Independent Assessment of Safety Management Program Development at the Hanford Site Low-Activity Waste Facility

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Office of Enterprise Assessments
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Acronyms

AHJ	Authority Having Jurisdiction
ALARA	As Low As Reasonably Achievable
BNA	Baseline Needs Assessment
BNI	Bechtel National, Inc.
CFR	Code of Federal Regulations
CM	Corrective Maintenance
CMMS	Computerized Maintenance Management System
CRAD	Criteria and Review Approach Document
CROS	Core Requirement Oversight Strategy
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EA	Office of Enterprise Assessments
FHA	Fire Hazard Analysis
FIMD	Field Implementation Methodology Document
FPAHJ	Fire Protection Authority Having Jurisdiction
FPE	Fire Protection Engineer
FPP	Fire Protection Program
FR	Facility Representative
FSW	Fire Service Water
HFD	Hanford Fire Department
I&C	Instrumentation and Control
iCAS	Integrated Contractor Assurance System
ITM	Inspection, Testing, and Maintenance
LAB	Analytical Laboratory
LAW	Low-Activity Waste
M&TE	Measurement and Test Equipment
NFPA	National Fire Protection Association
NMMP	Nuclear Maintenance Management Program
NMMPD	Nuclear Maintenance Management Program Description
OFI	Opportunity for Improvement
OOD	ORP Operations Oversight Division
ORP	Office of River Protection
PM	Preventive Maintenance
RadCon	Radiological Control
RCT	Radiological Control Technician
RL	Richland Operations Office
RPP	Radiation Protection Program
SAC	Specific Administrative Control
SE	System Engineer
SME	Subject Matter Expert
SMP	Safety Management Program
SRD	Safety Requirements Document
WRSS	Work Record Summary Sheet
WTP	Waste Treatment and Immobilization Plant

INDEPENDENT ASSESSMENT OF SAFETY MANAGEMENT PROGRAM DEVELOPMENT AT THE HANFORD SITE LOW-ACTIVITY WASTE FACILITY

Executive Summary

The U.S. Department of Energy Office of Enterprise Assessments (EA) conducted an independent assessment of the effectiveness of safety management program development by Bechtel National, Inc. (BNI) at the Hanford Site Waste Treatment and Immobilization Plant Low-Activity Waste (LAW) facility. EA conducted the onsite portion of this assessment May 9-13, 2022. The safety management programs selected for evaluation were the fire protection program and maintenance program being implemented at the LAW facility, and the occupational radiation protection program as it relates to laboratory sampling. The assessment also evaluated the effectiveness of Office of River Protection (ORP) and Richland Operations Office (RL) oversight of BNI's safety management program development and initial implementation.

EA identified the following strengths:

- BNI is establishing a comprehensive and well-designed fire protection program that, when fully implemented as described, will strongly support key assumptions in the documented safety analysis and other fire protection objectives.
- The maintenance and radiation protection programs include comprehensive documentation of regulatory and contract requirements, cross-walked to implementing policies and procedures.
- Strong teamwork and communication among the various ORP and RL groups responsible for oversight of BNI are evident and contribute to effective safety oversight.

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

- BNI maintenance procedures are not designed for ease of use in the field, were not always followed as written, and are inadequate to ensure that important notifications are made before performing work that occurs over multiple days.
- Current implementation of the fire protection program lacks sufficient rigor, including in configuration management, to ensure that all fire protection requirements are met as the facility shifts from a construction project to an operating nuclear facility.
- Fully qualified radiological control technicians are not proficient at performing fundamental radiological control tasks.
- ORP continues to have challenges in maintaining a full complement of qualified operations oversight personnel.

In summary, BNI is establishing safety management programs that, once fully implemented, should generally support key safety basis assumptions. The programs reviewed by EA were in various stages of development and implementation, and additional rigor is required in some areas to support future operational readiness. Until the concerns identified in this report are addressed or effective mitigations are put in place to improve operational proficiency and compliance with programs and procedures, risk will be elevated as the facilities continue transition to nuclear operations.

INDEPENDENT ASSESSMENT OF SAFETY MANAGEMENT PROGRAM DEVELOPMENT AT THE HANFORD SITE LOW-ACTIVITY WASTE FACILITY

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 safety management program (SMP) development by Bechtel National, Inc. (BNI) at the Hanford Site Waste Treatment and Immobilization Plant (WTP) Low-Activity Waste (LAW) facility. EA conducted the onsite portion of this assessment May 9-13, 2022.

The LAW facility has completed startup testing and is currently undergoing commissioning in preparation for waste processing operations to begin in 2023. Related activities include the development and implementation of SMPs that will support safe startup and operation of the LAW facility. This assessment evaluated the effectiveness of both BNI and DOE field office programs in managing the development of selected SMPs to support commissioning and startup. The SMPs selected by EA for this assessment, which were in various phases of implementation as the facility approaches operational readiness, were the fire protection program (FPP) and maintenance program at the LAW facility and the occupational radiation protection program (RPP) as it relates to laboratory sampling. The assessment also evaluated the effectiveness of DOE Office of River Protection (ORP) and Richland Operations Office (RL) (together "DOE Hanford")[1] oversight of BNI's SMP development and initial implementation. The scope of the assessment is described in the *Plan for the Independent Assessment of Safety Management Program Development at the Hanford Site Low-Activity Waste Facility* (May 2022).

2.0 METHODOLOGY

The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*, which is implemented 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 implementation of three SMPs at DOE nuclear facilities. EA used selected criteria from objectives FP.1, FP.3, and FP.5 of EA criteria and review approach document (CRAD) 31-12, Rev. 2, *Fire Protection Program*; objectives MT.1, MT.2, MT.5, MT.7, and MT.9 of EA CRAD 30-06, Rev. 0, *Conduct of Maintenance*; and sections A, B, C, D, and F of HSS[2] CRAD 45-35, Rev. 1, *Occupational Radiation Protection Program*. EA also used elements of EA CRAD 30-07, Rev. 0, *Federal Line Management Oversight Processes*, to collect and analyze data on DOE Hanford oversight activities related to SMP development for the LAW facility.

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 fire protection, maintenance, and

[1] Some site-wide oversight functions are consolidated to a single group within ORP or RL. The organizations conducting this oversight include the Safety & Health Division, which is part of RL, and the Nuclear Safety Division, which is part of ORP. Both RL and ORP provide programmatic oversight for projects managed by both offices.

[2] The Office of Health, Safety and Security (HSS) was an EA predecessor organization.

radiation protection activities; and walked down significant portions of LAW and associated facilities. The members of the assessment team, the Quality Review Board, and management responsible for this assessment are listed in appendix A.

There were no previous findings for follow-up addressed during this assessment.

3.0 RESULTS

3.1 Fire Protection

This portion of the assessment evaluated whether BNI is establishing and implementing adequate fire protection and prevention through program documents, system design, and inspection, testing, and maintenance (ITM) activities.

3.1.1 Fire Protection Program

BNI is establishing and implementing a comprehensive FPP to ensure the effectiveness of all fire protection activities. Its prime contract with DOE, No. DE-AC27-01RV14136, lists the applicable directives related to fire protection as DOE Order 420.1B, *Facility Safety*, attachment 2, chapter II, section 3.b, and, for maximum possible fire loss thresholds, DOE Order 420.1C, *Facility Safety*, attachment 2, chapter II, section 3.c. BNI policy 24590-WTP-G63-RAFP-FP-0001, *Policy: Fire Protection*, is effective in incorporating the requirements of DOE Order 420.1B, attachment 2, chapter II, section 3.a, affirming BNI's commitment to minimize losses from fire and related hazards consistent with highly protected risk status in private industry. Additionally, 24590-WTP-MN-RAFP-0001, *WTP Fire Protection Program Manual*, identifies appropriate codes and standards determined to be applicable to the LAW facility. However, this manual is based on DOE-STD-1066-97, *Fire Protection Design Criteria*, whereas the version of DOE Order 420.1B required in the contract references the more recent DOE-STD-1066-99. These requirements and standards have been significantly updated since the publication of the versions listed in the contract, so BNI's fire protection policy and manual are now significantly out of date with respect to current requirements and standards. (See **OFI-Hanford-1** and **OFI-BNI-1**.)

Combustible loading controls are implemented through 24590-WTP-REQM-RAFP-FP-0003, *Fire Protection Program Requirements for Control of Combustible and Flammable Materials*, which establishes site-level requirements and is appropriately based on National Fire Protection Association (NFPA) 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials*. It is supported by 24590-WTP-GPP-RAFP-FP-0005, *Control of Flammable and Combustible Materials*, which specifies controls for areas consistent with both 24590-LAW-FHA-RAFP-FP-0001, *Fire Hazards Analysis* [FHA] *for the Low-Activity Waste Facility*, and BNI's *Chemical Safety Management Program*. These documents are robust and, when fully implemented, should support key assumptions in 24590-LAW-DSA-NS-18-0001, *Documented Safety Analysis* [DSA] *for the Low-Activity Waste and Effluent Management Facilities*.

Fire area separation is clearly identified and described in the FHA and flowed down to comprehensive implementing procedures, such as 24590-WTP-REQM-RAFP-FP-0004, *Fire Protection Program Requirements for Inspection, Testing, and Maintenance of Fire Protection Systems and Components*; 24590-WTP-PL-RAFP-FP-0003, *Fire Barrier Visual Inspections*; and 24590-WTP-FIMD-FP-18-00005, *FPP Activity Level Flowdown Requirements for ITM - Fire Barriers*. EA reviewed five engineering analyses of two-hour fire rated penetration seals that adequately demonstrate seal fire rating and pressure resistance.

Identification and documentation of fire impairments are adequately addressed by 24590-WTP-GPP-RAFP-FP-0002, *Fire Protection System Impairments*. This document is based on appropriate industry

standards: NFPA 25, *Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2002 Edition; NFPA 101, *Life Safety Code*, 1997 and 2000 Edition; NFPA 72, *National Fire Alarm Code*, 2002 Edition; NFPA 801; DOE Order 420.1B; and FM 2-81, *Fire Protection System Inspection, Testing, and Maintenance and other Fire Loss Prevention Inspection*.

DOE Hanford has delegated to BNI authority having jurisdiction (AHJ) for fire protection to function on behalf of DOE for the purpose of rendering interpretations, including equivalent methods, alternatives, or variations in design. Document 24590-WTP-GPP-RADA-DA-0001, *Authority Having Jurisdiction (AHJ) Procedure*, appropriately provides the basis of implementation for all phases of the project. The fire protection AHJ (FPAHJ) is remote from the site and also serves as the LAW Project Fire Protection Engineer (FPE). While serving both functions may appear to represent a conflict of interest, the FPAHJ does not independently exercise delegated authorities. Fire protection-related engineering analyses typically go through a fire protection review board made up of several key BNI subject matter experts (SMEs), including other FPEs, prior to FPAHJ approval.

EA reviewed the qualification records of select BNI fire protection personnel. Contrary to DOE Order 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*, attachment 1, section 10, the FPAHJ's qualification record lists training but does not list relevant education, professional licensing, membership in a recognized professional organization, and a minimum of 10 years of relevant experience as required by 24590-WTP-GPP-RADA-DA-00001. (See **Deficiency D-BNI-1**.) In an interview, the FPAHJ stated that he met appropriate requirements for education, certifications, experience, and licensure as an FPE. However, DOE Order 426.2 requires that all personnel who can impact the safety basis through their involvement in operations, maintenance, and technical support must have qualifications that are formally documented. Qualification records for two FPEs who support the LAW facility, as documented on form 24590-CMNT-F00016, *Qualification for Inspection, Testing, and Maintenance of Fire Protection Systems*, demonstrated that the FPEs met qualification requirements.

The LAW facility FHA adequately assesses the hazards of and potential damage from fire, verifies that fire safety objectives are met, and is aligned with the DSA. Building fire areas are appropriately defined and bounded by fire-rated construction, with openings protected by equivalently rated fire doors and penetration seals. Appendix B of the FHA provides applicable design criteria that are formally tracked for implementation. Appendix F of the FHA lists approved exemptions, equivalencies, and interpretations, including the bases, approval status, and validation of approval conditions. Walkdowns of the spent carbon bed media storage areas (internal and external to the LAW facility) demonstrated appropriate fire-rated construction, as well as fire detection and fire suppression systems. Some areas associated with the construction were not yet complete (e.g., awaiting delivery of new fire doors).
Two building fire protection assessments (referred to by BNI as "fire protection facility audits") were comprehensive and appropriately identified weaknesses. Although DOE Order 420.1B cites no periodicity requirement, 24590-WTP-PL-RAFP-FP-0002, *Facility Fire Protection Audit Plan*, identifies that the LAW facility is required to be audited annually. BNI made efforts to meet this requirement, as evidenced by interviews with the Fire Protection Manager and two reviewed LAW facility fire protection facility audits conducted over a three-year period. An audit was performed in 2018 but, due to construction and pandemic work restrictions, not again until May 17, 2022. Both audits were appropriately performed by or under the direction of a qualified FPE. However, the audit checklist provides only "Yes/No" determinations without identifying the bases for making that determination. For example, the audit question, "Are the inspection, testing, and maintenance documentation for the fire protection systems in order?" does not include criteria for determining what is required for the documentation to be "in order" (e.g., the governing procedure). (See **OFI-BNI-2**.) Issues, deficiencies, and recommendations that resulted from these two audits were appropriately tagged with corrective action report numbers for tracking in the WTP issues management system.

The Hanford Fire Department (HFD) baseline needs assessment (BNA), HNF-SP-1180, *Hanford Fire Department Emergency Response Needs*, does not comprehensively address the response needs for the LAW facility during nuclear operations because it was still under construction when the BNA was developed in 2014. HNF-SP-1180 was developed in conjunction with the emergency response organization and was appropriately based on applicable requirements of NFPA codes and standards, including NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*. Although the BNA acknowledges that WTP will have inherent operational hazards, these were not included in the assessment. DOE Hanford approved the continued use of the 2014 BNA in June 2020 (correspondence number 2002071), stating that "no new hazards have been introduced to the Hanford Site since the submittal of the 2014 BNA." Interviewed HFD staff explained that a new draft BNA is in progress and will more explicitly address the LAW facility and its operational hazards.

Pre-incident planning by the HFD has not been developed for LAW facility operations. The current pre-incident plan, *WTP – LAW and Support Buildings (South Quadrant),* addresses only LAW facility construction activities. This pre-incident plan is inadequate to support the LAW facility initiating operations with respect to specific postulated events of concern, such as the carbon bed media fire in Room L-0304F and the crane fire involving equipment in Room L-0202. Interviewed HFD personnel reported that they had not received copies of the FHA from BNI and were unaware of this need. After EA informed BNI of this gap, BNI provided the FHA to the HFD for its use in developing credible fire scenarios of concern to establish appropriate strategies for effective emergency response. The FPP does not presently require BNI to transmit future revisions of the FHA to the HFD. (See **OFI-BNI-3**.) Drills specific to the LAW facility have not been identified to confirm that emergency response capabilities are adequate for the facility. (See **OFI-BNI-4**.)

3.1.2 Fire Prevention and Protection System Design

Fire protection design and performance requirements are adequately addressed in design products. Design and performance requirements were appropriately developed by, or under the direction of, an FPE and are based on design and performance requirements documented in the WTP safety requirements document (SRD). The SRD is approved by DOE and includes appropriate requirements for a reliable water supply, non-combustible or fire-resistive construction, and automatic fire extinguishing systems throughout all areas subject to significant life safety hazards (identified in the DSA). The design evaluation 24590-WTP-RPT-ENS-03-018, *Omission of Automatic Fire Suppression Systems from Selected WTP Rooms*, adequately justifies the omission of fire suppression systems for selected rooms within the LAW facility. The system description, 24590-WTP-3YD-FSW-00001, *System Description for the Fire Service Water (FSW), Fire Protection Water (FPW), and the Fire Detection and Alarm (FDE) Systems*, adequately addresses the requirements of the SRD. Reviewed calculations, drawings, and specifications adequately demonstrate compliance with cited requirements.

The LAW facility DSA does not include credited structures, systems, and components related to fire protection but does describe specific administrative controls (SACs) to limit the impact of a carbon bed fire event. BNI prepared analyses that support these SACs using sound engineering and scientific principles and appropriate standards, as illustrated by the following three key calculations:

- 24590-LAW-M6C-LVP-00010, *LAW Carbon Bed Fire Water Line Sizing Calculation*, uses an appropriate methodology and conservative assumptions to determine the required pipe size and restricting device size to ensure that the carbon beds are supplied with adequate fire water to fill the adsorber housing after a carbon adsorbent fire event, while preventing blockage of the exhaust gas flow for at least two hours.

- 24590-LAW-Z0C-20-00002, *Carbon Adsorber Fire Accident Analysis Calculation*, properly evaluates multiple events relating to carbon media fire, including (1) fire in the activated carbon adsorber material in the carbon adsorber housing, (2) fire in the spent activated carbon inside a storage drum (three variations), (3) fire in carbon material that has spilled on the floor, and (4) fire with an accelerant.
- 24590-LAW-U1C-FPW-00003, *Combustible Loading for Certain Rooms in the LAW Building*, evaluates combustible loading where sprinklers are omitted. Inaccessible high radiation areas that meet assumed combustible loading criteria were found acceptable. For the purpose of justifying unsprinklered high radiation rooms, the analysis is appropriate. However, there is no analysis for other rooms and areas in the facility that quantifies in-situ as well as transient combustibles to facilitate implementation of the programmatic combustible walkdown procedures. Rather, the facility has chosen to rely on a set of defense-in-depth controls. In part, these controls consist of controlling in-situ combustibles, preventing buildup of all ignitable materials through 24590-WTP-GPP-RAFP-FP-0014, *Fire Prevention and Protection*, and providing control of transient combustibles through 24590-WTP-GPP-REQM-RAFP-FP-0003. (See **OFI-BNI-5**.)

Verification and validation of design is appropriately completed before approval and implementation. Completed designs have been recorded in design output documents, and each design includes a cover sheet documenting the design scope, justification of need, and individuals, other than those who performed the work, who verified or validated the design.

3.1.3 Inspection, Testing, and Maintenance

BNI's ITM program requirements and implementing documents are generally adequate. Document 24590-WTP-REQM-RAFP-FP-0004 adequately identifies ITM requirements for all fire protection systems and components (i.e., water-based fire suppression systems, fire extinguishers, life safety code and lightning protection, fire alarm and signaling systems, and fire barriers), which are appropriately based on NFPA codes and standards. Field implementation methodology documents (FIMDs) flow down requirements for each system and are implemented through ITM procedures, which generally include appropriate acceptance criteria, requirements for test data records, and specified periodicities. However, EA identified the following two weaknesses:

- 24590-WTP-REQM-RAFP-FP-0004, section 3.1, states that water-based fire protection system test results shall be compared with those of the original acceptance test (if available) and with the most recent test results. Although ITM procedures for sprinklers generally include appropriate acceptance criteria, they do not provide a means to document the previous test results for comparison as required by 24590-WTP-REQM-RAFP-FP-0004. For example, 24590-WTP-FIMD-FP-18-00001, *Fire Protection Program Activity Level Flowdown Requirements for Inspection, Testing, and Maintenance – Water Based Fire Suppression Systems*, does not identify the original or previous supply water pressure acceptance test results for comparison with the current test results. (See **OFI-BNI-6**.) Without this information, inspectors cannot determine whether the water supply pressure is adequate to supply the required water to the sprinkler system.

- 24590-WTP-FIMD-FP-18-00005, *Fire Protection Program Activity Level Flow Down Requirements for Inspection, Testing, and Maintenance – Fire Barriers*, addresses weekly testing requirements for fire-rated swinging doors. The testing requires the inspector to verify that the door opens and closes freely through the full range of motion without any obstructions, and that it fully opens and closes from the following positions: full open, half open, and just off the latched position. There is presently no requirement to verify that the latching hardware operates and secures the door in the closed position, as was included in the annual testing. (See **OFI-BNI-7**.)

Observed ITM performance was generally adequate. For example, EA observed inspectors properly recording inspection results while performing procedure 24590-WTP-COWP-WC-22-01481, *Building 60 (LAB) Annual Maintenance of the Fire Rated Overhead Doors*, which cited the appropriate inspection acceptance criteria. During the observation of this evolution, the door was cycled open and closed as required. The inspectors noted a gap between the bottom cushion and the ends of the door exceeding the specified criteria, and properly recorded the issue for corrective action.

During a facility walkdown, EA observed a fire barrier penetration that could not be located in BNI's penetration seal database to confirm its details as required by 24590-WTP-FIMD-FP-18-00005, *Fire Protection Program Activity Level Flow Down Requirements for Inspection, Testing, and Maintenance – Fire Barriers*, and DOE Order 420.1B, chapter II, section 3.b(2)(a). (See **Deficiency D-BNI-2**.) Missing design and analysis details for penetrations may result in inadequate control of incipient fires. EA observed a fire barrier located on elevation +48 between L-0304F (carbon bed area) and the L-0304B corridor that was penetrated by a 12-inch insulated duct (penetration #10670), which lacked a damper. Through interviews, it was determined that this duct was installed in about 2018 as part of a facility modification to support off-gassing of the carbon bed. Interviewees explained that this duct is designed to divert the off-gas flow around the carbon beds during a fire, thereby reducing the fire's energy and release rate, and protecting downstream components, so the lack of damper was judged to be acceptable. However, this penetration could not be located in BNI's penetration seal database to confirm its engineering details. This weakness also implies that the post-modification activities were inadequate to ensure that configuration control for this fire barrier was maintained.

Facility observations demonstrated a lack of maturity in implementation of the combustible controls program to minimize the potential for incipient fire growth. The FHA appropriately estimates the fire risk posed by fixed combustibles and transient combustibles with conservative margin. Although buildup of ignitable materials is controlled through 24590-WTP-GPP-RAFP-FP-0005, no area-specific procedures for the LAW facility have been developed. BNI management explained that, although not implemented in the LAW facility, the transient combustible control program was implemented in the Analytical Laboratory (LAB). During a walkdown, EA observed transient combustibles in a LAB area that was posted as a "transient combustible exclusion area," contrary to 24590-WTP-GPP-RAFP-FP-0005, section 6.1.1(c) and DOE Order 420.1B, chapter II, section 3.b(2)(e). (See **Deficiency D-BNI-3**.) Allowing transient combustibles to accumulate in work areas promotes rapid incipient fire growth. BNI generally responded appropriately by removing most of the material; however, the following day EA observed four combustible stanchions remained in the posted area.

Impairments are appropriately tracked in an impairment log database by an impairment coordinator and categorized as either level-1 (Emergency), level-2 (Unplanned-Extensive), level-3 (Unplanned-Limited), or level-4 (Pre-Planned). Document 24590-WTP-GPP-RAFP-FP-0002 defines timelines by which impairments must be corrected or actions taken to formally extend the impairment with the approval of an impairment coordinator, based on these levels. An April 2021 log shows 21 level-1 impairments (two of which had been in place for more than 4 months) and nine level-2 impairments (two of which have been in place for 1.5 and 2 years). Most were related to fire door deficiencies, which BNI operations personnel explained were inherited when the LAW facility was turned over from the construction organization. However, contrary to 24590-WTP-GPP-RAFP-FP-0002, sections 6.3.7(b) and 6.4.6(b) and DOE Order 420.1B, chapter II, section 3.b(2)f), two level-1 and two level-2 impairments exceeded requirements to be corrected within 7 days and 30 days of the impairment initiation date, respectively. (See **Deficiency D-BNI-4**.) Ineffective management of fire impairments promotes complacency and increases the fire risk. Impairments are listed on the log for corrective maintenance but, in many cases, are waiting on parts and/or labor.

Additionally, one observed level-4 impairment, 24590-WTP-IMP-OP-21-0392, *Component LST03-6*, initiated on September 30, 2021, was written for a fire door blocked open to support maintenance work in LAW facility Room L-0203. The "expected restoration date" for this impairment was October 13, 2021, but the impairment was still in place on May 10, 2022, with no documented extension approval. Furthermore, the compensatory measures were ineffective, since the door was blocked open with no person present, contrary to the impairment compensatory measures to have a person "assigned to perform the work to isolate and disconnect the hose, then make sure the fire doors shut" in the event of a fire. Therefore, this impairment was expired and the cited compensatory measures were not in place, contrary to 24590-WTP-IMP-OP-21-0392 and DOE Order 420.1B, chapter II, section 3.b(2)f). (See **Deficiency D-BNI-5**.) With no one in place to support the necessary actions to disconnect the hose in case of a fire, the fire door would remain open, thereby increasing the risk of a fire penetrating a credited fire separation. BNI responded to this observation by immediately restoring the compensatory measure.

Fire Protection Conclusions

BNI is establishing a comprehensive FPP that, when fully implemented as described at the LAW facility, will effectively support key assumptions in the LAW facility DSA. Implementation of the program to support upcoming LAW facility operations is ongoing. The building fire protection assessments are comprehensive, but the BNA and pre-incident plans do not yet address LAW facility operations. Fire protection design requirements are adequately addressed in design products, and although no credited structures, systems, and components in the DSA are related to fire protection, the analyses supporting the SACs used sound engineering and scientific principles and appropriate standards. The ITM program is generally adequate; however, EA identified some weaknesses in the management of fire barriers, combustibles, and fire impairments.

3.2 Maintenance Program

This portion of the assessment evaluated whether BNI is establishing and implementing an adequate nuclear maintenance management program (NMMP) that addresses resources, types of maintenance, maintenance personnel training and qualification, and spare parts and materials.

3.2.1 Nuclear Maintenance Management Program Description

BNI has established an adequate NMMP for the proper conduct of maintenance activities. The NMMP program description (NMMPD), 24590-WTP-PD-RAMN-MN-0003, *DFLAW Nuclear Maintenance Management Program Description*, adequately addresses all 17 elements required by DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*. DOE Hanford approved revision 3 of the NMMPD on February 3, 2022, satisfying the requirement for DOE approval on a three-year cycle. After this revision of the NMMPD, BNI properly conducted an unreviewed safety question screen in April 2022 (24590-WTP-DSE-NS-22-120, *DFLAW Nuclear Maintenance Management Program Description*), which did not result in an unreviewed safety question but demonstrated adherence to DOE Order 433.1B, section 4.c.

The NMMPD appropriately requires assessment of all 17 elements on a three-year schedule in accordance with DOE Order 433.1B. The NMMP assessment schedule confirms that the order requirements are satisfied. Nine reviewed NMMP assessment reports from 2020 to 2022 demonstrate that BNI adheres to its schedule. Three of the more recent NMMP assessments were found to be adequate in rigor and depth and thoroughly reviewed the assessed areas. For example, a management assessment of work control (24590-WTP-SAR-WC-19-0001, *Work Control Management Assessment*) resulted in 34 OFIs.

Work control requirements are adequately established in 24590-WTP-GPP-RAMN-WC-0001, *Work Control Process*, and 24590-WTP-GPP-RAMN-WC-0004, *Periodic Maintenance/Surveillance and*

Administrative Tickler Process. Field work is performed to activity-level work control documents (ALWCDs), which are included in maintenance work packages and contain step-by-step instructions for performing work. EA identified the following three weaknesses related to BNI's use of and adherence to these ALWCDs:

- During an observed maintenance activity, quarterly fire service water (FSW) tank level alarm function checks were not performed as written in the ALWCD for both tanks, contrary to the 10 CFR 830.121(a) requirement that activities that may affect nuclear safety must be performed in accordance with 10 CFR 830.122, *Quality assurance criteria*, including the 10 CFR 830.122(e)(1) requirement that work be performed using approved procedures. (See **Deficiency D-BNI-6**.) Not following maintenance procedures as written could result in adverse consequences. In this case, not performing the checks in accordance with the ALWCD could have resulted in failure to identify miscalibration of the low-level switch, which in turn could allow a low water level in an FSW tank to go undetected, potentially impacting fire response capability.

  24590-WTP-COWP-WC-22-01622, *Quarterly FSW Tank Level Alarm Function Checks*, is a continuous-use ALWCD for performing a functional test of the low-level switches for each of WTP's two FSW tanks and verifying that associated alarms are received on the supervisory alarm panel. Multiple steps require instrumentation and control (I&C) craft personnel at the level transmitter at each FSW tank to simulate a water level change in the tank using calibrated measurement and test equipment (M&TE) while a sprinkler fitter monitors low-level indication on the remote level instrument inside the fire pump enclosure adjacent to the tank. Once the low-level switch on the remote level instrument actuates, the sprinkler fitter informs the I&C craft, who records actuation pressure. The ALWCD then directs verification that the switch actuation is indicated (or has cleared) on the supervisory alarm panel. The low-level switch for FSW tank 1 is in the enclosure for fire pump A; the switch for FSW tank 2 is in the enclosure for fire pump B. The supervisory alarm panel that receives indication from both level switches is in the A enclosure.

  During the observed maintenance activity, the sprinkler fitter remained in the A fire pump enclosure and monitored for tank low-level indication on the supervisory alarm panel only. Once informed by the sprinkler fitter that the alarm had been received on the alarm panel, the I&C craft used circle-slash place-keeping notation to incorrectly indicate that the steps had been completed both to observe the low-level switch indication and to verify the alarm on the alarm panel. The sprinkler fitter did not have a copy of the ALWCD but instead relied on verbal instructions from the I&C craft. Additionally, EA observed a delay of approximately three seconds between indication of low-level switch actuation on the remote level instrument and annunciation of the alarm on the supervisory alarm panel. During that interval, the I&C craft continued to adjust pressure, not knowing that the low-level switch had already actuated. Consequently, the low-level switch actuation and clear pressure setpoints, which correspond to FSW tank level, may not have been accurately verified.

- Three reviewed work packages for maintenance work performed over several days did not document completion of required pre-operational steps each time work recommenced, contrary to DOE Order 422.1, attachment 2, sections 2.h(1) and 2.h(2). (See **Deficiency D-BNI-7**.) This condition could lead to loss of control of equipment and system status. The BNI maintenance manager stated that work packages, including those worked multiple days, are reviewed daily by the shift operations manager (SOM) and documented on a daily release sheet prior to being released for work. In addition to this work-release process that ensures the SOM is aware of the daily work schedule, the ALWCD in each of the three reviewed work packages appropriately contained important pre-work steps for notifying the shift operations manager, the impairment coordinator, or the control room before performing work, as well as steps for recording the equipment status. However, the ALWCDs do not direct or provide for recording completion of notification steps multiple times prior to work starting when the work is performed over several shifts or days.

- Several issues that were observed in the reviewed ALWCDs and the performance of the activities could result in missed information, inaccurately recorded data, or poor procedural compliance. (See **OFI-BNI-8**.) The following are examples:

    - Maintenance ALWCDs contain a table to record calibration information for M&TE. The associated work packages include separate data sheets to record the same information. In five of the seven reviewed completed work packages, the data sheet was complete, but the table was not. Recording the same information in multiple places contributes to a lack of procedure adherence and potential transcription errors.
    - A reviewed completed work package for an observed evolution contained steps in the ALWCD to record information on the attached work record summary sheet (WRSS). During the evolution, workers drew a circle beside each step of the procedure as part of a circle-slash place-keeping technique to indicate that the step is in progress. The workers explained that, in practice, they perform the step and note in the margin any needed record information. Upon completion of the work evolution, the worker then transcribes all data recorded in the ALWCDs' margins into the WRSS before slashing the circle to indicate that the step is complete. This practice could contribute to missing data that is required to be transcribed into the WRSS or to transcription errors.
    - The ALWCD for conducting the FSW tank level alarm check discussed above contains a step to verify that the instrument gives the proper results but instructs the worker not to record any values. This instruction is not consistent with a step requiring verification of a parameter, which may need to be confirmed after completion of the activity.

3.2.2 Maintenance Management Program Resources

The NMMPD ensures adequate personnel and planning resources for nuclear maintenance activities. Maintenance staffing levels are appropriately determined through a formal staffing plan that takes into account current and future workloads. The current staffing plan identifies a need for 114 craft personnel once the LAW facility is fully operational, with 108 personnel currently on board. BNI is adding these personnel resources in phases to support upcoming 24 hours per day/7 days per week operations. Maintenance activities are appropriately scheduled and estimated in accordance with maintenance program processes described in the NMMPD, which specifies a graded approach depending on the level of control needed. Planners use input from craft personnel to better estimate the personnel resources needed to support planned work activities. Maintenance activities are appropriately tracked in the computerized maintenance management system (CMMS). At the time of this assessment, the CMMS database identified 41 LAW facility maintenance items that were in the grace period (i.e., within an allowable due-date extension before being considered overdue) and 48 preventive maintenance activities that were overdue. EA confirmed that all activities were being actively worked. The CMMS is appropriately used to populate BNI maintenance metrics to maintain high visibility on delinquent tasks.

BNI is making efforts to improve existing work processes. Revision 11 of 24590-WTP-GPP-RAMN-WC-0001, effective May 23, 2022, simplifies the work planning and execution processes. Additionally, the maintenance organization is instituting a "zone" maintenance matrix concept to provide better integration and ownership of maintenance activities among maintenance managers, operations managers, and facility managers. Each zone maintenance management team consists of a zone maintenance manager, an operations manager, and a facility manager to coordinate and conduct maintenance activities for a specific facility or area.

A walkthrough of the craft workshops confirmed that separate workshops are maintained for radiological and non-radiological work as described in the LAW facility DSA. The workshops were adequately equipped and controlled, free of unnecessary equipment, and neat and orderly.

Furthermore, a walkdown of the M&TE tool crib demonstrated that appropriate controls are in place for calibrated M&TE in accordance with the LAW facility DSA. Calibrated equipment is adequately tracked with a structured query language (SQL) server database that accounts for all calibrated equipment. Equipment returned for recalibration and equipment issued to the operators is adequately controlled and scheduled. The M&TE manager manually queries the database to identify equipment due for calibration and sends recall messages to the user. (See **OFI-BNI-9**.)

3.2.3 Types of Maintenance

The BNI maintenance program adequately uses preventive maintenance (PM), reliability-centered maintenance, and corrective maintenance (CM) to provide safe, efficient, and reliable equipment operation.

Development of PM activities is adequately described by 24590-WTP-GPP-RAMN-WC-0004. BNI appropriately uses engineering requirements and manufacturer recommendations in establishing PM activities. PMs are effectively planned and tracked in accordance with 24590-WTP-GPP-RAMN-WC-0001. A review of PM completion metrics for April 2022 demonstrated that these activities are prioritized and completed in a timely manner: 85% (960 of 1130) were completed on time.

Reliability-centered maintenance is adequately implemented. Plant Engineering personnel, in conjunction with system engineers (SEs), conducted a thorough reliability analysis in accordance with 24590-WTP-POSP-PENG-21-00001, *System Technical Risk Assessment*, and 24590-WTP-PL-PENG-19-0021, *Selection of WTP DFLAW Systems for RCM Analysis and Resulting System Critical Components.* Eight systems and approximately 800 components were analyzed. The completed analysis, EN-0022, *Reliability Centered Maintenance (RCM) Analysis*, identified the use of predictive maintenance technologies (e.g., vibration, ultrasonic, and thermography) for 41 components rated "Medium-High Risk," where use of such technology was feasible. Two interviewed SEs explained that they are actively monitoring system conditions using these technologies; this monitoring has not resulted in any needed adjustments to maintenance activities.

The reviewed work packages demonstrate adequate performance of CM. CM currently accounts for approximately 50% of the maintenance (by total maintenance hours) performed by the maintenance organization. Four reviewed completed CM work packages were documented as required by 24590-WTP-PD-RAMN-MN-0003. All show appropriate, timely supervisory review to ensure proper completion of the work and verification that the CM resolved the problem.

BNI ensures appropriate confirmation of completed maintenance work and documentation of maintenance history. Review of 10 work packages (PM and CM) demonstrated that post-maintenance testing was required and performed for all 10 activities. 24590-WTP-PD-RAMN-MN-0003 requires the development and maintenance of a documented and retrievable maintenance history using the CMMS. The interviewed CMMS database manager and the reviewed database entries adequately demonstrated the recording of maintenance histories. Monthly metrics provide adequate evidence that the maintenance history data is used to monitor system and maintenance organization performance. Interviews with SEs and review of their monthly system health reports for March and April 2022 confirm that SEs are using maintenance histories to trend system performance to identify early signs of equipment performance issues.

3.2.4 Maintenance Personnel Training and Qualification

Maintenance personnel are adequately trained and qualified to perform nuclear maintenance work. Program description documents 24590-WTP-LIST-RATQ-TQ-0001, *Qualified Positions in Accordance with DOE O 426.2*, and 24590-WTP-LIST-RATQ-TQ-0004, *Plant Management Maintenance Staff Training Program Description*, provide a comprehensive approach to training and qualification of nuclear facility maintenance personnel. These documents govern the qualification requirements for each craft discipline.

The Craft Qualification Status database provides appropriate tracking of qualification progress. The BNI training department maintains a list of fully qualified individuals, which the maintenance organization uses effectively to assign qualified staff to work activities. Completed qualification cards for two fully qualified and two partially qualified craftsmen demonstrated the inclusion of appropriate training elements (e.g., ammonia safety, fall protection, conduct of operations). These qualification cards ensure that craft personnel have the correct knowledge and experience to perform their nuclear facility maintenance tasks. Also, the maintenance organization appropriately assigns "craftsmen in training" to work under the watch of a fully qualified craftsman.

All craft discipline qualification cards include training on LAW facility DSA requirements. However, since facility nuclear operations have been repeatedly delayed, the maintenance organization has not enforced this training requirement because the facility is not yet operational. Readiness review activity is scheduled for late 2022. At the time of the assessment, the maintenance organization craft personnel were not adequately prepared with a basic knowledge of DSA requirements to support the readiness review. (See **OFI-BNI-10**.)

3.2.5 Spare Parts and Materials

BNI is establishing an effective spare parts and materials program to ensure continuous safety system availability and operability. The BNI spare parts manager, working collaboratively with the SEs, identified 606 critical spare components for eight LAW facility systems and one system outside of the LAW facility. Approximately 95% of these parts are currently on hand, and the rest are being procured. A summary table reviewed by EA was derived from the spare parts database and appropriately identifies minimum numbers for each component to trigger the ordering of additional parts. Critical spares are located in a warehouse with controlled personnel access and environmental conditions. More than 3,200 components for important spares (a maintenance organization grading level), including those components for the fire protection systems, have been identified; of these, 83% are on hand and the rest are in procurement.

Maintenance Program Conclusions

BNI has established and implements a generally adequate maintenance program through the NMMPD, which appropriately covers all 17 elements required by DOE Order 433.1B. In most cases, maintenance activities are properly scheduled, planned, and performed by qualified craft personnel. Facilities and calibrated equipment are properly controlled and available. Systems are correctly tested following maintenance activities, and maintenance history data is used to trend system performance. Critical spare parts are on hand or being ordered. However, several weaknesses were identified regarding work package inadequacies and weak procedure adherence.

3.3 Radiation Protection Program

This portion of the assessment evaluated whether BNI is establishing and implementing a comprehensive occupational RPP that includes radiological work planning, monitoring, area controls, and training and qualification to support WTP LAB operations.

3.3.1 Radiation Protection Program Administration

In preparation for conduct of radiological work, BNI is establishing a comprehensive occupational RPP, including a suite of implementing procedures, to effectively implement and control all radiological protection activities in accordance with 10 CFR 835.101, *Radiation protection programs*. The RPP document 24590-WTP-RPP-ESH-01-001, *Radiation Protection Program for Design, Construction, Commissioning and Operations*, in conjunction with the *WTP Radiation Protection DOORs*™ *Implementation* matrix, describes the flowdown of 10 CFR 835, *Occupational Radiation Protection*, requirements and appropriately directs that any updates to the RPP be submitted to DOE as required by 10 CFR 835.101. RPP organizational responsibilities for radiological protection are well defined. Twelve management personnel and 24 staff members demonstrated a thorough understanding of the RPP during interviews. Each interviewee described adequate staffing and sufficient resources to accomplish assigned tasks. Radiological protection-related ongoing work and training activities are actively monitored by site/facility managers and supervisors, as demonstrated through a daily radiological control (RadCon) staff meeting and a biweekly meeting between BNI and the DOE Hanford radiation protection SME. Managers' and supervisors' observations of radiological protection training evolutions and correction of any observed deficiencies ensure that personnel have the requisite skills to perform assigned tasks in accordance with established procedures.

BNI conducts internal audits of the RPP in accordance with 10 CFR 835.102, *Internal audits*. The internal audit schedule and EA's review of the audit requirements demonstrated that all functional elements of the RPP will be reviewed at least every 36 months. A comprehensive BNI management assessment completed in September 2021 appropriately addressed the conduct of planning, scheduling, and performing radiological work to determine the effectiveness of the RPP. Issues identified by the BNI management assessment were assigned appropriate corrective actions and are being tracked in the BNI issues management system.

3.3.2 Radiological Work Planning

BNI has adequate procedures for work planning to control personnel's external and internal radiation exposures. The work control process document, 24590-WTP-GPP-RAMN-WC-0001, includes defined work scopes and integration with other safety and health disciplines, ensuring that radiological exposures to personnel are maintained as low as reasonably achievable (ALARA) and minimizing the potential for spread of contamination in accordance with 10 CFR 835, subpart C, *Standards for Internal and External Exposure*. The radiological work planning process results in written work authorizations, including radiological work permits or other technical work documents (e.g., chemistry laboratory procedures) approved by the RadCon organization, that control entry and work performance in all radiological areas. Work authorizations also adequately provide for the RadCon SME's identification of radiological hazards and control measures, such as radiological conditions, personal protective equipment, limiting conditions, hold points, and void limits.

3.3.3 Radiological Monitoring

BNI has adequate procedures for routine and non-routine radiological monitoring external radiation, fixed and removable contamination, and airborne radioactivity in order to characterize radiological conditions and ensure the safety of personnel, in accordance with 10 CFR 835.401, *General requirements*, and 10 CFR 835.403, *Air monitoring*. Twelve radiological control procedures that EA reviewed identified the appropriate frequency and location for anticipated routine and non-routine radiation and contamination surveys. Five interviewed radiological control technicians (RCTs) and the RadCon operations manager were familiar with the survey planning processes.

Air sampling documents 24590-WTP-GPP-RARP-RP-3017, *Continuous Workplace Air Monitoring and Sampling*, and 24590-WTP-GPP-RARP-RP-3006, *Workplace Grab Air Sampling*, adequately address procedures and criteria to define radiological air sampling and monitoring needs. Anticipated air sampling needs have been identified in the LAB for chemical fume hoods, where fixed head air samplers are located. Two interviewed RCTs were knowledgeable of the air sampling procedures and are engaged in ongoing training in sampling operations. Additionally, 24590-WTP-3PS-HARA-T00001, *Airflow Testing of the Low Activity Waste, Lab and Effluent Management Facilities at the Waste Treatment Plant*, details the radiological engineering organization's planned smoke studies to confirm air flows and the correct placement of existing air sampling heads.

Document 24590-WTP-GPP-RARP-RP-1021, *Managing Radiological Records*, provides adequate criteria for completing survey records, documenting the chain of custody for samples, specifying acceptable documentation of survey results, evaluating survey and sampling results, and responding to and reporting unanticipated survey results. Because the LAB facility is not yet operational, no survey records were available for review to demonstrate readiness to perform radiation measurements, contamination surveys, or air sampling and monitoring.

BNI radiological control program documents reviewed by EA were adequate with one exception: the *WTP Radiation Protection DOORs™ Implementation* matrix shows that the radiation protection procedure for managing high and very high radiation areas in accordance with 10 CFR 835.502, *High and very high radiation areas*, is planned to be developed at a later date. Interviewed senior RadCon management explained that the development of this procedure is under way.

3.3.4 Radiological Area Controls

BNI has adequate procedures for radiological postings, access controls, and material controls to prevent unauthorized access and avoid unnecessary radiological exposures in accordance with 10 CFR 835.601, *General requirements*; 10 CFR 835.602, *Controlled areas*; and 10 CFR 835.603, *Radiological areas and radioactive material areas*. BNI has appropriate procedures and criteria for defining radiological areas and associated posting requirements; using administrative and engineering controls to provide adequate access control for entry into radiological areas, including signs, barricades, lights, locks, and/or interlock systems; and labeling radioactive materials, including containers and process lines, ducts, and vessels. Because the LAB is not yet operational, the only radiological materials in the facility are exempt and/or sealed radioactive calibration, training, and check sources, and radioactive stock solutions in storage for future use. EA's observation was limited because entry requirements are not yet posted, and the administrative and engineered access controls to radiological areas have not yet been implemented.

The observed radioactive material areas (e.g., areas associated with the storage and/or use of sealed radioactive calibration, training, and check sources) were appropriately posted and/or labeled, with one exception. During the walkdown of the LAB, EA observed two containers of liquid posted as hazardous waste satellite accumulation areas in a fume hood in laboratory RL-9. One container had a handwritten annotation that it contained radionuclides, in addition to several hazardous waste codes associated with

the properties of nitric acid contents as well as other markings. Neither the container nor the area had radiological postings or labeling, and the hood was tagged out of service. EA notified the LAB RadCon Operations Manager about this observation. The manager was not sure of the use or actual radiological composition of the liquid in the two containers but later identified the materials as wastes generated from the Inductively Coupled Plasma Mass Spectroscopy standard solutions being used by the analytical chemistry organization. The liquids contain thorium nitrite and uranyl nitrite solutions obtained as a consumer product and distributed under 10 CFR 40.13, *Unimportant quantities of source material*, regulatory licensing exemption and are therefore not required to be posted as radioactive materials. However, these liquids are readily dispersible and are a potential source of radiological contamination in the event of a spill. When these liquids are not posted as radioactive material, spills could unknowingly spread contamination, and first responders could respond improperly during an off-normal occurrence, such as a fire or an event resulting in personnel injury. (See **OFI-BNI-11**.)

3.3.5 Radiological Training and Qualification

As documented in 24590-WTP-PD-RARP-RP-0003, *Radiological Control Training Program Description*, BNI has established an adequate formal radiological training program for developing and improving the knowledge necessary for RCTs to perform assigned job functions, in accordance with 10 CFR 835.103, *Education, training, and skills*. Implementing procedure 24590-WTP-GPP-RARP-RP-1020, *Radiological Control Technician and Radiological Control Supervisor Training*, provides an adequate approach to initial and continuing training of workers and RCTs. The RCT radiation safety knowledge training appropriately includes the following topics:

- Risks of radiation and radioactive materials, including prenatal radiation exposure
- Basic radiological fundamentals and radiation protection concepts
- Physical design features
- Administrative controls, limits, policies, procedures, alarms, and other measures implemented at the facility to manage doses and maintain doses ALARA.

BNI appropriately performs formal RCT training activities to evaluate the qualification of radiological workers and technicians based on their knowledge. BNI has deemed that 18 of 26 employees hired as RCTs have completed the training and qualification process and are qualified RCTs; the remaining eight employees are engaged in initial RCT qualification.

Once qualified, an RCT must demonstrate operational proficiency in accordance with 24590-WTP-PL-RARP-RP-0005, *Radiological Control Proficiency Plan*, and satisfactorily perform tasks in accordance with 24590-WTP-GPP-RARP-RP-1023, *Radiological Control Performance Demonstrations*. BNI has deemed that one RCT is proficient based on prior experience as an RCT at Hanford; the proficiency of the remaining 25 RCTs has not been demonstrated. However, because 24590-WTP-GPP-RARP-RP-1023 does not include formal mechanisms for documenting and measuring the practical skills necessary for RCTs to perform their jobs, RCTs' progress toward full proficiency cannot be measured. (See **OFI-BNI-12**.)

EA observed the conduct of an RCT proficiency demonstration for "job coverage" (a topic specified in 24590-WTP-GPP-RARP-RP-1023). The proficiency demonstration appropriately included monitoring of radiological conditions and contamination controls. However, during the proficiency demonstration, EA observed the following radiological practices by qualified RCTs that are not consistent with RCT classroom training and appropriate radiological controls: (See **OFI-BNI-12**.)

- Attempting to perform contamination surveys with the survey instrument at waist height and/or several inches above simulated contaminated surfaces

- Performing 30-centimeter (cm) dose surveys at distances much greater than 30 cm
- Tossing waste and laundry items across radiological boundaries into radiological waste containers
- Reaching across radiological boundaries without personal protective equipment covering all portions of the body
- Entering a simulated contamination area in a manner that could allow loose and unprotected personal clothing to contact items or surfaces inside the boundary

Radiation Protection Program Conclusions

BNI is establishing and implementing a comprehensive occupational RPP through program documents, exposure controls, monitoring capabilities, radiological postings, and requisite radiological training to support LAB operations. Program elements include a suite of implementing procedures to effectively implement and control all radiological protection activities; procedures for work planning to control personnel external and internal exposures; and procedures for routine and non-routine radiological monitoring for external radiation, fixed and removable contamination, and airborne radioactivity. However, EA identified weaknesses in the areas of radiological material control and RCT training.

3.4 DOE Field Element Oversight

This portion of the assessment evaluated the adequacy of DOE Hanford's oversight of BNI's SMP development and initial implementation for the LAW facility, including program and field oversight of activities performed in support of the SMPs.

DOE Hanford has a dedicated WTP organization at the assistant-manager level within ORP that provides project and safety oversight of BNI during design, construction, and commissioning of WTP facilities, including the LAW facility. Oversight of BNI's maintenance program is performed by the Commissioning, Maintenance, and Operations Division within the WTP organization. Facility Representatives (FRs) in the Operations Oversight Division (OOD), who report to the ORP Assistant Manager for Safety and Quality, provide oversight of facility operations. Programmatic oversight functions are provided by appropriate organizations in both ORP and RL for projects managed by both offices. RPP oversight is performed by SMEs in the Safety & Health Division, which is part of RL; FPP oversight is performed by SMEs in the Nuclear Safety Division, which is part of ORP. All DOE Hanford oversight is performed using DOE-PRO-PAI-50085, *Integrated Oversight*.

DOE Hanford FRs and SMEs perform a variety of oversight activities related to LAW facility SMPs, ranging from formally documented surveillances to informal field observations, using a graded approach to ensure that the level of oversight is commensurate with the significance of the activity. Based on EA interviews with oversight personnel from several organizations, teamwork and communication among the various oversight groups is a strength, contributing to effective oversight.

DOE Hanford's strategy for oversight of SMP development for the LAW facility and other WTP facilities is documented in *Waste Treatment and Immobilization Plant Direct-Feed Low-Activity Waste Core Requirement Oversight Strategy: Core Requirement 1 – Safety Management Programs* (CROS-1), which describes a verification strategy for each of the 14 required SMPs, including the three reviewed by EA in this assessment, together with general descriptions of planned oversight activities for each. The stated purpose of CROS-1 is to ensure that contract requirements have been flowed down into facility-specific procedures, procedures have been effectively implemented, sufficient qualified personnel are available, and facilities and equipment are available and adequate for safe facility operation.

While CROS-1 provides a strategic-level description of the oversight to be performed to ensure effective SMP implementation, the day-to-day oversight activities that support CROS-1 are planned by the groups or individuals providing the oversight. The documentation of these plans is not consistent among groups

and subject areas. While different types of oversight (e.g., operational vs. programmatic) may necessitate different planning processes, not using a consistent approach may limit data collection and use of performance indicators to enhance continuous improvement of DOE Hanford oversight.

DOE Hanford oversight personnel effectively document most oversight results in the Integrated Contractor Assurance System (iCAS) and transmit the results to BNI for appropriate action. During interviews, oversight personnel described well-established relationships with BNI personnel in which DOE Hanford personnel routinely provide real-time feedback during oversight activities to ensure that issues are addressed. Oversight personnel stated that providing immediate feedback often elicits a faster response. However, many of the observations provided as real-time feedback are not documented in iCAS for tracking and trending. Oversight personnel interviewed by EA described varying thresholds for when they would document an issue in iCAS, though all noted that significant or programmatic issues would result in an iCAS entry. Several also stated that they made periodic iCAS entries to document their oversight activities generally, or to document the status of the program they are responsible for overseeing. Of particular note, the FPP SME enters into iCAS monthly a comprehensive and thoroughly documented status report for BNI's FPP, discussing FPP status, ongoing activities, recent accomplishments and challenges, a summary of oversight activities and self-assessments, performance indicators, a list of open condition reports, and discussion of strengths and weaknesses.

Between ORP's WTP organization and supporting program SMEs from both ORP and RL, DOE Hanford staffing is generally adequate for oversight of LAW facility startup activities. Program SMEs noted some staff shortages but stated that plans were in place to fill open positions or to transition work scope as the LAW facility and other WTP facilities approach operational readiness. However, OOD continues to have challenges in maintaining a full complement of qualified FRs to oversee operations, currently having two qualified FRs out of seven required for WTP facilities, including the LAW facility, per the October 2021 FR staffing analysis. Further, the 2021 staffing analysis was based on then-current field activities; additional qualified FRs will likely be needed to provide effective operational oversight as facilities complete the transition from construction and commissioning to waste treatment operations. During interviews, OOD leadership summarized plans to improve FR staffing and qualification levels in the near term, but continued management attention is warranted to ensure that staffing levels remain adequate to provide effective oversight as facilities become operational.

DOE Field Element Oversight Conclusions

DOE Hanford generally provides effective oversight of BNI's SMP development and initial implementation. Strong teamwork and communication among various groups responsible for oversight throughout DOE Hanford is evident, contributing to effective oversight. More consistent planning and documentation of oversight activities could allow for additional data collection and enhance continuous improvement. Continued attention to staffing and qualification of oversight personnel is warranted, particularly for operations oversight as facilities approach operations.

4.0 BEST PRACTICES

No best practices were identified during this assessment.

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.

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Deficiency D-BNI-1: The BNI FPAHJ qualification record does not address all position qualification requirements. (DOE Order 426.2, attachment 1, section 10, and 24590-WTP-GPP-RADA-DA-00001)

Deficiency D-BNI-2: BNI has not inspected the fire barrier and its associated penetration seals located at elevation +48 or documented them in the BNI penetration seal database. (24590-WTP-FIMD-FP-18-00005; DOE Order 420.1B, chapter II, section 3.b(2)(a))

Deficiency D-BNI-3: BNI allowed transient combustible materials to be stored in the LAB, contrary to postings and requirements. (24590-WTP-GPP-RAFP-FP-0005, section 6.1.1(c); DOE Order 420.1B, chapter II, section 3.b(2)(e))

Deficiency D-BNI-4: BNI exceeded 7-day and 30-day timeliness requirements for correcting two level-1 and two level-2 impairments, respectively. (24590-WTP-GPP-RAFP-FP-0002, sections 6.3.7(b) and 6.4.6(b); DOE Order 420.1B, chapter II, section 3.b(2)(f))

Deficiency D-BNI-5: BNI did not maintain compensatory measures for a fire impairment, and no extension approval was in place. (24590-WTP-IMP-OP-21-0392; DOE Order 420.1B, chapter II, section 3.b(2)(f))

Deficiency D-BNI-6: BNI did not follow the ALWCD instructions during the quarterly FSW tank level alarm functional checks. (10 CFR 830.122(e)(1))

Deficiency D-BNI-7: BNI documentation is inadequate to demonstrate that important system/facility status control steps are performed prior to each start of work that continues over multiple days and affects equipment and system status or alignment. (DOE Order 422.1, attachment 2, sections 2.h(1) and 2.h(2))

7.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified 12 OFIs 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.

DOE Hanford

OFI-Hanford-1: Consider updating BNI's Prime Contract to cite the latest applicable sections of DOE O 420.1C.

Bechtel National, Inc.

OFI-BNI-1: Consider updating the FPP programmatic elements to the latest version of DOE Order 420.1C and DOE-STD-1066-2016, *Fire Protection*, as referenced by the order.

OFI-BNI-2: Consider applying DOE-STD-1066-2016 section 7.2, to improve the depth and effectiveness of building fire protection assessments.

OFI-BNI-3: Consider revising the FPP to add requirements ensuring that future revisions of the FHA are transmitted to the HFD.

OFI-BNI-4: Consider coordinating with HFD to develop pre-incident plan(s) for the LAW facility that reflect the future operations and facilitate HFD training and drills on the use of those plans to confirm that emergency response capabilities are adequate for the facility upon startup.

OFI-BNI-5: To assist implementation of the combustible control programmatic controls, consider providing conservative quantity limits of transient combustible materials for each area that has not been analyzed.

OFI-BNI-6: Consider adding reference pressures to 24590-WTP-FIMD-FP-18-00001, section 3.2.2, table 1, to facilitate the comparison of the as-found water pressure to the original and previous test results in order to verify that pressure is being maintained.

OFI-BNI-7: Consider revising 24590-WTP-FIMD-FP-18-00005, section 3.2.2, item b, to require verification that the fire door latching hardware operates and secures the door in the closed position.

OFI-BNI-8: Consider improving work package processes and procedures to facilitate collection of data in the field, to eliminate recording of information in multiple places and in multiple formats during work, and to better align with expectations and requirements for work performance.

OFI-BNI-9: Consider automating the calibration recall of M&TE, similar to other DOE sites such as Pantex Plant.

OFI-BNI-10: Consider training craft personnel on DSA requirements to prepare for the upcoming readiness review.

OFI-BNI-11: Consider applying additional means of identifying radioactive materials (including those exempt from regulatory controls) that are readily dispersible or could result in radiological contamination during an off-normal occurrence (e.g., spill, fire), using procedure 24590-WTP-GPP-RARP-3004, *Radiological Posting and Labeling*, to ensure that personnel are aware of the need for special handling.

OFI-BNI-12: Consider using the practical guidance contained in DOE-HDBK-1122-2009, *DOE Handbook Radiological Control Technician Training*, to improve the radiological training program, including the use of job performance measures.

Appendix A
Supplemental Information

Dates of Assessment

Onsite Assessment: May 9-13, 2022

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William F. West, Deputy Director, Office of Enterprise Assessments
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