

**Office of Enterprise Assessments
Assessment of Nuclear Reactor Facility
Operations at the Idaho National Laboratory's
Advanced Test Reactor**



June 2017

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

Table of Contents

Acronyms.....	ii
Executive Summary.....	iii
1.0 Purpose.....	1
2.0 Scope.....	1
3.0 Background.....	1
4.0 Methodology.....	2
5.0 Results.....	3
5.1 Operations – Operations Activities, Logs, and Records.....	3
5.2 Operations – Self-Assessments and Reviews.....	4
5.3 Training and Qualification – Operator Certification and Continuing Training.....	6
5.4 Safety Basis – Surveillances and LCOs.....	9
5.5 Safety Basis – Experiments.....	11
5.6 DOE Field Element Oversight.....	15
6.0 Findings.....	20
7.0 Opportunities for Improvement.....	20
8.0 Items for Follow-Up.....	20
Appendix A: Supplemental Information.....	A-1
Appendix B: Key Documents Reviewed, Interviews, and Observations.....	B-1

Acronyms

5YS	5-Year Plant Health Investment Strategy
ALARA	As Low As Reasonably Achievable
ATR	Advanced Test Reactor
ATR-C	Advance Test Reactor Critical Assembly
BEA	Battelle Energy Alliance, LLC
CAS	Contractor Assurance System
CFR	Code of Federal Regulations
CRAD	Criteria and Review Approach Document
CSAP	Core Safety Analysis Package
CSE	Cognizant System Engineer
DOE	U.S. Department of Energy
DOP	Detailed Operating Procedure
EA	Office of Enterprise Assessments
ECAR	Engineering Calculations and Analysis Report
EO	Experiment Operator
ESA	Experiment Safety Analysis
ESAP	Experiment Safety Analysis Package
eSOMS	Electronic Shift Operations Management System
FR	Facility Representative
FSQS	Facility-Specific Qualification Standard
FY	Fiscal Year
ID	DOE Idaho Operations Office
INL	Idaho National Laboratory
LCO	Limiting Condition for Operation
LCS	Limiting Control Setting
LWP	Laboratory-Wide Procedure
NE	DOE Office of Nuclear Energy
OFI	Opportunity for Improvement
OPW	Operational Performance Walkthroughs
ORPS	Occurrence Reporting and Processing System
PDD	Program Description Document
QA	Quality Assurance
RO	Reactor Operator
RSS	Reactor Safety System
RWP	Radiation Work Permit
SAR	Safety Analysis Report
SME	Subject Matter Expert
SP	Standard Practice Manual
SRO	Senior Reactor Operator
SS	Shift Supervisor
SSO	Safety System Oversight
TSR	Technical Safety Requirement
UFSAR	Upgraded Final Safety Analysis Report
USQ	Unreviewed Safety Question
WI	Work Instruction

Office of Enterprise Assessments
Assessment of Nuclear Reactor Facility Operations at the
Idaho National Laboratory's Advanced Test Reactor

EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE) Office of Nuclear Safety and Environmental Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of nuclear reactor facility operations at the Idaho National Laboratory's Advanced Test Reactor (ATR). This assessment was conducted within the broader context of a series of targeted assessments to ensure that systems and processes at DOE nuclear reactor facilities are designed, implemented, and maintained in accordance with regulatory requirements and provide adequate protection of the health and safety of the public and workers. This targeted assessment was completed from March 13-17, 2017.

Overall, the Idaho National Laboratory operating contractor, Battelle Energy Alliance, LLC (BEA), conducts ATR facility operations safely and in accordance with applicable DOE requirements. Operators and staff who support operations that were interviewed are highly experienced, well trained, and well informed of plant conditions. BEA implements a thorough training, qualification, and certification program to prepare and certify operators and supervisors. The training process makes significant use of the simulator, which is a program strength. For the safety systems sampled, the limiting control settings, limiting conditions for operation, and associated surveillances have been developed consistent with the ATR safety basis. The procedures that implement the technical safety requirement surveillances are adequate to maintain the operability of the safety systems that were evaluated, and surveillances using these procedures were performed appropriately. The cognizant system engineer program has been established in accordance with DOE requirements and adequately implements a system health reporting process at ATR. The experiment review and approval process, as implemented for ATR, is comprehensive and effectively analyzes and manages the risks and hazards introduced by the many different experiments conducted at ATR. In addition, effective self-assessment and corrective action management programs have been established at ATR. While a few specific observations were made in areas where ATR operations can be improved, this assessment found no significant weaknesses in ATR operational practices.

For the documented and observed activities that were evaluated, the Idaho Operations Office demonstrated an effective oversight program to assess contractor performance at ATR. In addition, the Idaho Operations Office maintains a substantial presence on site, which facilitates considerable awareness of ATR activities.

Office of Enterprise Assessments
Assessment of Nuclear Reactor Facility Operations at the
Idaho National Laboratory's Advanced Test Reactor

1.0 PURPOSE

The U.S. Department of Energy (DOE) Office of Nuclear Safety and Environmental Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of nuclear reactor facility operations at the Advanced Test Reactor (ATR) at the Idaho National Laboratory. This assessment was conducted within the broader context of a series of targeted assessments to ensure that systems and processes at DOE nuclear reactor facilities are designed, implemented, and maintained in accordance with regulatory requirements and provide adequate protection of the health and safety of the public and workers. EA initially began this assessment at the Idaho Site the week of June 1-5, 2015; however, after a postponement to revise the review scope, this targeted assessment was continued and completed March 13-17, 2017.

2.0 SCOPE

This assessment evaluated the flowdown and implementation of applicable DOE requirements to ensure that nuclear reactor facility operations are conducted safely and in accordance with these requirements. The assessment reviewed performance of ATR operational activities, logs and records, and self-assessments; training and qualification; safety basis surveillance and limiting conditions for operation (LCOs); and safety basis experiments. The assessment also evaluated the effectiveness of DOE Idaho Operations Office (ID) oversight of nuclear reactor facility operations.

3.0 BACKGROUND

The Idaho Site includes the Idaho National Laboratory and the Idaho Cleanup Project (ICP) Core. 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 (EM). NE is responsible for INL facilities and general site operations including ATR, and EM is responsible for ICP Core 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 ATR. Battelle Energy Alliance, LLC (BEA) is the operating contractor for INL and is responsible for the management and operation of ATR.

ID oversees BEA and is responsible for administering the contract, executing assigned DOE 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.

ATR is one of two research reactors within DOE that is classified as a hazard 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 core is designed with fuel assemblies that create four distinct lobes, arranged to nominally form a clover leaf pattern. These fuel assemblies weave between four internal lobe flux trap locations, one central flux trap location, and four flux trap locations external to the lobes. Experiments are designed to be inserted into these flux traps and

various other reactor locations so that nuclear fuels and other materials can be studied for their response to neutron fields and a range of other parameters. 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 long-term effects of intense neutron and gamma radiation on reactor materials and fuels.

EA identified nuclear reactor facility operations as an area for targeted reviews in a memorandum to DOE senior line management, *Office of Enterprise Assessments Nuclear Safety, Worker Safety and Health, and Emergency Management Assessment Strategies and Activities*, dated February 5, 2015. This memorandum also stated that the performance of DOE oversight would be evaluated during the targeted reviews to provide input to the overall evaluation of the DOE Federal assurance capability.

4.0 METHODOLOGY

The DOE independent oversight program is described in, and governed by, DOE Order 227.1A, *Independent Oversight Program*. EA implements the independent oversight program through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. Organizations and programs within DOE use varying terms to document specific assessment results. In this report, EA uses the terms “deficiencies, findings, and opportunities for improvement (OFIs)” as defined in DOE Order 227.1A. In accordance with Section 4.f.(1) of DOE Order 227.1A, DOE line management and/or contractor organizations must develop and implement corrective action plans for any deficiencies identified as findings.

As identified in the assessment plan, *Plan for the Office of Enterprise Assessments Targeted Assessment of Advanced Test Reactor Facility Operations at the Idaho National Laboratory of the Idaho Site*, March 2017, this assessment considered DOE requirements related to the criteria and lines of inquiry of EA Criteria and Review Approach Document (CRAD) 31-08, Rev. 0, *Nuclear Reactor Facility Operations*, for the specified scope. EA CRAD 31-08 provides additional details about each of the objectives and criteria that were assessed, as well as EA’s approach. EA used the following sections of EA CRAD 31-08 in performing this assessment:

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

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

There were no specific items from previous assessments of ATR facility operations for follow-up during this assessment.

5.0 RESULTS

5.1 Operations – Operations Activities, Logs, and Records

Objective:

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

For this criterion, EA observed the operation of ATR during shutdown activities. Several operations daily meetings were observed, as well as the operation of the ATR simulator (see Section 5.3 of this report).

EA evaluated the operational logs for ATR and the ATR Critical facility (ATR-C), which is a full-scale, open core, used to test experiment worth prior to insertion into the ATR core. ATR-C is located near ATR in the same building, but in a separate room. DOE Order 422.1, *Conduct of Operations*, Section 2.k, *Logkeeping*, defines requirements for establishing, maintaining, and reviewing operator narrative logs. Laboratory-Wide Procedure (LWP)-9600, *Conduct of Operations*, Section 4.11, *Narrative Logs* implements these requirements for ATR. ATR narrative logs are documented electronically using a system called the Electronic Shift Operations Management System (eSOMS). Electronic logkeeping has been in place at ATR for approximately 12 months. EA reviewed a sample of log entries surrounding reportable events during the last 18 months. All entries were detailed and properly documented. Periodic supervisory review of the log entries was also documented. EA also reviewed a sample of log entries entered prior to the use of electronic logs, i.e., using a hard-copy log book, and found no issues with ATR logs. The log entries reviewed are consistent with DOE Order 422.1 requirements. Overall, eSOMS is effective in allowing operators to securely record pertinent operations information and to more readily search and find historical information in past entries.

ATR-C is typically manned by two individuals who make log entries into a hard-copy ATR-C logbook. EA reviewed a sample of log entries from selected days during the past two years. The dates (9/2/2015, 9/29/2015, 7/7/2016, and 9/29/2016) were selected based on instances where manual reactor scrams occurred. The penmanship of the ATR-C narrative log entries for the three dates sampled made them challenging to independently review, and contrary to INL Laboratory-Wide Procedure (LWP)-9600, *Conduct of Operations*, Section 4.11, *Narrative Logs*, the logs sampled had not been formally reviewed by the cognizant operations manager or a shift supervisor (SS).

Assessment timing and plant computer problems during the EA assessment prevented real-time observation of surveillance activities. Therefore, in lieu of observing surveillance work evolutions, EA reviewed documentation of completed technical safety requirement (TSR)-required reactor safety system (RSS) instrumentation surveillances, which consisted of the annual calibrations of the Fission Break Monitoring and Vessel Inlet Temperature subsystems.

ATR TSR 3.1.1, *RSS Instrumentation*, requires the RSS, including the Fission Break Monitoring and Vessel Inlet Temperature subsystems, to be operable during power operation and low power operation. Surveillance requirement 4.1.1.8 requires each RSS instrument channel to be calibrated annually. EA evaluated the two most recent calibration check and calibration surveillances that were performed on January 7 and November 23, 2016, for Channel A of the fission break monitoring subsystem. Detailed Operating Procedure (DOP) 2.6.64, *RSS Fission Break Monitoring Subsystem Calibration Check and Calibration of Channel A, B, or C*, was used to perform these calibrations, and both surveillances were documented as successfully completed with no abnormal readings recorded. For the vessel inlet temperature subsystem, EA evaluated the calibration check and calibration surveillances that were performed on June 2, 2015, and July 25, 2016, for Channels A, B, and C. DOP 2.7.88, *RSS Inlet*

Temperature Subsystem Calibration Check and Calibration of Channel A, B, and C, was used to perform these calibrations, and again, both surveillances were documented as successfully completed with no abnormal readings recorded. For the surveillances that were sampled, the requirements of the TSR were adequately implemented. In all cases that were evaluated, the documentation indicates that the surveillances were adequately performed and successfully completed using appropriate conduct of operations, as well as helpful place-keeping practices. No issues were identified with these procedures or their documented performance.

During plan-of-the-day meetings, EA noted appropriate communication of current issues, conditions, and events and emergent resources. Operator activities observed during ATR shutdown operations were properly performed with oversight by the on-duty control room supervisor and SS. All observed ATR communications exhibited excellent use of formal three-way communications.

EA also observed multiple shift turnovers. During shift turnover, position-specific checklists were used to guide the process. This approach was adequate, as the checklists were generally comprehensive and covered all key areas to support a thorough turnover. Several operators stated that operator logs for the previous 24 hours were reviewed, in accordance with the applicable procedures and DOE Order 422.1, *Conduct of Operations*. However, some operators and SAs stated that, in reviewing logs, they typically go back to the last shift they manned. Although there is no requirement, the latter practice may yield a higher performing shift turnover process, especially when an operator has been off shift for multiple days.

ATR has adequately established and effectively implemented facility operations activities, logs, and records. As evaluated, the measured parameters for RSS instrumentation adequately implemented limitations set by the TSR. Reactor operators (ROs) are well informed of conditions, properly comply with procedures, and accurately record measured nuclear safety parameters. Electronic logkeeping is being used effectively for ATR narrative operator log entries. However, some ATR-C logkeeping did not meet the expectations of the established procedures and practices that govern ATR operator narrative logs.

5.2 Operations – Self-Assessments and Reviews

Objective:

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

ATR has an adequately defined self-assessment program, as described in approved documents. The ATR Upgraded Final Safety Analysis Report (UFSAR) invokes requirements for independent safety review and audit in Section 13.5.5, *Review and Audit*; Section 17.16.1, *Independent Management Assessment*; and Section 17.16.2, *Audits*. UFSAR Chapter 13 discusses the general topical areas to be audited, such as work control processes, radiation exposures, TSR monitoring and compliance, and unreviewed safety question (USQ) evaluations. Chapter 13 also describes responsibilities and expectations of independence for groups such as the Safety Operations Review Committee (SORC). UFSAR Chapter 17 discusses the expectations of the quality assurance (QA) program regarding the evaluation of performance in support of the BEA contractor assurance system (CAS) metrics. BEA implements INL-wide monitoring of CAS metrics using the procedure LWP-13730, *Performance Assurance and Assessment*. This procedure provides direction for: identifying performance outcomes; developing monitoring strategies; analyzing performance indicators; documenting, reporting, and disseminating performance and risk information; addressing performance issues; and reassessing. The procedure further identifies the roles, responsibilities, accountabilities, and authorities that the various independent assessment organizations and management have for implementing an effective self-assessment program. Throughout INL, BEA

uses the LabWay electronic data system to manage and track assessments, issues, and conditions that impact performance and quality.

The LabWay data is used to assist in selecting and scheduling self-assessments. Assessments are either initiated based on specific regulatory requirements and frequencies, or selected based on observed performance data trends. EA reviewed the BEA assessment schedule for fiscal year (FY) 2016 (dated December 7, 2015), which included projections through 2018. The planned schedule comprehensively covered topics such as emergency management, safety and health, environmental compliance, radiation protection, QA, maintenance, training, operations, system engineering, experiment engineering, and reactor safety. Specific regulatory and procedural requirement references were included, as were projected due dates. The schedule also identified assigned assessors and responsible managers. EA found this schedule to be an effective and comprehensive tool for assuring required assessments were planned and performed.

EA reviewed a sample of four completed Assessment Activity Forms recorded in the LabWay system. Three of the documented activities were for routine assessments of aspects of programs that are driven by regulatory or procedural requirements. Specifically, the forms were for assessments of the standing radiation work permits (RWPs), the software analysis programs used to support the core safety analysis packages (CSAPs), and QA program implementation at ATR. A fourth documented assessment activity evaluated the completion and effectiveness of the issues management processes. This assessment activity followed a condition report that documented a non-compliance in the experiment safety analysis package (ESAP) for an ATR loop experiment. Each form appropriately identified the purpose and scope of the assessment activity, the applicable procedural or regulatory drivers, the lines of inquiry, and the results and conclusions. EA noted that, in the condition report being reviewed, IAS-16S9, *Effectiveness Review for Non-Compliance in Experiment Safety Assurance Package for the 2A-C-BU Experiment at the Advanced Test Reactor*, the causal analysis, and the corrective action plans were referenced, but the nature of the non-conformance, the determination of the causes, and the prescribed corrective actions were not clearly or specifically identified. The condition report itself does contain much of this information; however, by not articulating the issues and each aspect of the process, the report does not directly provide an evaluation of corrective action effectiveness, as implied by the title of the report.

EA observed that the LabWay program allows users to review, analyze, and report performance metrics and data, and to track conditions and progress for issues management. ATR performance assessment personnel routinely use LabWay for these purposes. EA reviewed the ATR performance indicator reports for the last two quarters of 2016 and found them to be adequate performance indicators as related to operations. The covered topics included illness and injury trends, as low as reasonably achievable (ALARA) radiation exposures, equipment reliability, ATR availability, ATR project performance trends, and ATR CAS metrics. The distribution and sign-off pages for these reports indicate that both BEA and DOE line management are routinely informed of the status and conditions at ATR. EA observed a regularly scheduled meeting with ATR management and DOE oversight personnel that provided routine updates of the performance metrics and progress for issues management.

LWP-13840, *Issues Management*, adequately describes the BEA issues management process. This procedure provides instructions for condition reporting and immediate response. Based on the category and type of the incident or condition, the procedure provides direction for the type and level of event investigation, causal analysis, and corrective action that is expected to be performed. In addition to direct, timely, verbal notification, the procedure requires that issues be documented in the LabWay electronic issues tracking and management system.

EA sampled the following three recent incidents that are currently in various stages of causal analysis and corrective action management:

- Sprinkler system activation during uninterruptible power supply battery cycling activities
- Sink drain pipe failure resulting in a confinement penetration
- High reading (failure) of a log count rate meter system following a SCRAM event.

EA evaluated the LabWay initial notification reports and the current status of causal analysis and corrective action planning for each of these incidents. While not fully complete and closed, documentation and interviews indicate that the appropriate processes are being followed and appropriate corrective actions are being pursued. EA also reviewed documentation and closure of an incident in 2012, where a Cobalt-60 capsule ruptured during transfer cask loading, resulting in elevated dose rates in the staging area around the cask. This incident predates implementation and use of LabWay, but still utilized many of the same basic reporting structures, causal analysis processes, and corrective action management practices. An evaluation of the documentation for these four incidents provides sufficient evidence to conclude that BEA:

- Identified the off-normal condition promptly,
- Initiated appropriate immediate control and response to the off-normal condition,
- Planned and implemented an appropriate and safe recovery process,
- Conducted a thorough and independent evaluation of the conditions that led to the incident,
- Analyzed the significant causal factors and the extent of condition,
- Developed appropriate preventive corrective action plans, and
- Implemented effective corrective actions (in the case of the Cobalt-60 capsule rupture).

The sampled staff activities and documentation showed that assessments are adequately planned and conducted for ATR. In addition, for the samples evaluated, BEA implemented effective processes at ATR to develop and implement corrective actions, and appropriate attention has been given to determining causes and extent of condition.

5.3 Training and Qualification – Operator Certification and Continuing Training

Objective:

Reactor operators, senior reactor operators, and fuel handlers (or fissionable material handlers) at Hazard Category 1 and 2 nuclear reactor facilities are trained and certified to be capable of performing their assigned work. Training for reactor operators and senior reactor operators includes formal classroom-type and on-the-job training to ensure familiarity with all required aspects of reactor operation, including anticipated transients and accident conditions, and written examinations are administered to candidates for certification. Continuing training is provided to personnel to maintain their job proficiency. Continuing training programs for certified operators and supervisors consist of preplanned classroom-type training, on-the-job training, and operational evaluations on a regular and continuing basis. (10 CFR 830.122(b), DOE Order 426.2)

For ATR, the following positions are considered certified positions:

- Experiment operator (EO)
- Senior experiment operator (SEO)
- Reactor operator (RO)
- Senior reactor operator (SRO)
- Shift supervisor (SS)
- Canal operator.

The SS, who manages shift operations, is also an SRO who completes and maintains SS qualification in addition to SRO certification. The canal operator periodically handles fissionable material associated with reactor experiments and reactor fuel.

The ATR operator training program is implemented through Program Description Document (PDD)-105, *ATR Programs Training*. PDD-105 has been approved by ID and adequately implements DOE Order 426.2, *Personnel Selection, Training, Qualification and Certification for DOE Nuclear Facilities*. EA assessed the systematic approach to training (SAT) documentation, required by DOE Order 426.2, for the aforementioned certified positions. This assessment included SAT elements of task analysis, task-to-training matrices, qualification cards, and written and oral examinations. The task analyses were sufficiently detailed and facilitated compliance review. ATR has developed and implemented an effective operator training program using the SAT. Initial training consists of classroom fundamental theory and systems training, followed by completion of a qualification checklist. The checklist is completed by certified personnel on the assigned shift of those training to be qualified, and also covers theory and systems, but mostly focuses on specific job tasks of the positions. Comprehensive written, operational and simulator exams, and oral boards must also be successfully completed prior to the ATR Operations Manager approving the candidate's certification. EA evaluated a sample of each of these elements and found them to be acceptable. In addition, each of the operators and SSs interviewed exhibited adequate knowledge and skills related to duties of their respective positions. EA also reviewed recertification requirements for ATR certified positions. They are consistent with DOE Order 426.2 requirements, including comprehensive written exams, operational evaluations, evaluated simulator performance, and oral boards.

Continuing training is utilized to ensure that certified operators and supervisors maintain the knowledge and skills to operate ATR safely during the two years since their last recertification. Each year, four to five sessions of week-long continuing training are conducted. Examples of continuing training activities indicated that significant changes to facility systems and components were appropriately covered, and several examples showed that industry experience was also incorporated. Selected fundamentals were also included in the continuing training. The continuing training program is designed to address the material to be included on recertification written examinations, evaluated walkthroughs, and oral boards. The continuing training program acceptably meets DOE Order 426.2 continuing training requirements.

During the assessment, EA observed two training evaluations. The first was an oral board for an SS/SRO recertification. The board was comprised of a senior SS and the deputy operations manager and senior operations manager, who are trained/qualified as oral board chairmen. Each board member met the oral board requirements defined in PDD-105. During the oral board, the lines of inquiry covered all required areas of the recertification, including fundamentals, normal and abnormal operations, and SS administrative duties. Results from the candidate's recent recertification written and walkthrough examinations were used to probe potential weak areas. EA observed that the oral board was properly conducted and rigorously interrogated the SS who was being evaluated.

The second training activity observed was *Training Cycle 2017-02 Simulator Training*. The training and qualification program is designed to ensure that each certified person receives four to five sessions of simulator training and evaluation each year. The simulator evaluations are considered part of maintaining certification and are included with operator continuing training. EA observed six simulator scenarios, including three that were formally evaluated by qualified/knowledgeable individuals. The final scenario, which modeled a radiological release from the facility, also evaluated the emergency response of the crew's SS to perform duties of the emergency action manager. The training department effectively used the simulator, which is an essential part of operator certification and ATR continued operations. In addition, the simulator is also used to support the development of ATR plant modifications and

procedures. The utilization of the simulator to test plant modifications, procedure revisions, and as a training resource was observed to be a strength at ATR.

The ATR Training Department has developed metrics to evaluate training performance and effectiveness. The performance measures are designed to measure ongoing training performance against the objectives of DOE STD-1070-94, *Criteria for Evaluation of Nuclear Facility Training Programs*. Included in these performance measures are training staffing and qualifications, training unexcused absences, student feedback, and simulator health. These performance measures are acceptable for monitoring training program performance, and ATR is generally meeting the established goals for all except student feedback and simulator health.

Student feedback is comprised of two elements:

- Percentage of feedback forms returned
- Percentage of forms returned with constructive comments included.

Over the last year, the percentage of returned feedback forms for training has only met the 50% goal during one month (November 2016), and the percentage of feedback forms returned that contain constructive comments has only met the goal twice (April and September of 2016). BEA is aware of the issue but has not identified actions to resolve the problem.

Simulator health is comprised of three elements: lost simulator time incidents, number of system errors, and number of deficiencies. Although no lost time incidents or deficiencies have occurred during the last 12 months, simulator system errors occurring each month have prevented this metric from meeting the goal of two or less simulator issues per month. During this EA assessment, an evaluated simulator session was delayed until system errors could be resolved. Although the evaluated session was initially cancelled, engineers diagnosed and corrected a hardware issue so that the session could be conducted. The simulator is critical to ATR's mission, and the ATR training manager is aware of the trend in simulator system issues and is working with other ATR managers to add simulator health to the ATR plant health process. Adding simulator health to the ATR plant health process is a useful initiative, because doing so will allow ATR management to stay apprised of issues adversely affecting the health and reliability of this vital system, as is the case for other critical ATR systems.

ATR training assessments conducted during the last three years were reviewed against the criteria in DOE-STD-1070-94, *Guidelines for Evaluation of Nuclear Facility Training Programs*. As required by DOE Order 426.2, all eight objectives in the DOE standard were covered between five assessments during the last three years. However, key elements of the operator certification were not included in the scope of the assessments. Of the five assessments performed, two evaluated simulator training and, of those two, one also looked at a portion of classroom training. On-shift training and certification activities (e.g., evaluated walkthroughs, and qualification card activities) were not evaluated by contractor assessments. The ATR training manager is aware of this issue and initiated LabWay SG 2017-0309 during the on-site EA assessment to address possible improvements in the conduct of ATR training program assessments.

EA reviewed a sample of 14 training records, found no issues related to operator education and experience requirements, and determined that the associated requirements of DOE Order 426.2 for hazard category 1 reactors were met. No exceptions to experience or education requirements have occurred within the last five years. In addition, all certified personnel were current on their operator certifications. The operator certifications/qualifications reviewed during the course of this assessment were adequate. However, on May 24, 2016, the contractor found a lapse in on-the-job training instructor qualification for

one EO, which resulted in a TSR minimum staffing violation (ORPS NE-ID—BEA-ATR-2016-0016). The actions to prevent recurrence included the implementation of operating crew metrics to specifically track the number of expired qualifications for individual members of the crew and additional management reviews of department qualification status. EA will follow up on this issue to review the effectiveness of the implemented corrective actions.

At ATR, several different types of operators may handle fissionable material. Because these operators handle reactor fuel and other fissionable materials, the training program incorporates the requirements of DOE Order 426.2, Section 6.b, *Fissionable Material Handlers*, and Section 8.d, *Fuel Handling Operator*, requirements into applicable certification programs for EOs, ROs, and canal operators. Most operators at ATR begin as EOs. The qualification requirements for the EO position also specifically address fissionable material handlers. Once an individual becomes a certified EO, he/she typically begins to work toward RO certification. When an RO recertifies at ATR, he/she recertifies for both RO and EO requirements. Training records were reviewed against the requirements in DOE Order 426.2 for fissionable material, and were satisfactory.

The position of canal operator is an additional fissionable material handler and moves various materials within the refueling/fuel storage canal under the direction of an SRO. This separate certified position contains specific classroom and on-the-job training related to criticality safety and the specific areas listed in Sections 6.b and 8.d of DOE Order 426.2. The canal operator training and certification program was evaluated and acceptably meets the Order requirements for fissionable material handling.

The ROs, SROs, and fissionable material handlers at ATR are acceptably trained and certified to perform their assigned work. Training for ROs and SROs includes effective formal classroom-type and on-the-job training to ensure familiarity with all required aspects of reactor operation, including anticipated transients and accident conditions. Comprehensive written examinations are administered to candidates for certification. Continuing training is acceptably administered to personnel to maintain their job proficiency, and the simulator is effectively utilized as part of continuing training to maintain each crew in a high state of readiness to perform their assigned duties for normal, abnormal, and emergency operations. The ATR simulator is vital to training and continued operations, and BEA is evaluating methods to ensure its reliability, including use of the system health process.

5.4 Safety Basis – Surveillances and LCOs

Objective:

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

EA reviewed the current ATR TSR revision, TSR-186, *Technical Safety Requirements for the Advanced Test Reactor*, Rev. 43, limiting control settings (LCSs)/limiting conditions for operation (LCOs) and surveillance requirements, including the associated technical bases. TSR-186 is derived from the ATR documented safety analysis (DSA)/UFSAR, Safety Analysis Report (SAR)-153, *Upgraded Final Safety Analysis Report for the Advanced Test Reactor*. Numerous safety systems must be checked and tested on a periodic basis to ensure their operability. Due to scheduling, EA was unable to observe real-time surveillance operations during this assessment. However, EA sampled several TSR LCSs, LCOs, TSR Bases, and implementing surveillance procedures to evaluate the development of surveillance requirements and their adequacy in assuring the TSR conditions are met. For example, surveillance

packages for both the RSS fission break monitoring subsystem calibration and the RSS inlet temperature subsystem calibration were evaluated.

The fission break subsystem initiates a reactor scram upon detecting a high radiation field; this safety function applies to the Power and Low Power modes of operation, corresponding to >3 megawatts (MW) and ≤ 3 MW, respectively. The signal to scram the reactor has a setpoint of 150% of the normal operating radiation level, with $\pm 10\%$ for instrument uncertainty. Calibration of this subsystem is the credited surveillance; however, the TSR Bases state that there is no calibration of the actual ion chambers associated with this subsystem. It further states that this exclusion exists because of “the inability to adequately perform a CALIBRATION for these components.” The TSR Bases appropriately credit component reliability, channel inter-comparison, and plant operating experience for ensuring that the fission break subsystem can meet the performance requirements of the ATR safety basis. The LCS setpoint is adequately conservative, considering the range of potential events considered in the UFSAR that would lead to fuel cladding failure and the release of fission products into the ATR primary coolant. The implementing procedure that was sampled for the surveillance requirement, DOP 2.6.64, was utilized to adequately calibrate the subsystem without issue.

The vessel inlet temperature subsystem protects the core and primary coolant from high temperature events. As such, the credited safety function signals the reactor to scram before the primary coolant temperature is detected to be 150°F , i.e., $\leq 144^\circ\text{F}$, with $\pm 6^\circ\text{F}$ for instrument uncertainty. Like the fission break subsystem, the vessel inlet temperature subsystem safety function applies to the Power and Low Power modes of operation. Based on analysis, a reactor scram at this temperature provides reasonable assurance that an acceptable margin to critical heat flux is maintained. The TSR Bases demonstrate an adequate connection between the safety basis assumptions and the LCS that ensures operability of this subsystem. EA also sampled recently completed surveillance packages and observed that surveillance procedure DOP 2.7.88 resulted in calibration of the subsystem without issue.

To track and maintain TSR-required surveillance records, the ATR TSR Database software is used. This software is also referred to as TRACKER. TRACKER is a networked, multi-user database application operated, within a web browser, in accordance with SD-11.1.55, *ATR TSR Database Operation*. ATR staff use TRACKER to maintain TSR-required surveillance records and automatically notify appropriate personnel for scheduling the next required surveillance. EA confirmed that ATR conducts the required surveillances within the appropriate time intervals, and TRACKER is a useful tool that helps to maintain on-schedule performance of required surveillances.

During interviews, ATR operators demonstrated that they are well trained and knowledgeable of the LCOs, and they routinely interact with engineering and nuclear safety staff on USQ determinations, system modifications, implementation verification reviews, and DSA annual updates, as guided by appropriate procedures. EA verified that a sample of applicable as-built system design documents and supporting documents are kept current using formal change control processes.

BEA has assigned cognizant system engineers (CSEs) to be responsible for all ATR safety systems. EA’s interviews and review of a sample of relevant documents indicated that ATR CSEs effectively support operations and maintenance activities related to their assigned systems. EA observed that the training and qualification records were current and complete for the CSE assigned to the safety systems sampled during this assessment. CSEs routinely interact with ROs and safety basis engineers, and perform periodic system health monitoring and trending. EA discussed system health monitoring with the CSEs and reviewed several system health reports. The system health reports effectively documented the condition of ATR safety systems and provided useful information to help engineers anticipate issues. ATR has established an adequate system engineering program and a CSE training and qualification program that complies with DOE Order 420.1C, Chg. 1, *Facility Safety*, and DOE Order 426.2. Overall,

the CSEs demonstrated acceptable knowledge and ownership of their systems to ensure the operability and quality of safety systems.

Recognizing system reliability shortfalls at ATR, BEA developed a strategy to address a mission need for strategic risk-based investments to improve plant reliability and achieve predictable annual operation of at least 210 days to meet customer objectives. This plan was called 5-Year Plant Health Investment Strategy (5YS), dated April 20, 2015. The 5YS created a compilation of tasks to increase operational reliability by upgrading or replacing the highest equipment risks in the plant. The 5YS has been integrated into INL budget planning cycles, and in 2016, it was determined that the 5YS would be a five-year rolling strategy to be updated annually, with the ultimate goal of supporting operation of the ATR beyond 2050. The 5YS utilizes input from the ATR Plant Health Committee and system engineers to develop its risk-based improvement strategies. EA reviewed the 5YS and determined it to be a useful tool for managing the safety systems of an aging user facility in an informed manner.

For the data sampled during this assessment, EA observed that ATR surveillances and LCSs/LCOs effectively maintain the operability and quality of safety systems. ROs and CSEs are knowledgeable and appropriately trained and qualified to understand the technical bases of TSR limits. An effective working relationship exists between the engineers and operators in nuclear safety, design, and operations divisions of the ATR organization, which helps to ensure that nuclear safety requirements are met.

5.5 Safety Basis – Experiments

Objective:

Experiments are reviewed according to a DOE approved USQ process. (10 CFR 830.203(d)(3))

Criteria:

Experiment Reviews: A safety review process is required to review each experiment or class of experiment prior to its conduct. The need for specific experiment review depends on the degree of its complexity and safety significance.

Conduct of Experiments: Guidance is required for operators relative to any unusual hazards associated with an experiment and the methods for identifying and responding to them. During an experiment, the installation of items in the reactor and removal of items from the reactor is dependent on regulatory and administrative limits, the level of radioactivity anticipated or measured, engineered safety features, and the qualifications of the individuals handling the items.

Post-Experiment Activities: In accordance with 10 CFR Part 835, irradiated items are to be controlled until disposal, until they decay to an acceptable level, or until they are acceptably transferred to another facility. Engineering controls for experiments, such as temporary shielding, time, distance, or remote handling devices, will effectively limit occupational exposures to the levels required by 10 CFR Part 835, and the facility's administrative limits. They will also help maintain exposures as low as reasonably achievable (ALARA). Access to areas where radiation is present is required to be posted in accordance with Subpart G of 10 CFR 835 and be limited as required by facility's radiation protection program. Special attention is to be given to experiments that involve the use of neutron beam ports, if there is a reasonable potential for a radiation dose to a major part of the body, gonads, or lens of the eye.

Before any experiment is accepted into the ATR facility, it undergoes a comprehensive, structured, process that includes the following steps:

- Experiment proposal
- Conceptual design

- Conceptual design review and approval
- Formal design
- Safety analysis review and approval
- Manufacture (according to the approved design)
- QA assessment of the as-built configuration
- Final acceptance.

Following final acceptance, the experiment is installed in the reactor in accordance with a previously reviewed operating instruction. Throughout the irradiation cycle, the experiments and reactor conditions are monitored in accordance with the operating procedures. After irradiation is completed, the experiments are removed from the vessel and placed in storage in the pool for cooling and to await transfer to other facilities for further examination.

ATR UFSAR Chapter 10, *Experiment and Irradiation Facilities*, outlines the safety basis requirements, limitations, and expectations for experiments and tests at the ATR. In accordance with Chapter 10, the following are required to be analyzed for each experiment:

- Effects on plant transients
- Effects of normal and off-normal experiment conditions on plant equipment and personnel
- Thermal performance of the experiment
- Material content and material containment, including structural integrity and irradiation effects
- Potential to initiate off-normal conditions in the plant
- The full range of operations and operating modes supporting the irradiation
- Evaluation of USQ issues related to the experiment.

LWP-20700, *Nuclear Materials Experiment Process*, provides the process flow and the roles, responsibilities, authorities, and accountabilities for developing, analyzing, constructing, reviewing, and approving experiments conducted throughout INL, including at ATR. Standard Practice Manual (SP)-10.6.2.1, *Experiment Safety Analysis Preparation and Approval*, details the defining safety parameters that must be determined as part of the ESAP that is developed and reviewed for all approved experiments performed at ATR. The ESAPs are supported by engineering calculations and analysis reports (ECARs). At a minimum, ECARs are developed for each experiment that address structural properties, thermal properties, and neutron physics. The structural properties ECAR determines limitations and controls on capsule and experiment structural integrity during pressure changes, flow induced vibrations, potential material phase changes, or induced swelling. The thermal properties ECAR includes calculation of heating due to experiment capsule fission processes, activation, gamma captures, and other experiment heating. This analysis also includes thermal hydraulics and cooling requirements to prevent boiling during the irradiation, excessive heating during transfers, and structural damage that could occur due to sudden quench cooling during potential off-normal conditions. The neutron physics ECAR analyzes neutron activation, potential absorption and reactivity insertions, and sample fission processes that could couple with the reactor activation; this ECAR also includes dynamic in-growth of daughter products and breeding of fissile isotopes. Further, the procedures require material controls to limit the potential for introducing non-compatible, corrosive, cryogenic, pyrophoric, reactive, or explosive materials into the reactor. The ESAP processes serve as a USQ screen to ensure conformance with the ATR UFSAR. Therefore, as described, the procedure and manual adequately implement the requirements and expectations outlined in Chapter 10 of the ATR UFSAR.

EA reviewed ESAPs for several ongoing and recent experiments. The ESAPs followed a template outlined in SP-10.6.2.1. Each ESAP included comprehensive crosswalk tables to illustrate how the individual UFSAR requirements are satisfied. The ESAPs include limitations and controls on the

determined reactivity worth of the individual experiments, depending on the flux trap location to be used. If the reactivity worth of a specific experiment cannot be adequately determined based on previous measurements or analytical calculations, a direct measurement is performed using the ATR-C low power assembly. Each experiment safety analysis (ESA) appropriately contained or referenced comprehensive safety analyses considering normal operating conditions, anticipated fault conditions, unlikely fault conditions, and extremely unlikely fault conditions. These conditions included a variety of control element, reflector, and coolant flow conditions. BEA analysts use a set of guides, such as GDE-607, *Experiment Engineering Design Process*, and experiment type or topic-specific guides, such as GDE-168, *Evaluation of Capsule Experiments*, and GDE-594, *Experiment Design and Analysis Guide – Neutronics and Physics*, which include example calculations, typical parameters, and checklists, to ensure that the analyses are complete.

To support the ESAs, ECARs are performed, documented, and reviewed in accordance with LWP-10200, *Engineering Calculations and Analysis Report*, which requires a variety of reviews and approvals, based on the quality-level requirements and topic. Each approval is to be obtained according to designated roles and responsibilities in accordance with the LWP. For example, EA observed that an analysis performed for a quality-level 2 experiment, ECAR-2571, *Thermal Analysis of the HAS Cobalt Capsule*, was signed off by a preparer, a checker, an independent peer reviewer, an ATR manager, the document owner, and ATR Engineering, as is consistent with LWP-10200 requirements. EA reviewed several ESAPs and interviewed a selection of analysts who perform ECARs. EA found the ECARS to be comprehensive and performed in accordance with the appropriate procedures, and the results were founded on sound engineering principles. EA also found the analysts to be knowledgeable of the technical issues of the respective disciplines and areas of expertise.

The composite value of all experiments loaded into the core is calculated as part of the CSAP, developed in accordance with SP-10.6.2.3, *ATR Core Safety Analysis Preparation, Approval, Revision, and Use*, prior to each cycle. The estimated control element positions are calculated prior to each startup and documented in the CSAP. Startup procedures require the ROs to verify that these positions are within the appropriate range of the estimates. EA reviewed CSAP-157C-1/2, *Advanced Test Reactor Cycle 157C-1/2 Core Safety Assurance Package*. The CSAP provided placement information for each experiment and fuel element. It also provided the calculated or measured reactivity worth for each experiment, and calculated the power levels for each reactor lobe. The CSAP provided estimates for the total core excess reactivity, individual plate peak power levels, and evaluation of element burnup at the end of the operating cycle. In addition, it provided verification that the reactivity worth of the control elements would satisfy the TSR requirements and be sufficient to offset any impacts of the experiments throughout the operating cycle. The CSAP evaluation considered potential anticipated off-normal conditions, such as xenon ingrowth or loop void reactivity insertions. The CSAP also considered stresses on the beryllium reflector. Consistent with procedural requirements, the CSAP was reviewed and approved by ATR Reactor Engineering, ATR Fuel Management, ATR Experiment Engineering, the SORC, and ATR Operations. In summary, the CSAP provided a comprehensive evaluation of the overall performance of the anticipated vessel loading and verification that the TSR conditions and limitations would be satisfied. In addition, for the CSAPs sampled, the appropriate information regarding the in-core reactivity worth of each experiment and the overall effect on core reactivity of all the experiments was adequately communicated.

Prior to assembling experiment capsules and apparatus, the project engineers establish a QA verification plan. Following manufacture of the experiment apparatus or capsules, a QA acceptance process is used to verify that the as-built experiment matches the design. EA interviewed the QA manager and reviewed documentation of the QA acceptance for a selected sample of experiments. Many of the capsules are manufactured in BEA facilities at INL using certified materials, so appropriate QA records on materials selections are readily available for QA inspection. In addition to the pedigree verifications, the BEA QA

organization has access to various nondestructive testing capabilities, such as radiographs, leak and pressure testing, and instrumentation lead electrical signal tests, which are applied in accordance with the predetermined QA verification plan. However, in some cases, materials or experiment components are supplied by outside manufacturers or experiment sponsors. In these cases, the BEA QA organization is often dependent on the adequacy of the suppliers' QA systems and records. Depending on the level of importance and the QA verification plan, BEA may conduct audits of the supplying organization's QA processes. During interviews some ATR experiment engineers acknowledged that dependence on outside QA processes could represent a potential vulnerability in assuring appropriate materials pedigree management; and as such, significant attention is given to components provided by outside experimental collaborators.

Using the ESA procedures, ATR engineering, operations, and radiation protection engineers are integrated into experiment design, analysis, and approval processes. Experiment operations personnel work with the experiment managers and engineers to develop an Experiment Operating Instruction Letter (EOIL) that outlines the monitoring and operating parameters for each mode of the reactor operating cycle and post-irradiation transfers and storage. EA observed that the EOILs for the instrumented experiments in the lobe flux traps are significantly more in-depth than those for fixed capsules loaded into the beryllium reflector positions, because the former require more active EO attention. EA sampled experiment control room training simulator exercises for off-normal conditions (e.g., loss of thermocouple signal for the simulated experiment), and reviewed the EOIL for the simulator exercise and noted that it was based on an actual previously performed experiment. EA observed that the EOs and senior experiment operators were knowledgeable of the monitoring capabilities, anticipated off-normal condition indications, and appropriate response procedures. Even under challenge from the training SS, they conservatively and correctly maintained responses in accordance with written procedures.

Relatively little post-irradiation processing or manipulation of experiments or material is performed at ATR. Following irradiation, experiments are typically transferred from the core directly to the storage canal to cool down before transfer to other facilities. The pool water maintains adequate levels of cooling and shielding. Shipment to other facilities is performed inside appropriately shielded and certified transfer casks. Movement and transfer operations are conducted by reactor operations and experiment staff under RWPs, the criticality safety program, and the shipment management plan based controls. In the cases where dry manipulation of the experiments is required, ATR uses a specialized dry transfer cubical, which functions as a shielded hot cell utilizing active ventilation controls to protect workers. Although, experiment handling practices appear to be sound as described, EA was unable to observe installation of experiments into the vessel or transfer to the pool following irradiation, due to the schedule of experiment handling activities.

EA reviewed the dosimetry records from RWPs related to reactor top and experiment handling operations and found them to be well within the acceptable levels. The total collective dose for test handling from January 2015 through December 2016 was 242 millirem, and the maximum individual dose was 18 millirem. Records indicate that there had been no significant off-normal or unexpected conditions, exposures, or contamination incidents during handling operations throughout that period. These observations provide an indication of the effectiveness of experiment handling processes implemented at ATR.

LWP-15009, *Radiological Work Permit*, describes the RWP process. The ESAPs identify a general set of controls that include the post-irradiation handling and storage of the experiments. Radiation protection engineers have ESAP information available during development of post-irradiation experiment handling RWPs. Typical post-irradiation operations are for opening the vessel, transferring experiments to the storage pool, and, following sufficient cool down, transferring the experiments into appropriate shipping casks. EA interviewed ATR radiological control management and reviewed a sample of RWPs related to

post-irradiation operations. Most post-irradiation RWPs are written for standard operations based on typical experiences and general control sets. For example, RWP-ATR2016030, *Nozzle Trench Removal of Rx Vessel Flange/Fit Up*, is a standing RWP applicable from January 2016 through December 2017. It identifies the principal isotopes of concern based on past experience (e.g., Co-60, Cs-137, Fe-59, Zn-65, Zr-95, and Hf-181), and then establishes the primary controls and monitoring necessary to minimize external radiation hazards. These controls are supplemented by negative pressure ventilation of the vessel and active radiological control technician coverage during the operations to detect and respond to potential contamination or airborne distributions. Similarly, RWP-ATR2017001, *Reactor Top Work*, is a standing RWP valid for a two-year period, covering a wide range of reactor top operations. EA noted that this and similar RWPs address the expected operating conditions and controls. As observed, the RWPs are comprehensively written and appropriate for the typical conditions encountered during these operations. However, the RWPs that were sampled did not incorporate task- or experiment-specific hazard analysis. ATR radiological control management indicated that experiment-specific isotopic information is not typically incorporated in the work packages or RWPs, except as part of the shipping and transportation documentation. Including experiment-specific isotopic information in the RWPs would aid in establishing monitoring and controls for hazards that could be expressed during off-normal conditions (e.g., leaking or ruptured capsule), thus assuring prompt detection of an off-normal condition and predetermined protective responses.

EA observed preparations and initial operations conducted in the pool for underwater camera-based visual examination of the test fuel elements. Appropriate pre-job and RWP briefings were held and preparations were comprehensive and addressed potential hazards. All operations personnel in the pool deck wore required flotation devices; rigging systems were designed to prevent the elements from being raised too close to the surface of the water; radiological control technicians were positioned with appropriate “teletector” extension monitoring instruments to measure along the rigging as it was raised from the water; prior to operations, the pool surface was “misted” with Radiac solution; and wash-down equipment was prepared to further reduce the potential for spreadable contamination as rigging and tools were lifted out of the water. Based on these observations, procedures, and records reviews, the post-irradiation handling processes were sufficient to address typical expected conditions and most potential off-normal conditions that would be encountered while handling ATR experiments.

In summary, BEA has established comprehensive, robust, and effective processes for analyzing the wide range of hazards associated with proposed experiments, and ensuring that the experiments are designed, assembled, installed, irradiated, examined, and transferred in accordance with safety basis requirements and appropriate ALARA controls. Records indicate that the existing processes have, in recent years, been effective at ensuring safe reactor operations and handling of the experiments. However, opportunities to further strengthen the post-irradiation experiment handling processes do exist.

5.6 DOE Field Element Oversight

Objective:

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

5.6.1 Idaho Operations Office Oversight Program

As previously mentioned, the operation of ATR falls under the scope of NE and Federal oversight is performed by ID. The oversight program is adequately described in Process Description (PD) 03.PD.04, *Contract Oversight*, which provides details on planning oversight activities and evaluating contractor performance. The ID oversight program appropriately takes into consideration the facility hazards,

degree of risk, and the effectiveness of the CAS. Work Instruction (WI) 03.WI.04.02, *Conduct of Oversight Activities*, adequately details how oversight activities are conducted, whether using approved oversight plans, or as determined by management in response to indicators and/or evolving issues. This WI includes the process for issuing a stop-work action, criteria for evaluating the CAS, and general guidance on evaluating contractor performance. ATR oversight is routinely performed by Facility Representatives (FRs), with frequent assistance from the safety system oversight (SSO) engineer, and support from various subject matter experts (SMEs). Oversight includes both scheduled and non-scheduled activities. The scheduled activities typically involve audits or formal reviews as listed on the approved oversight plan, while the non-scheduled activities may involve field monitoring through routine walkthroughs, attendance of pre-job briefings, event response, or other similar day-to-day activities.

03.WI.04.01, *Oversight Planning and Scheduling*, requires a combined oversight plan for all Idaho Site facilities to be developed annually and maintained within the *Zeus* electronic issues management database used by ID. The procedure also requires the plan to be managed and updated on a quarterly basis. EA reviewed the combined oversight plan for the first quarter of FY 2017, and the FY 2016 oversight schedule of ATR oversight activities. In 2016, ID completed more than 20 assessments of various types at ATR, adequately addressing a wide range of topics related to the operation of the ATR facility. These assessments appropriately included quarterly reviews of UFSAR/TSR implementation that were conducted by the SSO engineer, monthly operational awareness assessments by the FRs, and semi-annual reviews of the deviations of minor significance for trending purposes. In addition, several assessments focused on cross-cutting topics, such as worker safety and health, and hoisting and rigging conducted by SMEs for all INL facilities, including ATR. EA evaluated three assessments from 2016 that were performed by ID staff assigned to ATR. EA found that these assessments comprehensively assessed the subject areas. Based on these assessments, and the current FY 2017 oversight schedule, ID is adequately scheduling, planning, and conducting effective oversight activities in the form of operational awareness, surveillances, reviews, and assessments.

Appendix D of 03.WI.04.02, *Conduct of Oversight Activities*, describes the criteria for ID's evaluation of the contractor's self-assessments that are conducted as part of an effective CAS at ATR. This WI provides the option of evaluating the contractor's CAS evaluation process, in lieu of an evaluation of the specific, individual CAS elements for contractors with sufficiently developed CAS evaluation programs. As of October 2014, ID has implemented this option. Currently, BEA performs a self-evaluation of performance on a monthly basis, and ID reviews the contractor's input, verifies the computation, and approves the performance rating for ATR. This process provides an appropriate level of oversight, based on ID's assessment of contractor performance and the maturity of the self-assessment programs.

According to interviews and documented by meeting minutes, senior managers from BEA and ID meet with a prepared agenda for CAS discussions every two months. Although EA was unable to observe a bi-monthly CAS meeting, minutes from the two most recent CAS meetings were reviewed. The topics discussed at the meeting appropriately focused on documenting, tracking, and closing issues; clearing out a backlog of DOE findings; and evaluating performance metrics and trending. Review of these meeting minutes indicated that the ID management is actively engaged in oversight and maintains awareness of facility operations and the status of major activities.

The *Zeus* program provides multiple capabilities for documenting ID oversight and replaces the previous issues management program, *Pegasus*. *Zeus* is effectively used to develop the schedule for planned assessments, document routine operational awareness activities, describe and track issues until satisfactory closeout, describe occurrences, develop reports on oversight activities, and collect inputs on contractor performance. *Zeus* has capabilities for report generation that significantly streamline the development of weekly and monthly oversight reports.

Each FY, ID develops a Performance Evaluation and Measurement Plan (PEMP) to provide performance goals and objectives for the contractor. Safe and reliable operation and maintenance of the ATR facility are included in several of the seven primary goals for the contractor. All those who conduct oversight at ATR are expected to evaluate the contractor's performance at multiple times throughout the year. Near the end of the FY, performance information is collected and graded. The letter grades are converted to a numerical score, and a goal-weighting factor is applied to develop an overall score for each performance goal. These scores are used to determine the amount of the performance-based award fee that the contractor earns. EA sampled the PEMP for FY 2016 and found it to communicate clear performance goals and objectives. In addition, EA observed that all FR, SSO, and SME staff who were interviewed actively contribute useful input to the performance evaluation process.

ID uses oversight information from *Zeus*, along with input from multiple evaluators, to develop a quarterly evaluation report (QER) on the contractor's effectiveness in four strategic areas and 12 functional performance areas, as well as two cross-cutting areas. The QER is color-coded to provide a highly visual indication of the contractor's effectiveness in each area for management attention. The QER also provides some level of trending in each performance area, by including color-coded indicators for the previous three performance quarters. According to Attachment 2 of 03.WI.04.02, "the QER is a key tool for reporting contractor performance to senior ID management." EA evaluated several QERs and found them to provide a useful method for indicating contractor performance.

EA observed that ID uses another useful indicator of contractor operational performance at ATR, called the Equipment Reliability Index (ERI). The ERI uses information from system health reports, maintenance backlogs, reactor availability, and other sources to provide a monthly color-coded evaluation for eight primary indicators. This tool is an adaptation to the Electric Power Research Institute (EPRI) process for evaluating reliability in commercial reactors. Some indicators are evaluated monthly, while others use a rolling three-month average, or are based on the reactor run cycle. The ERI is a valuable tool for the ATR SSO engineer and others in evaluating the effectiveness and reliability of the ATR operation, and for establishing priorities for maintenance and system upgrades.

DOE Order 426.2 provides additional direction to field element oversight organizations regarding the monitoring of operator certification programs implemented by the contractor. Specifically, DOE Order 426.2, Section 5, Responsibilities, requires the following:

- Periodic attendance at certification oral examinations
- Periodic and random review of individual training records
- Periodic monitoring and evaluation of oral examinations/walkthroughs
- Periodic spot checks of oral examinations, initial and continuing training classes, performance of practical factors, operational evaluations, and other training program materials
- Periodic review of certification records.

EA observed an oral examination for recertification, accompanied by an FR. In addition, FRs, SSO engineers, and SMEs assigned to ATR spend significant time in the field observing various aspects of ATR operations and operator training. EA reviewed several assessment reports generated over the past five years that demonstrate significant awareness and oversight of the ATR training, qualification, and certification program. However, no examples were observed of ID oversight performing periodic spot checks of operational evolutions, performed for the purpose of qualification, or monitoring walkthroughs associated with operator certification.

As described above, ID has developed several useful tools for evaluating contractor performance, based on the results of operational awareness activities; assessments of facilities, operations, and programs; and

reviews of the CAS. ID also uses equipment reliability and reactor availability for measuring the effectiveness of the contractor in safely operating and maintaining the ATR. These tools are effectively used to monitor and evaluate the contractor on a regular basis, providing frequent feedback to drive continuous improvement. Based on the items reviewed, ID effectively identifies issues, communicates them to the contractor, and manages the resolutions.

5.6.2 Facility Representative Program

For ID, document 03.OD.03, *Facility Representatives*, adequately implements the applicable requirements of DOE-STD-1063, *Facility Representatives*; DOE Order 422.1; and DOE Order 426.1, *Federal Technical Capability*. Document 03.OD.03 defines and describes the FR program; lists the duties, responsibilities, and authorities of management and staff; and describes the selection, assignment, and staffing of FRs.

Memorandum OS-OPAD-FRP-16-016, *DOE Idaho Operations Office Fiscal Year 2017 Facility Representative Staffing Analysis*, issued on September 1, 2016, indicates a need for three full-time FRs to provide sufficient Federal oversight of the ATR Complex. Consistent with these expectations, ID currently has three fully qualified FRs assigned to ATR, two of whom are senior FRs; this was observed to be an adequate level of oversight staffing. The FRs assigned to ATR have a combined 26 years of experience at ATR, in addition to many years spent at other Idaho Site facilities. Most of the FRs hold multiple technical qualifications in accordance with DOE Order 426.1. An additional FR assigned to the nearby Materials and Fuels Complex is also fully qualified at ATR. In addition to the FRs, one fully qualified SSO engineer supports ATR, and ID has numerous technical staff with expertise in areas such as industrial safety, fire protection, radiation protection, and chemistry available to support the onsite ATR oversight staff. EA considers this coverage for ATR to be appropriate.

FR training and qualification is conducted in accordance with 02.OD.01, *Idaho Operations Office (ID) Technical Qualification Program*, which provides detailed guidance for the training and qualification process. Attachment C of 02.OD.01 specifically addresses the FR qualification program, which includes the ID core qualification and the ATR FR Facility-Specific Qualification Standard (FSQS). EA reviewed the qualification records for the three FRs at ATR and found the records to be complete and well organized, with sufficient evidence to demonstrate that the FRs were fully qualified.

In accordance with 02.OD.01, requalification of FRs is performed through continuing training, rather than waiting until the required five year requalification cycle. Continuing training includes quarterly classroom training for the FRs, SSO engineers, SMEs, and other technical staff. Quarterly training includes management messages, information on specific systems or topics (e.g., underground infrastructure or migratory species), and relevant lessons learned. In addition, required reading is assigned and special training is provided on emerging issues, such as safety basis changes. All safety basis changes are reviewed by management or the senior FRs to identify potential “gaps” in the ATR-specific qualification. Along with the safety basis changes, additional information from potential inadequacies in the safety analysis (PISAs), equipment replacements, and resolution of issues in *Zeus* are reviewed to determine gaps. As appropriate, a gap training plan and an FR “gap card” for the currently approved ATR FR FSQS is then developed to address these changes. Each qualified FR is required to complete the training identified on the “gap card” and conduct a facility walkthrough examination. This requalification process through continuing education and training ensures that ATR FRs are continually learning and maintaining awareness of the changes to the facility, new requirements, and changing technologies. EA observed that all ATR FRs have been effectively requalified using the aforementioned methodology.

DOE-STD-1063-2011 requires an assessment of the FR program every three years. EA found that the

most recent independent FR Program Assessment from August 2015 was well done. It was conducted by a team composed of DOE Headquarters and Idaho Site staff not affiliated with the FR program. The assessment did not identify any findings, but did provide observations on potential program improvements. Although the scope of the 2015 FR Program Assessment was broader than ATR (i.e., all ID FRs), the conclusions of the assessment provide evidence that the FR program is adequate for conducting consistent and effective oversight at ATR.

Overall, the assigned FRs have the necessary technical competence and knowledge of the site and contractor activities to make informed decisions about hazards, risks, and resource allocation; provide direction to the contractor; and evaluate contractor performance, as required by DOE Order 226.1B. The FRs are fully qualified, actively engaged in oversight, and demonstrate a high level of awareness of the ATR facility status and current activities.

5.6.3 Safety System Oversight Program

ID has one fully qualified SSO engineer for ATR, who also has collateral duties for the Materials and Fuels Complex and the Transient Reactor Test (TREAT) Facility (currently not operating). Interviews indicated that the SSO engineer currently spends 75 to 80% of her time at ATR, meeting informally with the contractor's CSEs and facility engineers, attending management meetings, conducting system walkdowns and facility walkthroughs, and reviewing the monthly system health reports. The SSO engineer for ATR is heavily involved in work planning, and also frequently selects one or more work orders from the schedule to follow, based on relative importance to overall reactor operations. The SSO engineer occasionally participates on an augmented or integrated assessment team with the contractor, in accordance with a recently established ID policy to reduce redundancy and ensure effective use of oversight resources. The SSO engineer generates deviations of minor significance or other issues through her oversight activities and regularly contributes to the weekly reports. Limited SSO program staffing creates challenges to maintaining awareness of all activities associated with ATR safety systems. Nevertheless, good coordination with FRs, SMEs, and contractor engineering staff, as well as significant time in the field, allows for effective implementation of the ID SSO program at ATR.

Training and qualification for SSO engineers is conducted in accordance with 02.OD.01, with specific details covered in Appendix D. The SSO Qualification Standard is unique to ID, in that in order to become qualified as an SSO engineer, the qualifying person must first complete qualification as an SME in at least one functional area. As with FRs, the qualification standard includes both a generic sitewide qualification card and a facility-specific qualification card. EA interviews, as well as observations during walkthroughs, indicated that the SSO engineer was knowledgeable of the key safety systems and actively engaged in routine oversight activities at ATR.

In summary, the ID oversight program for ATR provides management with an overall awareness of the effectiveness of safety management systems and the safe performance of work activities. ID has assigned appropriate FR coverage for ATR, and FRs provide effective day-to-day oversight of ATR facility operations. ID has one SSO engineer and numerous SMEs for oversight of safety systems. ID maintains sufficient technical capability and knowledge of site and contractor activities to make informed decisions about hazards, risks, and resource allocation; provide direction to the contractor; and evaluate contractor performance, as required by DOE Order 226.1B.

6.0 FINDINGS

EA identified no findings during this assessment.

7.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified no OFIs during this assessment.

8.0 ITEMS FOR FOLLOW-UP

Follow up to evaluate the effectiveness of corrective actions taken to address May 24, 2016 minimum staffing TSR violation, which resulted from a lapse in an on-the-job training instructor qualification (ORPS NE-ID – BEA-ATR-2016-0016). See Section 5.3.

Appendix A Supplemental Information

Dates of Assessment

Onsite Assessment: June 1-5, 2015, and March 13-17, 2017

Office of Enterprise Assessments (EA) Management

Glenn S. Podonsky, Director, Office of Enterprise Assessments
William A. Eckroade, Deputy Director, Office of Enterprise Assessments
Thomas R. Staker, Director, Office of Environment, Safety and Health Assessments
William E. Miller, Deputy Director, Office of Environment, Safety and Health Assessments
C.E. (Gene) Carpenter, Jr., Director, Office of Nuclear Safety and Environmental Assessments
Kevin G. Kilp, Acting Director, Office of Worker Safety and Health Assessments
Gerald M. McAteer, Director, Office of Emergency Management Assessments

Quality Review Board

William A. Eckroade
John S. Boulden III
Thomas R. Staker
William E. Miller
C.E. (Gene) Carpenter, Jr.
Gerald M. McAteer
Michael A. Kilpatrick

EA Site Lead for the Idaho Site

Alem E. Boatright

EA Assessors

Alem E. Boatright – Lead
Timothy F. Mengers
Glenn W. Morris
Rosemary B. Reeves

Appendix B

Key Documents Reviewed, Interviews, and Observations

Documents Reviewed

- SAR-153, *Upgraded Final Safety Analysis Report for the Advanced Test Reactor*, Rev. 47
- TSR-186, *Technical Safety Requirements for the Advanced Test Reactor*, Rev. 43
- SAR-153, Chapter 10, *Experiment and Irradiation Facilities – Upgraded Final Safety Analysis Report for the Advanced Test Reactor*, Rev. 21, 12/17/14
- CTR-900, *Operations Council Charter*
- CTR-902, *Lockout and Tagout Committee*
- CTR-9000, *ESOMS Working Group Charter*
- CO 2016-1445, *TSR violation on minimum staffing*
- CO 2016-1463, *Expired OJT instructor qualification*
- CO 2016-2856, *RCR Break Room sink clogged and drain leak 10/24/16*
- CO 2017-0215, *Failure to properly place LCRM in service 1/18/2017*
- CO 2017-0433, *ATR 480 Volt Uninterruptible Power Supply (UPS) Inoperable Due to Fire Sprinkler*
- DOP 7.1.4, *Reactor Operator Pre-startup Checklist*
- DOP 7.1.8, *Reactor Instrumentation Control Technician Pre-startup Checklist*
- DOP-7.2.1, *Normal Reactor Startup*
- DOP-7.2.13, *Quick Reactor Startup*
- DOP 7.2.14, *Reactor Reverse*
- DOP-7.2.15, *Reactor Setback*
- DOP 7.2.16, *Fuel Element Handling Checklist*
- DOP 7.9.25, *PPS Setpoints for Pressurized Operations*
- DOP 7.9.45, *N-16 System Setpoints*
- DOP-2.6.64, *RSS Fission Break Monitoring Subsystem Calibration Check and Calibration of Channel A, B, or C*
- SP-10.6.2.1, *Experiment Safety Analysis Preparation and Approval*, Rev. 46, 2/28/17
- SP-10.6.2.3, *ATR Core Safety Analysis Preparation, Approval, Revision, and Use*, Rev. 5, 1/30/15
- TEM-224, *Experiment Execution Plan Template*, Rev. 0, 4/2/2015
- GDE-607, *Experiment Engineering Design Process*, Rev. 2, 5/20/2014
- GDE-594, *Experiment Design and Analysis Guide – Neutronics & Physics*, Rev. 1, 6/26/2014
- GDE 588, *Thermal-Hydraulic Analysis Team (THAT) Guidebook*, Rev. 1, 6/26/2014
- GDE 168, *Evaluation of Capsule Experiments*, Rev. 4, 2/16/2014
- CRT-390, *ATR Program Safety Operations Review Committee Charter* Rev. 4, 8/2/16
- ESAP-EPRI-ZG, *Experiment Safety Analysis for the EPRI Zirconium Growth Experiment*, Rev. 5, 11/26/16
- ESAP-HSA-COBALT, *ESA for Irradiation of HSA Cobalt Capsules at the Advanced Test Reactor*, Rev. 6, 8/9/16
- ESAP-KJRR, *The KJRR Experiment at the ATR*, Rev. 3, 1/25/17
- ESAP-TMIST-3A-SEG1, *TPBAR Materials Irradiation Separate-Effects Test-3A Experiment at the Advanced Test Reactor, Segment 1*, Rev. 2, 1/30/17
- ECAR-2626, *Thermal Analysis of the KJRR Experiment*, Rev. 0, 3/26/2015
- ECAR-2624, *Advanced Test Reactor Physics Analysis to Support the Ki-Jang Research Reactor Fuel Assembly Irradiation Experiment*, Rev. 0, 3/10/2015
- ECAR-2592, *KJRR-FAI Assembly Structural Evaluations*, Rev. 0, 3/30/2015
- ECAR-2578, *Criticality Safety Evaluation for the Ki-Jang Research Reactor Low Enriched Uranium Fuel Assemblies*, Rev. 0, July, 2014

- ECAR-772, *EPRI Zirconium Growth Experiment Neutronic Analysis*, Rev. 0, 12/21/2010
- ECAR-780, *Thermal Analysis of EPRI Zirconium Growth Experiment*, Rev. 0, 01/06/ 2010
- ECAR-781, *Structural Analysis of EPRI Zirconium Growth Experiment*, Rev. 0, 1/06/2010
- ECAR-2567, *HSA Cobalt Capsule Reactor Physic Analysis*, Rev. 1, 11/17/2014
- ECAR-2571, *Thermal Analysis of the HAS Cobalt Capsule*, Rev. 1, 11/14/2014
- ECAR-2586, *HAS Cobalt-60 Isotope Production Program Structural Analysis*, Rev. 2. 11/5/2014
- ECAR-2619, *Nuclear Safety Analysis Supporting GE-100 Cask Transport*, Rev. 1, 06/15/16
- ECAR-2673, *Evaluation of Shielding for the Transport of Radioactive Material Using the GE-100 Cask*, Rev. 0, 12/8/14
- ECAR-3077, *ATF-1 Experiment Payloads for GE-100 Cask*, Rev. 0, 02/17/16
- ECAR-3120, *ATF-1 Capsules ATF-00, ATF-03, and ATF-04 End of Irradiation Source Term*, Rev. 1, 02/16/16
- ECAR-3089, *High Specific Activity Cobalt Dose Rate And Shielding Evaluation For Loading, Unloading, and Handling Activities At The ATR*, Rev. 0, 11/23/17
- ECAR-3240, *Radiological Dose Consequence of an Engulfing Fire Accident while Handling Cobalt-60 between TRA-670 and an Outside Transport Cask*, Rev. 0, 03/30/16
- CRD 15a CSAP 157C-1/2, *Advanced Test Reactor Cycle 157C-1/2 Core Safety Assurance Package* February 2015
- Draft EXP-63-16, *2A-C-BU Experiment Operating Information Letter*
- EXP-83-16, *TMIST-31 Experiment Operating Information Letter*, 12/5/2016
- Spread sheet *Reactor Top and Test Handling Activities for the period 1/1/2015 through 12/31/2016* data from RWP ATR2015001
- INL/INT-16-39525, *Apparent Cause Analysis for TSR Violation*
- RWP-ATR2017001, *Reactor Top Work 3/14/17 through 2/9/19*
- RWP-ATR2016030, *Nozzle Trench Removal of RX Vessel Flange/Fit Up*, Rev.00
- LRD-9001, *Operational Safety Boards*
- LST-9000, *Conduct of Operations Conformance Matrix*
- LWP-9101, *INL Procedure Usage*
- LWP-9201, *Briefings*
- LWP-9301, *Event Investigation and Occurrence Reporting*
- LWP-9400, *Lockouts and Tagouts*
- LWP-9401, *Using Administrative Tags*
- LWP-9500, *Laboratory Excellence Program Organization and Administration*
- LWP-9511, *Facility Turnover*
- LWP-9600, *Conduct of Operations for the Idaho National Laboratory*
- LWP-9903, *Performing Management Self-Assessments for Readiness*
- LWP-20700, *Nuclear Materials Experiment Process*, Rev. 0, 4/8/2015
- LWP-10200, *Engineering Calculations and Analysis Report*, Rev. 8, 4/12/16
- LWP-10600, *System Engineering*, Rev. 6, 08/25/2016
- LWP-10800, *INL Category A Reactor Unreviewed Safety Question*, Rev. 1, 05/01/2013
- LWP-13840, *Issues Management*, Rev. 8, 9/30/2015
- LWP-13730, *Performance Assurance and Assessment*, Rev. 8, 7/26/2016
- LWP-10106, *Engineering Verification* Rev. 5, 2/28/17
- LWP 15009, *Radiological Work Permit*, Rev. 15, 2/23/15
- LWP-12061, *Conduct and Evaluation of On-The-Job Training*
- MCP-9500, *ATR Program Training and Qualification Implementation*
- MCP-9501, *ATR Programs Communications and Procedure Use*
- MCP-9502, *ATR Programs Operations Implementation*

- OS-QSD-17-006, *Annual Workforce Analysis and Staffing Plan Report for Calendar Year 2016*, as of 12/31/2016
- 01.PD.01, *IDMS Document Control Process*, Rev. 14
- 01.OP.05, *Differing Technical Opinion*
- 01.WI.03.05, *ID Lessons Learned*, Rev. 8
- 02.OD.01, *Idaho Operations Office Technical Qualification Program*, Rev. 5
- 02.PD.01, *Process for Employee Competency*
- 02.WI.01.01, *Individual Development Plan (IDP)*
- 03.OD.03, *Facility Representative Program*, Rev. 7
- 03.OP.02, *ID Event Notification and Reporting*, Rev. 11
- 03.PD.01, *Contractor Document Review and Comment/Approval/Certification Process*, Rev. 9
- 03.PD.04, *Contract Oversight*, Rev. 12
- 03.WI.04.01, *Oversight Planning and Scheduling*, Rev. 6
- 03.WI.04.02, *Conduct of Oversight Activities*, Rev. 17
- 03.WI.04.04, *Identification of Oversight Elements*
- 03.WI.04.05, *Risk Determination*
- 03.WI.04.08, *Oversight Plan*
- 09.OD.07, *Safety System Oversight Program*, Rev. 8
- ATR Complex Facility Representative Weekly Evaluation Report, 02/06/2017
- ATR Complex Facility Representative Weekly Evaluation Report, 02/13/2017
- ATR Complex Facility Representative Weekly Evaluation Report, 02/20/2017
- ATR Complex Facility Representative Weekly Evaluation Report, 02/27/2017
- ATR Complex Facility Representative Weekly Evaluation Report, 03/06/2017
- ATR Complex Facility Representative Weekly Evaluation Report, 03/13/2017
- DOE Assessments:
 - Nuclear Safety Basis Implementation Assessment – ATR 2nd Quarter 2015
 - System Interaction Walkdown Assessment – ATR & ATRC for 2nd Quarter 2015
 - Assessment of ATR System Health Reports – 4th Quarter 2015 (1st Qtr. FY 2016) (unscheduled)
 - SSO Assessment - Oversight of the Beryllium (Be) reflector blocks Crack Recovery – ATR – 3rd Quarter 2016
 - SSO Assessment - Oversight and review of the ATR south safety rod (safety rod 6) recovery and operability review – 4th Quarter 2016
- System 11 Reactor Shutdown System - ATR Complex System Health (SH) Report Card, January 2017
- OS-OPAD-FRP-16-022, *Department of Energy, Idaho Operations Office, Facility Representative Event Notification List*, 12/21/2016
- PDD-105, *ATR Programs Training*
- PDD-9001, *Nuclear Management System Programs*
- PLN-3664, *Transport Plan for the Transfer of Less than Hazard Category 3 Radioactive and Nonradioactive and Hazardous Materials between INL Site Facilities*, Rev. 3, 06/15/16
- PLN-4518, *Transport Plan for the Transfer of the BRR Cask*, Rev. 0, 07/21/15
- PLN-4723, *Experiment Analysis Plan for the HAS Cobalt-60 Isotope Production Program*, Rev. 0, 06/25/14
- PLN-4766, *Transport Plan for the Transfer of the Irradiated Experiments in the GE-100 Cask*, Rev. 0, 09/16/15
- PLN-9000, *INL Electronic Shift Operations Management Software (eSOMS) – Project Plan*
- PLN-9001, *Software Test Plan for INL eSOMS*
- GDE-9001, *Conduct of Operations Guidance for Training and Qualifications*

- Reactor Operator Written Exams (6)
- R2A2-10004, *Cognizant System Engineer*, Rev. 3, 08/23/16
- R2A2-10009, *System Engineer*, Rev. 1, 08/23/16
- SD-11.1.55, *ATR TSR Database Operation*
- SD-11.2.27, *Operations Crew Performance Monitoring and Key Performance Indicators*
- SD-15A.1.5, *Job Responsibilities for ATR Programs Training*
- SD-15A.5.5, *Training Library and Materials Controls*
- SD-15A.5.8, *ATR Programs Training Schools and Course Administration*
- SD-15A.5.9, *Continuing Training Scheduling and Administration*
- SD-15A.6.1, *Training Effectiveness Evaluation Program*
- ATR Operation Training Program Assessments (5)
- Senior Experiment Operator Qualification Check List
- ATR Training Department Performance Measures for the last 12 months
- Job Analysis Task Plans for Senior Experiment Operator, Reactor Operator, Shift Supervisor
- Continuing Training Plans for 2017 TC-02 and TC-03
- Walkthrough Examinations for ATR certified positions
- Experiment Operator Written Exams (4)
- Senior Reactor Operator (SRO) Written Exams (8)
- SRO Qualification Checklists (7)
- TJA-12011-1, *Develop and Administer Written Examinations*
- TRA00013, *Criticality Safety Training Course Material*
- Initial Notification Report, *ATR Reactor Shutdown Due to Elevated Leak Rate* 1/18/2017
- Initial Notification Report, *Unexpected radiation levels experienced in the ATR Canal area during Actuation* 3/6/17
- *GE-2000 Cask Helium Leak Test* 6/28/2012
- *ATR Complex ALARA Committee Meeting Minutes July 2, 2012 - 10:30 a.m.*
- INL/LTD-12-27634 NE-ID--BEA-ATR-2012-0022 ICAMS IO-020768, *Unexpected Radiation Levels in ATR Canal Area during GE-2000 Cask Helium Leak Test*, June 2012
- Review Plan – *Independent Review of Cobalt 60 High Radiation Event Causal Analysis and Proposed Corrective Actions*, October 2012
- TEV-1664, *Co Target System Failure Analysis*, Rev. 0, 1/10/2013
- TEV-2286, *Safety Analysis for the Storage and Handling of Experiments with >365 g U-235 Equivalent in the Advanced Test Reactor Facility*, Rev. 0, 11/24/14
- TFR-881, *DOE-SC Isotope Program Cobalt-60 Production Capsule Design*, Rev. 0, 11/07/14
- Letter CCN 235636, to DOE via BEA, *5-Year Plant Health Investment Strategy (5YS)*, April 20, 2015

Interviews

- ID ATR Complex Team Lead
- ID ATR Complex Deputy Team Lead
- ID Facility Representative Supervisor
- ID ATR Facility Representatives (3)
- ID ATR SSO Engineer
- ID SMEs (2)
- ATR Operations Manager
- ATR Operations Training Manager
- ATR Programs Training Manager
- ATR Quality Assurance Manager
- ATR Radiation Control Manager

- ATR Simulator Engineer
- ATR TSR Coordinator
- ATR Cognizant System Engineer (2)
- ATR Experiment Operator (2)
- ATR Reactor Operator (2)
- ATR Shift Supervisors (3)
- ATR Safety Analysts (2)
- ATR Experiment Engineers (3)
- ATR Director of Experiment Safety Analysis
- ATR Manager of Reactor and Nuclear Safety Engineering
- ATR Nuclear Safety Analysts (2)
- ATR Experiment Engineering Technical Lead
- ATR Systems Engineering Manager
- ATR Program Quality Engineer
- ATR Senior Experiment Operator
- ATR Experiment Operators
- ATR Radiological Engineer
- ATR Performance Assurance Manager

Observations

- ATR Radiological Control Daily Brief
- Pool Work Preparations for KJRR Fuel Element Experiment Visual Examinations
- ATR Simulator Operator Training – Experiment Control Room & Evaluated Simulator Training
- Reactor Top Operations
- Shift Supervisor Recertification Oral Board
- ATR Shift RO and SRO Shift Turnover (2)
- Operations Shift Briefing (2)
- Plan-of-the-Day Meeting (3)
- Operator Shutdown Rounds
- Walkdown of Reactor Refueling Floor