2015*
LST-9000, *Conduct of Operations Conformance Matrix,* May 21, 2013
LWP-9101, *INL Procedure Usage,* March 16, 2010
LWP-9201, *Briefings,* July 17, 2014
LWP-9301, *Event Investigation and Occurrence Reporting,* January 23, 2012
LWP-9400, *Lockouts and Tagouts,* April 6, 2015
LWP-9401, *Using Administrative Tags,* June 27, 2012
LWP-9600, *Conduct of Operations for the Idaho National Laboratory,* October 17, 2012

LWP-10000, *Engineering Initiation*
LWP-10200, *Engineering Calculations and Analysis Report*
LWP-10500, *Managing the Configuration of Structures, Systems, and Components*
LWP-10501, *Engineering Change Control*
LWP 10601, *System Health Monitoring*
LWP-10800, *INL Category A Reactor Unreviewed Safety Questions*, May 1, 2013
LWP-13740, *Performing Inspections*
LWP-13840, *Issues Management*, February 26, 2015
LWP-13735, *INL Management Observation Program*, Revision 1, 01/30/2015
LWP-13730, *Performance Assurance and Assessment*, Revision 5, 02/19/2015
LWP-13850, *Processing Lessons Learned and Operating Experience*, Revision 4, 12/16/2014
LWP-13820, *Identification, Reporting, and Resolution of DOE Regulatory Noncompliance*, Revision 5, 06/05/2014
LWP-7205, *INL Subcontracted Work*, Revision 11, 06/23/2014
LWP-10603, *Nuclear Facility System Interaction Control Procedure* Revision 0, 07/31/08
MCP-9500, *ATR Programs Training and Qualification Implementation*, March 29, 2007
MCP-9501, *ATR Programs Communications and Procedure Use*, February 8, 2015
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MCP-9504, *Advanced Test Reactor Labeling Implementation Procedure*, March 18, 2015
MCP-9600, *Conduct of Operations for Materials and Fuels Complex Facility Operations*, October 13, 2014
MCP-6102, *Conducting Facility Condition Assessments*
NE-ID--BEA-ATR-2011-0013, *Occurrence Report - Potential Inadequacy in the Safety Analysis (PISA) Concerning Diesel Generator 674-M-6 Operability and Surveillance Requirements*, March 14, 2013
NE-ID--BEA-ATR-2012-0013, *Occurrence Report - ATR Shutdown due to Loss of Diesel Power with Subsequent Excessive Confinement Negative Pressure and Airborne Contamination in Buffer Area*, March 26, 2012
NE-ID--BEA-ATR-2013-0012, *Occurrence Report - Advanced Test Reactor (ATR) Manual Scram Due to Imminent Loss of Diesel Power*, April 15, 2013
NE-ID--BEA-ATR-2015-0013, *Occurrence Report - Quarterly Report of Diesel Engine Startup at the Advanced Test Reactor (ATR)*, April 6, 2015
NTS-ID--BEA-ATR-2011-0005, *Noncompliance Report - Diesel Generator 674-M-6-Operability and Surveillance Requirement Results in Positive USQ*, December 2, 2011
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PDD-105, *ATR Programs Training*, June 17, 2014
PDD-10000, *Conduct of Engineering*
PDD-10502, *INL Configuration Management Program*
PDD-10601, *Advanced Test Reactor Equipment Reliability Program Description*, August 28, 2012
PDD-171, *Contractor Assurance System*, August 21, 2014
PDD-13720 *Assessment Training and Qualification Program*, 02/27/2013
PDD-6000, *INL Nuclear and Non-nuclear Maintenance Management Program*
PLN-4386, Transition Plan for INL Condition Assessment Surveys
RCCD-157D-1, *ATR Reactor Cycle Control Document for Cycle 157D-1*, April 23, 2015
RP-1249C, *ATR Programs Senior Reactor Auxiliary Operator 480V Diesel Bus UPS Daily Data Sheet*, April 7, 2015
SAR-153, *Upgraded Final Safety Analysis Report for the Advanced Test Reactor*, April 7, 2015
SAR-153-ADD-3, *SAR-153 Addendum for the Advance Test Reactor Hydraulic Shuttle Irradiation System*, June 17, 2014

SAR-153-ADD-9, *SAR-153 Addendum for 480 V Diesel Bus Battery-Backed Power System,* April 7, 2015
SD-11.1.2, *Drawing Control*
SD-11.1.40, *ATR Proficiency Requirements,* December 6, 2012
SD-11.2.4, *Document Control*
SDD-7.4.1.3, *System Design Description Emergency Flow Subsystem,* July 13, 2011
SP-10.1.1.2, *ATR Programs Management Roles and Responsibilities,* August 6, 2013
SP-10.1.1.12, *ATR Programs Management Observation and Oversight Program (Includes Senior Supervisory Watch),* June 20, 2012
SP-10.1.1.13, *Equipment Reliability Index (ERI),* February 8, 2012
SP-10.1.1.14, *ATR Plant Health Committee (PHC) and ATR Equipment Reliability Working Group (ERWG),* September 11, 2012
SP-10.2.4.1, *Configuration Management*
SP-10.2.4.12, *ATR Control of Temporary Modifications,* January 8, 2014
STD-143-104, *Idaho National Laboratory Configuration Management*
TFR-7.3-1, *ATR Transition to Commercial Power (Quad Z) Project*
TOC-135, *ATR Complex – Laboratory Wide Manual 9 – Operations – ATR Programs Implementing Procedures,* March 18, 2015
TOC-142, *ATR Complex SP- Standard Practices Manual Volume 1,* March 4, 2015
TOC-143, *ATR Complex SP- Standard Practices Manual Volume 2,* April 7, 2015
TOC-144, *ATR Complex SP- Standard Practices Manual Volume 3,* August 21, 2007
TOC-197, *ATR Abnormal Operating Procedures,* April 7, 2015
TOC-199, *ATR Complex SD-11.0 – ATR Operations Standing Directives,* April 13, 2015
TOC-340, *ATR Complex DOP-4.1 - Lead Experiment Detailed Operating Procedures,* March 18, 2014
TFR-7.3-1, *Technical and Functional Requirements, Advanced Test Reactor Transition to Commercial Power (Quad Z) Project,* November 25, 2013
TSR-186, *Technical Safety Requirements for the Advanced Test Reactor,* April 7, 2015

Interviews

Assessment Assurance Lead
ATR Director of Programs
ATR Operations Assistant Manager
ATR Shift Supervisor
ATR Station Manager
ATR Surveillance Coordinator
Cognizant Systems Engineer (3)
Engineering Manager
Maintenance Manager
Maintenance Training Coordinator
On-line Work Execution Manager
Operations Deputy Manager
Operations Manager
Outage Planning and Execution Manager
Performance Assurance/ Document Management Manager
Performance Assurance Specialists (3)
Performance Monitoring Manager
Planning and Material Support Manager
Quality Assurance Manager
Site Operations Review Committee Chairman
Systems Engineering Manager

Training Manager
TSR Compliance Manager
Work Center Coordinator

Observations

AOP-40.5, *480 V Diesel UPS Trouble*, Performance
Daily PODs
DOP-2.7.7.12, *N-16 Chamber Sensitivity Check* Performance
DOP-2.7.88, *RSS Inlet Temperature Subsystem Calibration Check and Calibration Channels A, B, and C*, Performance
DOP-2.7.84, *RSS Outlet Temperature Subsystem Calibration Check and Calibration Channels A, B, and C*, Performance
DOP-2.8.18, *ATR Weekly Battery Bank Surveillance,* Performance
DOP-2.8.23, *ATR Monthly Battery Bank Surveillance,* Performance
Lead Senior Reactor Auxiliary Operator (LSRAO) Rounds
Plan of the Week
RP-0805, *ATR Programs Reactor Safety Daily Checklist*, Performance
RP-1206, *Senior Reactor Auxiliary Operator 674 Standby Diesel Generator Daily Data Sheet*, Performance
RP-1242A, *Standby Diesel and Equipment Operational Test*, Performance
RP-1249A, *Senior Reactor Auxiliary Operator Battery Backed Power Supply Daily Data Sheet Instrument Bus Uninterruptible Power Supply 670-E-104*, Performance
RP-1249B, *Senior Reactor Auxiliary Operator Battery Backed Power Supply Daily Data Sheet*, Performance
RP-1249C, *Senior Reactor Auxiliary Operator 480V Diesel Bus UPS Daily Data Sheet*, Performance
Shift Turnover in Control Room
Daily Manager’s Meeting
Management Review Committee
Corrective Action Review Board