Independent Assessment of the Nuclear Maintenance Management Program at the Pacific Northwest National Laboratory

July 2026

U.S. DEPARTMENT of ENERGY | Office of Enterprise Assessments

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Acronyms

325RPL	Building 325 Radiochemical Processing Laboratory
AVT	Absence-of-Voltage Tester
BMI	Battelle Memorial Institute
CAS	Criticality Alarm System
CM	Corrective Maintenance
CRAD	Criteria and Review Approach Document
DOE	U.S. Department of Energy
EA	Office of Enterprise Assessments
FCI	Facility Condition Inspection
HDI	How Do I
HEPA	High Efficiency Particulate Air
IDID	Important to Defense in Depth
LOTO	Lockout/Tagout
M&TE	Measuring and Test Equipment
MEL	Master Equipment List
NMMP	Nuclear Maintenance Management Program
OFI	Opportunity for Improvement
PM	Preventive Maintenance
PMT	Post-maintenance Testing
PNNL	Pacific Northwest National Laboratory
PNSO	Pacific Northwest Site Office
S/CI	Suspect and Counterfeit Item
SE	System Engineer
SHR	System Health Report
SOE	Stationary Operating Engineer
SS	Safety Significant
SSCs	Structures, Systems, and Components
USQ	Unreviewed Safety Question
WO	Work Order

INDEPENDENT ASSESSMENT OF THE NUCLEAR MAINTENANCE MANAGEMENT PROGRAM AT THE PACIFIC NORTHWEST NATIONAL LABORATORY

Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of the effectiveness of the nuclear maintenance management program at the Pacific Northwest National Laboratory (PNNL). PNNL's sole high-hazard nuclear facility requiring implementation of a nuclear maintenance management program is the Building 325 Radiochemical Processing Laboratory (325RPL), a hazard category 2 nuclear facility. PNNL is managed and operated by Battelle Memorial Institute (BMI) for the DOE Office of Science Pacific Northwest Site Office. The assessment was performed in January and February 2026.

EA identified the following strengths, which have been determined to be best practices:

- BMI's proactive use of absence-of-voltage testers (AVTs) enhances the protection of workers by reducing hazardous energy exposure and human error. (Best Practice)
- BMI's detailed approach and rigorous management of facility condition inspections increases facility-wide engagement of all organizations to improve facility conditions. (Best Practice)

EA also identified several areas of concern, as summarized below:

- The labeling of some structures, systems, and components was not consistent between the field and the master equipment list of safety basis-affecting components.
- Not all procedures and work instructions included a required use level (continuous, reference, or informational) as required by BMI procedures.
- BMI's semiannual test procedure for the criticality alarm system (CAS) did not clearly direct that all required steps of the CAS outage procedure be completed as part of the maintenance activity.
- Low-level issues identified by BMI personnel are not consistently documented, tracked, and trended.

In summary, the nuclear maintenance management program at 325RPL is adequately designed and generally adequately implemented. However, exceptions were noted in the areas of component labeling, required use levels for maintenance procedures and work instructions, consistency of procedure directions, and tracking of low-level issues. Until the concerns identified in this report are addressed or effective mitigations are put in place, some risk remains in the continued reliable performance of structures, systems, and components that are part of the 325RPL safety basis.

INDEPENDENT ASSESSMENT OF THE NUCLEAR MAINTENANCE MANAGEMENT PROGRAM AT THE PACIFIC NORTHWEST NATIONAL LABORATORY

1.0 INTRODUCTION

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 the effectiveness of the nuclear maintenance management program (NMMP) at the Pacific Northwest National Laboratory (PNNL). PNNL is managed and operated by Battelle Memorial Institute (BMI) for the DOE Office of Science Pacific Northwest Site Office (PNSO). The assessment was conducted in January and February 2026.

PNNL's sole high-hazard nuclear facility requiring implementation of an NMMP in accordance with DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*, is the Building 325 Radiochemical Processing Laboratory (325RPL), a hazard category 2 nuclear facility. The primary mechanism for providing protection to workers and the public at 325RPL is limiting the material available for release from any potential accident. This control is achieved via a directive action specific administrative control on the allowable radioactive material operating limit. The primary structures, systems, and components (SSCs) credited in the hazard and accident analyses as preventing or mitigating the potential consequences of accidents to workers or the public are designated as being safety significant (SS) and include the fire suppression system, criticality alarm system (CAS), and passive design features: hot cells and gloveboxes. Additional systems such as confinement ventilation are credited as important to defense in depth (IDID).

Consistent with the *Plan for the Independent Assessment of the Nuclear Maintenance Management Program at the Pacific Northwest National Laboratory, January – February 2026*, this assessment evaluated the effectiveness of BMI programs in managing and maintaining NMMP performance and focused on SS and IDID systems and design features. Because of limited opportunity to observe work on SS and IDID systems, performance-based observations extended to work on other SSCs using credited NMMP processes.

2.0 METHODOLOGY

The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*, which EA implements through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. This report uses the terms "best practices, deficiencies, findings, and opportunities for improvement (OFIs)" as defined in the order.

As identified in the assessment plan, this assessment considered requirements related to BMI's implementation of the NMMP. Criteria to guide this assessment were based on the objectives and criteria of EA CRAD 30-06, Revision 0, *Conduct of Maintenance*.

EA examined key documents, such as system descriptions, work packages, procedures, manuals, analyses, policies, and training and qualification records. EA also interviewed key personnel responsible for developing and executing the associated programs; observed maintenance activities; and walked down significant portions of 325RPL, focusing on the implementation of NMMP requirements. The members of the assessment team, the Quality Review Board, and the management responsible for this assessment are listed in appendix A.

There were no previous EA findings to follow up on during this assessment.

3.0 RESULTS

3.1 Integration with Regulations and DOE Orders and Manuals

This portion of the assessment evaluated BMI's implementation and maintenance of a DOE-approved NMMP with changes approved through the unreviewed safety question (USQ) process.

The BMI NMMP is adequately described in RPL-PLN-1104, *Nuclear Maintenance Management Program (NMMP)*, in accordance with DOE Order 433.1B, attachment 2, section 2.a. The most recent DOE approval was documented in 25-PNSO-0075, *Contract No. DE-AC05-76RL01830 – Approval of the Radiochemical Processing Laboratory Nuclear Maintenance Management Plan, Revision 9*, in February 2025. Subsequent changes to the NMMP were administrative only and were approved through the USQ process. RPL-PLN-1104, attachment A, *DOE Order 433.1B General Requirements Implementation for 325RPL*, contains a matrix that adequately addresses the requirements of DOE Order 433.1B and identifies the associated 325RPL implementing documents.

BMI adequately assesses NMMP implementation in accordance with DOE Order 433.1B, attachment 2, section 1.g, at least every three years. BMI adequately satisfies this requirement by completing a series of assessments during the three-year period that collectively assess the implementation of the 17 NMMP elements. Reviewed assessment reports over the current three-year period were appropriately scoped and included results based on observations of maintenance work being performed. A review of assessor qualification records confirmed that the assessments were conducted under the direction of a qualified individual. PNSO also conducted assessments over the previous three-year period covering all 17 NMMP elements as required by the order.

Integration with Regulations and DOE Orders and Manuals Conclusions

BMI has an adequate DOE-approved NMMP description document denoting applicable implementing documents at 325RPL. BMI and PNSO are adequately assessing the NMMP elements within the required three-year periodicity.

3.2 Maintenance Organization and Administration

This portion of the assessment evaluated BMI's maintenance organization and processes to verify that they have defined roles and responsibilities and sufficient resources to implement the NMMP.

Maintenance Organization

BMI has established and implemented an adequate nuclear maintenance organization structure defining management, craft supervision, and craft personnel, in accordance with DOE Order 433.1B, attachment 2, section 2.b. Procedure ADM-008, *Maintenance*, adequately describes organizational responsibilities for personnel conducting maintenance activities on SS and IDID SSCs. Reviewed records demonstrated that craft personnel are qualified in the various areas required at 325RPL, including electricians, instrumentation and control technicians, mechanics, millwrights, welders, and carpenters. ADM-008 appropriately requires personnel supporting the maintenance function (e.g., engineering, radiological control, oversight, safety) to be either 325RPL-permanent staff or matrixed PNNL personnel who are available and qualified to perform work at 325RPL.

Resources

Maintenance staffing levels are determined annually through a formal staffing plan (RPL-PLN-920, *RPL Staffing Plan*) that considers priorities for current and future workloads. The annual staffing plan is developed based on available task order funding and the anticipated maintenance workload for the maintenance organization, as identified in RPL-PLN-1113, *325RPL Annual Work Plan*.

BMI's maintenance organization chart identifies a Nuclear Work Team Manager and 14 craft personnel compared to staffing plan levels of one manager and 15 craft personnel who support the conduct of nuclear maintenance activities. At the time of the assessment, maintenance craft staffing was generally stable, and all maintenance craft personnel were qualified and experienced. If supplemental craft support is needed, 325RPL-qualified craft personnel are obtained from other PNNL facilities. The current maintenance craft staffing is adequate for planned workloads, which is substantiated by performance metrics showing a limited backlog of corrective maintenance (CM) and preventive maintenance (PM) work orders (WOs).

Based on interviews with BMI personnel, a high amount of turnover has occurred over approximately the past two years in management positions related to NMMP areas of interest (Building Manager, Assurance Manager, Nuclear Operations Division Manager, and system engineers [SEs]); additional turnover is expected. Several individuals are in the process of obtaining qualifications as Building Managers and SEs. However, the loss or transition of several very experienced individuals has resulted in limited back-ups for key positions. (See **OFI-BMI-1**.)

Maintenance Organization and Administration Conclusions

BMI has established an adequate nuclear maintenance organization with implementing maintenance procedures. At the time of the assessment, BMI had sufficient maintenance craft resources assigned to specific functional areas necessary to support the NMMP.

3.3 Master Equipment List

This portion of the assessment evaluated BMI's process for developing, implementing, managing, and maintaining a master equipment list (MEL) that identifies all SSCs that are part of the safety basis.

BMI has established and implemented a generally adequate MEL in accordance with DOE Order 433.1B, attachment 2, section 2.c, through RPL-PLN-1111, *325RPL Master Equipment List*. RPL-PLN-1111 appropriately establishes the responsibilities for all involved organizations to develop and maintain the MEL. Observed subassemblies and components were adequately identified in the MEL. Critical spare parts are appropriately identified in the MEL and tracked in Maximo, the computerized maintenance management system (CMMS). The MEL clearly identifies the Maximo number, the drawing and field label, and SSC designation in the safety basis as either SS or IDID. An annual assessment is conducted by building management to identify and rectify issues between Maximo and the MEL. Observation of the ongoing annual assessment activities demonstrated that they were thoroughly conducted.

During walkdowns and observed maintenance activities, facility SSC labeling was generally consistent with the MEL. However, contrary to DOE Order 433.1B, attachment 2, section 2.c, observed HEPA filter HVE-452-HEPA exhibited three different component numbers, only one of which matched the MEL entry; most other observed primary HEPA filters were similarly labeled. (See **Deficiency D-BMI-1** and **OFI-BMI-2**.) Not labeling components in accordance with the MEL identifier could lead to maintenance on an incorrect component and unknown safety risks. These inconsistencies are shown in figure 1.

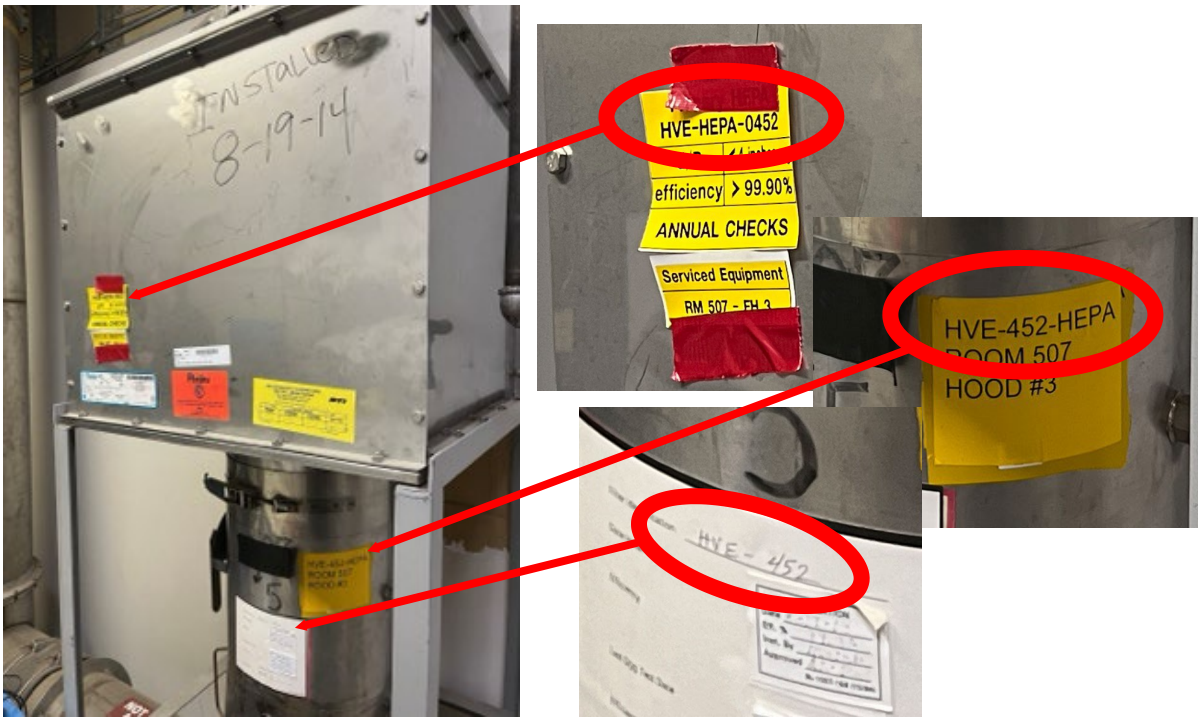

Figure 1. HEPA Filter Labels

Master Equipment List Conclusions

BMI has defined an adequate process for developing and maintaining the MEL. However, inconsistencies were observed in the field labeling of some MEL components.

3.4 Planning, Scheduling, and Coordination of Maintenance

This portion of the assessment evaluated whether BMI's work control process, with SE involvement, ensures that work planning, scheduling, coordination, and control of maintenance activities are carried out and that equipment is available.

BMI adequately plans, schedules, coordinates, and controls maintenance activities and emphasizes equipment availability through ADM-008 and ADM-016, *Work Planning and Control*, in accordance with DOE Order 433.1B, attachment 2, section 2.d. The reviewed 325RPL integrated maintenance schedule adequately prioritized and managed maintenance activities and was sufficiently detailed to support organizational coordination and track progress. Operational coordination and teamwork to integrate and execute the scheduled maintenance was adequate during 10 observed 325RPL plan-of-the-day and 3 plan-of-the-week meetings. Based on a review of 12 maintenance WOs and interviews with a planner and 5 SEs, planned maintenance WOs were clear, concise, and sufficiently detailed to enable safe work performance. Hazards and identified controls were appropriately tailored to the respective work scope. However, in some instances, the reliability of components could be overestimated. For example, when a ventilation exhaust fan was removed from service on several occasions to troubleshoot and make repairs, system health reports (SHRs) did not track the component as unavailable because removing the fan from service was planned, and the overall system remained available with redundant components. While BMI management expectation is that SSCs are tracked as unavailable when out of service for CM, interviewed SEs stated that SSCs were only considered unavailable following an automatic trip. (See **OFI-BMI-3**.)

Tracking availability only at the system level and not at the component/train level could mask challenges to overall system reliability.

BMI effectively controlled an observed maintenance activity to install new breakers in an electrical panel. Workers appropriately conducted the pre-job briefing, established electrical safety barriers, and performed a lockout/tagout (LOTO) to isolate a panel from its high-voltage source. Observed work and a review of the applicable WO and Maximo work authorization demonstrated an adequate work release process and appropriate use of human performance principles, such as three-way communication, questioning attitude, stop when unsure, self-checking, and peer checking. The observed maintenance evolution was adequately performed in accordance with the procedure. During the performance of the LOTO, a stationary operating engineer (SOE) identified an incorrect panel on the LOTO paperwork, appropriately stopped the activity, and informed his supervisor; appropriate changes were made to the LOTO per SOP-022, *Lockout and Tagout*. See section 3.15 for further discussion regarding this LOTO observation.

Notably, BMI has made effective use of a particular technology to help protect workers from exposure to electrical hazards. During an observed maintenance activity to remove power to an electrical panel, maintenance technicians used an absence-of-voltage tester (AVT) to verify that the panel was de-energized prior to removing the cover. BMI's proactive use of this technology is considered a **Best Practice** because it enhances the protection of workers by reducing hazardous energy exposure and human error. Products such as AVTs and voltage test stations can reduce and, in many cases, eliminate the risk of exposure to shock and arc flash hazards during voltage measurements. An interviewed BMI manager explained that this particular practice was developed by the Energy Facility Contractors Group – Electrical Safety Community of Practice (EFCOG-ESCoP).

Planning, Scheduling, and Coordination of Maintenance Conclusions

BMI adequately plans, schedules, coordinates, and controls maintenance activities. BMI's proactive use of AVTs to enhance the protection of workers from exposure to electrical hazards is considered a best practice.

3.5 Types of Maintenance

This portion of the assessment evaluated types of maintenance (e.g., preventive, reliability-centered, and corrective) to ensure that they are appropriate to provide safe, efficient, and reliable operation of safety SSCs.

BMI has adequately implemented a program for different types of maintenance (e.g., preventive, reliability-centered, and corrective) to provide safe, efficient, and reliable operation of safety SSCs, in accordance with DOE Order 433.1B, attachment 2, section 2.e. ADM-008 adequately addresses PM and appropriately requires the use of engineering requirements and manufacturer recommendations in establishing PM activities. A review of 10 PM WOs and interviews with SEs demonstrated that periodic maintenance is adequately planned and tracked in accordance with ADM-016. Reviewed PM completion metrics from January 2024 to January 2026 showed that PM activities were appropriately prioritized and timely completed.

SEs conducted adequate reliability analyses in accordance with OSD-PD-004, *Plant Engineering Program*. Five interviewed SEs demonstrated adequate knowledge of the reliability-centered maintenance (RCM) process and collected data. Three reviewed RCM analyses adequately implemented the process. For example, PM vibration data identified that a ventilation exhaust fan was not performing as expected (see section 3.4 for additional discussion). As a result, the SE initiated several CM WOs, but the fan was not restored to the desired specification. While the fan remains functional (but degraded), BMI plans to replace the fan during the May 2026 maintenance outage.

A review of six CM work packages and interviews with SEs confirmed an adequate process for performing CM in accordance with ADM-016. The reviewed CM work packages associated with safety SSC-related systems adequately included SE review and post-maintenance testing (PMT) acceptance criteria consistent with the safety basis. Each of the six CM work packages showed timely completion and verification that corrective action(s) resolved the problem.

Types of Maintenance Conclusions

BMI has adequately implemented a program for different types of maintenance (e.g., preventive, reliability-centered, and corrective) to provide safe, efficient, and reliable operation of safety SSCs.

3.6 Maintenance Procedures

This portion of the assessment evaluated BMI's maintenance procedures to ensure that they provide appropriate direction for maintenance activities.

BMI has adequately established and implemented a procedure process through ADM-001, *Document Management*, in accordance with DOE Order 433.1B, attachment 2, section 2.f, which is further refined by ADM-008. These procedures define a generally adequate process to perform work, including hazard identification and control hold points, appropriate review and sign-off, and PMT. ADM-001 properly requires changes to the NMMP and maintenance procedures to be evaluated through the USQ process. ADM-001 also institutes a graded approach by categorizing maintenance procedures with "use levels," either continuous use or reference use. Continuous use procedures must be in-hand and followed step-by-step whereas reference use procedures need only be available for reference, if needed. ADM-008 appropriately requires the use of pre-job briefings to ensure that workers are prepared to safely perform work.

Reviewed procedures and observed work activities were generally adequate. Ten evaluated work packages properly adhered to ADM-008. Four observed work activities were adequately performed in accordance with the written maintenance instructions without deviation. The closeouts of the work packages associated with the four observed activities were appropriately reviewed and approved by management, system engineering, and work control. Three observed pre-job briefings were properly conducted by the maintenance supervisor and included the maintenance personnel involved in the work and appropriate supporting safety personnel. All personnel fully participated in the pre-job briefings by answering supervisors' questions and asking for clarifying information.

While procedures were generally adequate, the following weaknesses were identified:

- Contrary to ADM-001, appendix C, 11 of 12 reviewed maintenance procedures (e.g., a CAS outage procedure, a technical safety requirement surveillance of the hydrogen displacement system, and a fire protection system PM) did not specify a use level[1]. (See **Deficiency D-BMI-2**.) Not identifying procedures with the use level could result in improper procedure adherence. In contrast to ADM-001, ADM-008 defines a different process for identifying maintenance work instructions as either mandatory or operationally significant; ADM-008 designations are not equivalent to ADM-001 use levels. Eleven of the 12 reviewed maintenance procedures were categorized as mandatory or operationally significant but were missing a use-level designation.

[1] In September 2024, ADM-001 was changed to require the designation of use levels for all maintenance procedures. Use levels include continuous use, reference, and informational. Three of the 11 reviewed maintenance procedures that did not include the use level in accordance with the current version of ADM-001 were issued prior to that change.

- Contrary to ADM-001, appendix C, which requires maintenance procedures to be written in a logical process understandable to the user, PM-13070, *Criticality Alarm System (CAS) Semiannual Test Procedure*, step 3.1.1, directs that the system be declared inoperable but does not specify the process to remove the system from service. BMI management stated that the intent of the step is to direct the implementation of a planned system outage in accordance with section 4.2 of ADM-RPL-702, *325RPL Building CAS Alarm System Outage Procedure*, which includes declaring CAS inoperable. However, declaring the system inoperable is only 1 of 18 required steps for implementing a planned CAS outage (step 4.2.14). (See **Deficiency D-BMI-3** and **OFI-BMI-4**.) Not specifically directing that intended portions of ADM-RPL-702 are complete prior to beginning PM-13070 could result in taking the CAS out of service incorrectly. PM-13070 is identified as a mandatory procedure governing the PM testing of the CAS.
- An SOE periodically performed checks during observed rounds that were not on the round sheet checklist but served as enhancements to the rounds. (See **OFI-BMI-5**.)
- During observation of the hydrogen displacement system test, the calibration information for permanently installed gauges was not recorded in the work record. (See **OFI-BMI-6**.)

Maintenance Procedures Conclusions

BMI's maintenance procedures define a generally adequate process to perform work, including hazard identification and control points, review and sign-off, and PMT. Reviewed procedures and observed work activities were generally adequate. However, weaknesses relating to the designation of use levels and the CAS semiannual test PM procedure were identified.

3.7 Training and Qualification

This portion of the assessment evaluated whether BMI's training programs for maintenance personnel ensure that they are appropriately trained and qualified.

BMI uses a systematic approach to training in accordance with DOE Order 433.1B, attachment 2, section 2.g, and DOE Order 426.2A, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*, to develop, implement, and maintain an effective training and qualification program for maintenance personnel. This is executed through ADM-RPL-902, *Systematic Approach to Training*. BMI's hiring and selection process for maintenance personnel adequately addresses requirements in DOE Order 426.2A, attachment 1.

Job task analyses and task-to-training matrices are used as the bases for developing and updating maintenance training. Initial training and qualification of maintenance personnel appropriately employs a combination of classroom training, computer-based courses, on-the-job training, and self-study.

BMI's training program for qualified positions is adequately described in RPL-PLN-910, *325RPL Training Program Plan.* Training for craft personnel is further described in OSD-PD-009, *Craft Training*. Training records are managed electronically and were accessible and easily retrievable, meeting the DOE Order 426.2A requirement that qualification records be maintained in an easily auditable format. Craft personnel do not specifically have a required requalification frequency; however, certain individual courses applicable to all craft personnel must be completed periodically. If an individual does not complete the various courses on a timely basis, the electronic training system will show that the individual is no longer qualified. Other individuals with NMMP-related positions (Building Manager and SEs) have bi-annual requalification requirements and associated continuing training. Reading packages are provided as needed to NMMP-related personnel, with completion tracked in the electronic system. Reviewed documentation showed that BMI is adequately executing the provisions of DOE Order 426.2A for qualification and requalification.

Training and Qualification Conclusions

BMI adequately implements a training and qualification program for maintenance personnel that meets DOE order requirements.

3.8 Configuration Management

This portion of the assessment evaluated whether BMI's configuration management processes ensure controlled alignment of SSCs with technical basis documents, that changes are not inadvertently introduced, and that required system performance is not compromised.

BMI has adequately established and implemented a robust configuration management program, flowed down from the NMMP through OSD-CM-PLAN-001, *Configuration Management Plan*, in accordance with DOE Order 433.1B, attachment 2, section 2.h. This plan appropriately mirrors the requirements specified in DOE-STD-1073-2016, *Configuration Management*, which is invoked through DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*. Further detail is appropriately specified by ADM-058, *OSD Facility and SSC Configuration Management*. Two reviewed in-process change packages contained adequate detail to document the change, were appropriately reviewed through the USQ process, and were approved by management. An interviewed work planner and five SEs were familiar with the requirement for changes to be reviewed by appropriate engineers and processed through the USQ process. Additionally, the interviewed configuration management program manager appropriately described the permit process that has been established to ensure that system and document changes do not deviate from the established process in ADM-058.

While BMI's configuration management process documentation is robust, several minor housekeeping issues were observed during walkdowns. Additionally, several observed HEPA filters were not labeled in accordance with the MEL component designation, as discussed in section 3.3.

Configuration Management Conclusions

Configuration management is well established through OSD-CM-PLAN-001. The configuration management program manager has established a permit process for processing changes. However, several minor housekeeping issues were noted during observations of facility operations.

3.9 Procurement

This portion of the assessment evaluated BMI's processes to ensure that parts, materials, and services are procured and made available when required.

BMI has established and implemented an effective procurement process to ensure the availability of parts, materials, and services for maintenance activities. ADM-RPL-807, *Control of Purchased Items/Materials*; ADM-RPL-808, *Identification and Control of Items/Materials*; and ADM-057-007, *Commercial Grade Dedication*, adequately address the implementation of the procurement process in accordance with DOE Order 433.1B, attachment 2, section 2.i. Four reviewed purchase orders demonstrated that items and services met requirements established in ADM-RPL-807. The reviewed purchase orders also adequately included clauses addressing suspect and counterfeit materials and labeling of electrical items and equipment. BMI has adequately established and maintains a qualified supplier list that specifies acceptable items and services.

Overall, BMI effectively stores procured parts and materials. Observed storage facility racks were adequately labeled to identify the location of materials and parts. Items were appropriately segregated by quality level (QL) and separate nonconformance report (NCR) areas were adequately maintained. Items were appropriately labeled with quality assurance acceptance tags, which included the QL number, Maximo number, purchase order number, contents, end user designation, storage level, and quantity. Two reviewed receipt inspection records demonstrated adequate receipt inspections for visual damage, part number identification, and suspect and counterfeit item (S/CI) identification. However, during a walkdown of spare parts with a quality engineer, some IDID parts staged for installation and awaiting verification were not stored in a segregated area, which could result in damage, loss, or deterioration. (See **OFI-BMI-7**.)

Procurement Conclusions

BMI has established and implemented an effective procurement process to ensure the availability of parts, materials, and services for maintenance activities. Overall, BMI effectively stores procured parts and materials.

3.10 Maintenance Tool and Equipment Control

This portion of the assessment evaluated BMI's processes to ensure that maintenance tools and equipment are controlled, maintained, and calibrated.

BMI appropriately controls measuring and test equipment (M&TE) through ADM-RPL-812, *Control of Measuring and Test Equipment (M&TE)*, in accordance with DOE Order 433.1B, attachment 2, section 2.j. This procedure thoroughly describes the calibration process for M&TE, which includes a robust recall process to ensure that calibrations remain current by notifying the user two months prior to the equipment going out of calibration. PNNL's operation of an onsite primary standards laboratory provides for an efficient process to calibrate installed equipment using a combination of 325RPL craft and PNNL calibration personnel.

ADM-RPL-812 adequately governs the handling, storage, and use of calibrated equipment in the maintenance process. During a walkdown of the maintenance shop area and observed maintenance activities, craft personnel proficiently demonstrated how M&TE was staged and controlled. Four interviewed craft personnel were knowledgeable of the process to check M&TE prior to use to ensure that equipment calibration was current.

Maintenance Tool and Equipment Control Conclusions

BMI has established and implemented adequate processes to control maintenance tools and equipment. 325RPL personnel make use of PNNL's primary standards laboratory to calibrate M&TE used in the facility.

3.11 Suspect and Counterfeit Items

This portion of the assessment evaluated BMI's processes to ensure that S/CIs are detected, controlled, reported, and appropriately dispositioned.

BMI has established and implemented an adequate S/CI inspection process in accordance with DOE Order 433.1B, attachment 2, section 2.k, through ADM-RPL-808. ADM-RPL-808 appropriately requires the involvement of maintenance, engineering, and quality assurance engineering personnel in identifying, evaluating, notifying, and dispositioning S/CIs to prevent the use of S/CIs. BMI has appropriately

designated a quality assurance engineer as the S/CI subject matter expert. Reviewed training documentation demonstrated the use of adequate personnel training material for preventing entry of S/CIs into the DOE supply chain, and to ensure detection, control, reporting, and disposition of S/CIs. ADM-RPL-808 also appropriately emphasizes S/CI identification by supply chain inspectors during the receipt inspection process.

BMI effectively uses operating experience and the S/CI inspection and corrective action process. For example, an interviewed quality assurance engineer described receiving an operating experience report in February 2024 regarding S/CI bolts in a manipulator crane, a type of equipment also used at 325RPL. This report prompted BMI to examine the cranes, resulting in the identification of several installed suspect bolts. The affected manipulator cranes were appropriately removed from service, and the suspect bolts were replaced. The issue was appropriately documented in AST-03492, *Assessment of 325 RPL Manipulator Counterweights for Possible Suspect Counterfeit Items*, and RPL-NCR-2024-004, *Nonconformance Report (NCR).*

Suspect and Counterfeit Items Conclusions

BMI has established and implemented an adequate S/CI inspection and corrective action process.

3.12 Maintenance History

This portion of the assessment evaluated BMI's use of documented and retrievable maintenance history to support work planning and performance analysis.

BMI personnel effectively document maintenance history through ADM-008 and ADM-RPL-607, *Periodic System Assessments*, in accordance with DOE Order 433.1B, attachment 2, section 2.l. Prompt responses to requested documents demonstrated the retrievability of maintenance records from the electronic document management system. Procedures adequately establish responsibilities for work planners to conduct maintenance history reviews and for SEs to implement performance trending, which are documented in SHRs. BMI personnel adequately conducted maintenance history reviews and performance trending, as documented in 15 reviewed SHRs.

Maintenance History Conclusions

BMI's maintenance history reviews and performance trending were adequately conducted, as documented in reviewed SHRs.

3.13 Aging Degradation and Technical Obsolescence

This portion of the assessment evaluated inspections performed by BMI to evaluate age-related degradation and technical obsolescence.

BMI has appropriately established and implemented a system evaluation process to evaluate SSC aging and technical obsolescence through ADM-RPL-607, in accordance with DOE Order 433.1B, attachment 2, section 2.m. This responsibility is appropriately performed by the SE in accordance with ADM-RPL-901, *System Engineer*. Systems are assessed monthly at a minimum, and results are documented in the SHR. Each SHR appropriately documents any aging degradation issues. A review of the seven most recent SHRs (for seven different systems) showed that periodic system assessments were properly performed and documented, with no system aging/obsolescence issues currently identified.

Aging Degradation and Technical Obsolescence Conclusions

Periodic system assessments were properly performed and documented in reviewed SHRs.

3.14 Seasonal Facility Preservation

This portion of the assessment evaluated BMI's seasonal facility preservation processes to prevent weather-related damage to safety SSCs.

BMI has established and implemented an effective seasonal facility preservation program through ADM-008-PS-028, *Freeze Protection*, in accordance with DOE Order 433.1B, attachment 2, section 2.n. This program establishes robust processes to perform a pre-cold weather assessment and a post-cold weather assessment following the winter season. The pre-cold weather assessment reviews the freeze protection PM, the adequacy of cold weather checks, and any previous year events. The post-cold weather assessment appropriately evaluates how the facility performed during the cold season.

During SOE rounds, temperature-related issues are reviewed during the year; additionally, the SOE appropriately adds cold weather checks during the winter months. During observed SOE rounds, the SOE diligently checked facility temperatures throughout the round process. BMI's seasonal facility preservation processes have resulted in no freeze damage events in the last several years.

Seasonal Facility Preservation Conclusions

BMI effectively implements a seasonal facility preservation program through procedures, pre-cold and post-cold weather assessments, and additional SOE temperature checks during the winter season.

3.15 Performance Measures

This portion of the assessment evaluated whether BMI uses performance measures to promote maintenance improvement.

Performance management is adequately executed through RPL-PLN-714, *RPL Performance Management Program*, and related procedures described therein, in accordance with DOE Order 433.1B, attachment 2, section 2.o. This procedure addresses required assessments (e.g., NMMP program element assessments), as well as management walkthroughs, SE assessments, and facility condition inspections (FCIs). Documentation reviews and interviews showed that SEs conduct periodic system assessments and prepare monthly SHRs on all SS and IDID systems. SEs evaluate system trends as an element of SHR development. BMI-identified issues are addressed using "How Do I?" (HDI) workflow, *Develop and Complete Actions and Evaluate Effectiveness*. Issues determined to require formal corrective action are tracked in the Issue Tracking System (ITS). Improvement actions are separately tracked in the Optional Tracking System (OTS). Field observations showed that some housekeeping and other low-level items are tracked in Lab Assist or other management-approved systems.

While performance management is adequate, not all low-level issues are consistently tracked and trended. During an observed maintenance activity (also discussed above in section 3.4), work was appropriately halted due to an identified discrepancy in the LOTO documentation. The issue was subsequently documented in a BMI *Lockout and Tagout Field Assessment*. Discussion with BMI staff revealed that a similar LOTO-related nomenclature error had occurred during the previous week. That activity was also appropriately stopped and corrections made prior to resuming work; however, the discrepancy was not documented for tracking/trending purposes. Additionally, during a minor maintenance activity, BMI

workers self-identified that maintenance technicians did not maintain control of an electrical plug[2]. Not maintaining control of a plug during minor maintenance was determined to be reportable in the DOE Occurrence Reporting and Processing System (ORPS) and was therefore documented in ITS. Interviewed subject matter experts confirmed that low-level issues that do not meet reporting criteria would not trigger tracking or trending, as BMI procedures do not require these types of issues to be tracked or trended. The lack of a process to track, trend, and address low-level issues is a missed opportunity to prevent more significant events. (See **OFI-BMI-8**.) BMI currently uses the Lab Assist system to track, trend, and document the disposition of low-level issues identified during FCIs (as discussed in section 3.16); Lab Assist is an existing system that could be used more broadly for low-level issues.

During observed SOE rounds, it was noted that the rounds documentation (SOP-325-RND-01, *325RPL Operator Rounds*) appropriately provided for validation that components related to SS, IDID, and balance-of-plant SSCs were operating within expected parameters. However, the rounds sheets do not provide for the documentation of actual component operating parameters, which results in the loss of valuable equipment operating performance that would enhance SHRs and preventive/predictive maintenance. (See **OFI-BMI-9**.)

Performance Measures Conclusions

BMI adequately uses performance measures to improve organization maintenance performance. However, not all low-level issues are consistently tracked and trended.

3.16 Facility Condition Inspection

This portion of the assessment evaluated BMI's conduct of FCIs to identify issues related to operability, reliability, housekeeping, and general condition.

Based on document reviews, field observations, and interviews, FCIs are effectively performed using RPL-PLN-714 and HDI workflow, *Develop Assessment Schedule and Conduct Assessments*, in accordance with DOE Order 433.1B, attachment 2, section 2.p. A schedule is prepared annually that provides for all 325RPL workspaces (approximately 130) to be evaluated at least once. Assessments extend to research laboratories, facility operating spaces, storage spaces, common areas, and office spaces, including the 325RPL exterior and associated outbuildings. Reviewed FCIs were conducted by a multi-disciplinary group, including building management, construction, maintenance, and associated support groups (e.g., radiation and industrial safety, system engineering), and identified issues related to operability, reliability, housekeeping, and the general condition of SSCs. Results were documented, including photos taken of any identified issues. Identified facility actions were assigned a priority level, documented in Lab Assist, and tracked to completion. BMI's detailed approach and rigorous management of FCIs is considered a **Best Practice** because it increases facility-wide engagement of all organizations to improve facility conditions.

Facility Condition Inspection Conclusions

BMI's performance of FCIs effectively identifies issues related to operability, reliability, housekeeping, and the general condition of SSCs at 325RPL, and is considered a best practice.

[2] For "minor maintenance" where the only source of power to the equipment is cord-and-plug, SOP-022 allows an exception to using an otherwise-required LOTO for hazardous energy control. That exception is that the plug can be under the positive control of the electrician performing the maintenance.

3.17 Post-maintenance Testing

This portion of the assessment evaluated BMI's use of PMT to confirm continued capability for credited SSCs to perform their intended function when returned to service.

BMI has established and implemented an adequate PMT WO process through ADM-008 and ADM-RPL-607, in accordance with DOE Order 433.1B, attachment 2, section 2.q, to verify that safety SSCs perform their intended function when returned to service. A review of 12 completed safety SSC-related WOs, as well as interviews with the associated work planners and SEs, confirmed appropriate coordination in developing the PMT scope, initial conditions and prerequisites, job instructions, hold points, test requirements, acceptance criteria, and post-test restoration. The reviewed PMT WO sections showed that testing results, including deficiencies, were properly documented, corrected, and met the acceptance criteria; final test results were formally reviewed and accepted for return to operability.

Post-maintenance Testing Conclusions

BMI has established and implemented an adequate PMT WO process to properly maintain safety SSCs and return SSCs to service.

4.0 BEST PRACTICES

Best practices are safety-related practices, techniques, processes, or program attributes observed during an assessment that may merit consideration by other DOE and contractor organizations for implementation. The following best practices were identified as part of this assessment:

- BMI's proactive use of AVTs enhances the protection of workers by reducing hazardous energy exposure and human error.
- BMI's detailed approach and rigorous management of FCIs increases facility-wide engagement of all organizations to improve facility conditions.

5.0 FINDINGS

No findings were identified during this assessment.

6.0 DEFICIENCIES

Deficiencies are inadequacies in the implementation of an applicable requirement or standard. Deficiencies that did not meet the criteria for findings are listed below, with the expectation from DOE Order 227.1A for site managers to apply their local issues management processes for resolution.

Battelle Memorial Institute

Deficiency D-BMI-1: BMI has not ensured that all HEPA filters are labeled with consistent component numbers that match the MEL. (DOE Order 433.1B, att. 2, sec. 2.c)

Deficiency D-BMI-2: BMI does not ensure that all maintenance procedures specify a use level. (ADM-001, app. C)

Deficiency D-BMI-3: BMI's CAS semiannual test PM procedure (PM-13070) does not clearly direct that all required steps of the CAS outage procedure (ADM-RPL-702) are to be completed as part of the PM. (ADM-001, app. C)

7.0 OPPORTUNITIES FOR IMPROVEMENT

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

Battelle Memorial Institute

OFI-BMI-1: Consider accelerating the qualifications process for additional management personnel to provide qualified back-ups for NMMP and other key positions.

OFI-BMI-2: Consider including field verification as part of the annual MEL surveillance to check for field discrepancies, in addition to the current practice of ensuring that the MEL matches engineering drawings.

OFI-BMI-3: Consider revising procedures and metrics for availability to track out-of-service time when component performance requires removal from service for troubleshooting or CM.

OFI-BMI-4: Consider revising PM-13070 step 3.1.1 to provide direction similar to procedural steps that direct taking the CAS out of service, such as ADM-RPL-702 step 4.1.2.1, 4.1.2.4, or 4.1.2.5: "INITIATE a CAS outage in accordance with Section 4.2 Planned System Outages Resulting in a Not OPERABLE Criticality Alarm System."

OFI-BMI-5: Consider evaluating non-proceduralized checks performed by the SOE on rounds for inclusion in round sheet checklists.

OFI-BMI-6: Consider requiring calibration information for permanently installed equipment to be recorded in the work record.

OFI-BMI-7: Consider roping off staged components and segregating spare parts that are awaiting inspection from general areas of the facility so that damage, loss, or deterioration is minimized.

OFI-BMI-8: Consider developing/implementing or using an existing system (e.g., Lab Assist) to track and trend low-level issues that are not currently managed through ITS or OTS.

OFI-BMI-9: Consider documenting key system parameters on the daily SOE round sheet SOP-325-RND-01, in addition to documenting system operability status.

Appendix A
Supplemental Information

Dates of Assessment

January 16 to February 19, 2026

Office of Enterprise Assessments (EA) Management

Mark D. Barth, Acting Director, Office of Enterprise Assessments
Eric A. Ruesch, Acting Director, Office of Environment, Safety and Health Assessments
Tamara D. Powell, Director, Office of Nuclear Safety and Environmental Assessments
David Olah, Director, Office of Worker Safety and Health Assessments
Wade W. Gough, Acting Director, Office of Emergency Management Assessments
Brent L. Jones, Director, Office of Nuclear Engineering and Safety Basis Assessments

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