Office of Enterprise Assessments
Assessment of the Hanford Site
Waste Treatment and Immobilization Plant
Construction Quality

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Acronyms

AHJ	Authority Having Jurisdiction
ASME	American Society of Mechanical Engineers
BNI	Bechtel National, Inc.
BOF	Balance of Facilities
BPS	BNI Procurement System
CAMP	Corrective Action Management Program
CDR	Construction Deficiency Report
CFR	Code of Federal Regulations
CM	Commercial Grade
CMB	Corrective Maintenance Backlog
CMMS	Computerized Maintenance Management System
CON	BNI Construction
CR	Condition Report
CRAD	Criteria and Review Approach Document
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
EA	Office of Enterprise Assessments
EMF	Effluent Management Facility
FMM	Field Material Management
HLW	High-Level Waste Facility
kcmil	thousand circular mils
LAB	Analytical Laboratory
LAW	Low-Activity Waste Facility
MHF	Material Handling Facility
MRR	Material Receiving Report
NCR	Non-Conformance Report
NDE	Nondestructive Examination
NEC	National Electrical Code
NQA	Nuclear Quality Assurance
NWII	Northwest Inspection, Inc.
OFI	Opportunity for Improvement
ORP	Office of River Protection
PM	Preventive Maintenance
PMDF	Preventive Maintenance Disposition Form
PMTF	Periodic Maintenance and Surveillance Task Form
POM	Plant Operations Maintenance
psi	Pounds per Square Inch
PTF	Pretreatment Facility
PvM	Preservation Maintenance
Q	Quality Related
QA	Quality Assurance
QAM	Quality Assurance Manual
QC	Quality Control
SC/I	Suspect/Counterfeit Item
SE	System Engineer
SRR	Site Receiving report
SSC	Structure, System, and Component
TC	Tension Control

UL	Underwriters Laboratories
WCD	ORP Construction Oversight and Assurance Division
WTP	Waste Treatment and Immobilization Plant

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EXECUTIVE SUMMARY

The U.S. Department of Energy Office of Nuclear Safety and Environmental Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of construction quality and the implementation of the quality assurance program at the Hanford Site Waste Treatment and Immobilization Plant (WTP) from September 12 to 22, 2016. EA performed this assessment in the broader context of an ongoing program of quarterly assessments of construction quality at the WTP construction site.

The scope of this EA assessment included observing ongoing work activities, reviewing the Bechtel National, Inc. (BNI) program for controlling non-conforming conditions, examining the implementation of certain requirements in the BNI quality assurance program, evaluating the BNI program for storage and preservation of stored and installed equipment, and following up on issues identified during previous assessments.

BNI continues to identify non-conforming conditions involving procured equipment and hardware. Much of this equipment was manufactured and delivered to the project between five and ten years ago, and the vendors or manufacturers who supplied some of this equipment are no longer in business. BNI Design Engineering has dedicated a large number of personnel and resources to resolve these non-conforming conditions.

BNI procedures and work processes are adequate for preservation maintenance (PvM) of stored and installed equipment purchased by BNI and supplied through subcontractors. Received materials are systematically evaluated for PvM needs, storage facilities are well maintained, and observed items are controlled in a manner that prevents damage and loss and minimizes deterioration. Also, the BNI quality assurance organization is performing satisfactory quality assurance audits and surveillances of PvM in accordance with the BNI quality assurance manual. BNI is addressing a systemic weakness they identified regarding failure to enter some subcontractor supplied equipment into their computerized maintenance management system after close out of the subcontracts.

BNI took appropriate corrective actions to address corroded High-Level Waste Facility tension-control high-strength structural steel bolts by replacing the deficient bolts. The requirements in the procedure on structural steel installation need to be clarified to address the time limit for bolt exposure to the elements.

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1.0 PURPOSE

The U.S. Department of Energy (DOE) Office of Nuclear Safety and Environmental Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of construction quality at the Hanford Site Waste Treatment and Immobilization Plant (WTP). The onsite portion of this assessment was conducted from September 12 to 22, 2016. This EA assessment was performed within the broader context of an ongoing program of assessments of construction quality at DOE major construction projects. Because of the safety significance of WTP facilities, EA plans to continue these ongoing quarterly assessments at the WTP construction site to ensure that construction contractors meet the requirements of 10 CFR 830, Subpart A, *Quality Assurance Requirements*.

2.0 SCOPE

This quarterly assessment evaluated construction quality by observing ongoing work activities, reviewing the Bechtel National, Inc. (BNI) program for controlling non-conforming conditions, and examining the implementation of selected requirements in the BNI quality assurance (QA) program, the BNI corrective action program, and the BNI program for oversight of subcontractors. Design and procurement programs were not included in this assessment.

3.0 BACKGROUND

The DOE Office of River Protection (ORP) manages the 56 million gallons of liquid or semi-solid radioactive and chemical waste stored in 177 underground tanks at the Hanford Site and the WTP, an industrial complex for separating and vitrifying the radioactive and chemical waste in the underground tanks. The WTP is in the design and construction phase.

BNI manages design and construction activities at WTP under contract to ORP. The QA program requirements for design and construction of the WTP referenced in the preliminary documented safety analysis and cited in the BNI contract are American Society of Mechanical Engineers (ASME) Nuclear QA (NQA) -1-2000, *Quality Assurance Requirements for Nuclear Facility Applications*, and DOE Order 414.1C, *Quality Assurance*.

The WTP complex consists of the Pretreatment Facility (PTF) for separating the waste into low-activity waste and high-activity waste; the High-Level Waste Facility (HLW), where the high-level waste will be immobilized in glass; the Low-Activity Waste Facility (LAW), where the low-activity waste will be immobilized in glass; the Analytical Laboratory (LAB) for sample testing; and the balance of facilities (BOF) that will house support functions. Construction work is essentially complete for the LAB and most BOF buildings. The BOF Electrical Distribution Building was recently turned over from BNI Construction (CON) to Operations. ORP staff members, primarily WTP Construction Oversight and Assurance Division (WCD) staff, provide oversight of construction activities at the WTP.

Construction work activities are deferred in the PTF pending satisfactory resolution of technical questions regarding separation and processing of the waste and the design life of PTF equipment. Construction has slowed in the HLW pending resolution of technical issues involving the waste treatment process.

ORP currently plans to commission the LAW to start processing low-activity waste in 2022, before completion of the HLW and the PTF. An additional facility, the Effluent Management Facility (EMF), will be constructed to process the non-radioactive liquid byproducts resulting from the low-activity waste processed in the LAW. Initial design of the EMF is completed, and some preliminary construction work is in progress, such as relocating fire service water piping, isolating systems necessary to facilitate operation of the LAW prior to completion of the HLW and PTF, placing reinforcing steel for the EMF foundation, and preparing for procurement of equipment. Concrete placement is on hold pending approval of the EMF design by the State of Washington Department of Ecology.

4.0 METHODOLOGY

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

EA conducted this assessment of WTP construction quality processes in accordance with the *Plan for the Office of Enterprise Assessments Review of the Hanford Site Waste Treatment and Immobilization Plant Construction Quality*, June 2016. This assessment considered the requirements of 10 CFR 830, Subpart A, and DOE Order 414.1C, which specify that the contractor must use appropriate national consensus standards to implement DOE QA requirements.

EA used the following criteria and review approach documents (CRADs):

- CRAD 45-52, *Construction – Piping and Pipe Supports*
- CRAD 64-15, *Construction – Structural Concrete*
- CRAD 64-16, *Construction – Structural Steel*
- CRAD 64-20, *Feedback and Continuous Improvement Inspection Criteria and Approach – Contractor*.

EA reviewed procedures, specifications, drawings, and records; interviewed key personnel responsible for equipment storage, preservation, construction, and inspection work activities; and conducted site walkdowns to observe work activities and inspect WTP components. EA conducted several walkdowns at the WTP construction site and offsite storage areas with BNI and the WCD staff to determine whether work activities were completed in accordance with the appropriate design drawings, specifications, and procedures. EA observed a pressure test; inspection of piping welds in the LAW, and installed electrical cables and equipment in the Water Treatment Building and LAW. EA also examined storage and preservation of equipment on site and at the offsite Material Handling Facility (MHF), South 40 Laydown Yard. EA reviewed records documenting concrete and structural steel inspections, BNI QA and quality control (QC) surveillances and assessments and non-conformance reports (NCRs), construction

deficiency reports (CDRs), and condition reports (CRs) that BNI identified under its corrective action program. EA also reviewed ORP's progress in resolving the conflict of interest regarding the delegation of the Authority Having Jurisdiction (AHJ) to BNI.

The members of the EA assessment team, the Quality Review Board, and EA management responsible for this assessment are listed in Appendix A. A detailed list of the documents reviewed, personnel interviewed, and observations made during this assessment, relevant to the findings and conclusions of this report, is provided in Appendix B.

5.0 RESULTS

The national consensus standard and basis for the BNI QA program is ASME NQA-1-2000. BNI Document 245909-WTP-QAM-QA-06-001, *Quality Assurance Manual*, provides a detailed description of the application of the 18 NQA-1-2000 requirements to the WTP. The QA Manual (QAM) establishes a management system of planned and systematic actions necessary to ensure that structures, systems, and components (SSCs) perform satisfactorily in service.

5.1 BNI Corrective Action Program

Criteria:

A process shall be established to identify, control, document, evaluate, and correct conditions adverse to quality. Records shall be maintained documenting the corrective action program, including documentation of objective evidence of satisfactory implementation of corrective actions. (NQA-1, Requirement 16; Policy Q-16.1 of the WTP QAM; and DOE Order 414.1C)

Identified conditions adverse to quality shall be documented, evaluated, and corrected in a timely manner. Objective evidence shall demonstrate satisfactory implementation of corrective actions and performance improvement. (NQ A-1, Requirement 16; Policy Q-16.1 of the WTP QAM; and DOE Order 414.1C)

BNI Procedure 24590-WTP-GPP-MGT-044, *Nonconformance Reporting and Control*, adequately defines the requirements for identifying, documenting, reporting, controlling, and dispositioning non-conforming conditions associated with Q (previously classified as Quality-List or QL) and commercial grade (CM) SSCs at the WTP. This procedure requires that NCRs be issued to document and disposition non-conforming conditions associated with Q SSCs, while CDRs are required to document and disposition such conditions associated with CM SSCs.

The process for determining quality levels is specified in BNI Procedure 24590-WTP-3DP-G04T-00905, *Determination of Quality Levels.* This procedure references other supporting, interfacing project documents regarding identification of items/services subject to the QA program and procurement requirements. SSCs designated as Q in the design documents must be constructed or manufactured in accordance with the WTP QA program and the ASME NQA-1 standard. SSCs designated in the design documents as non-Q (i.e., CM) are constructed in accordance with CM standards, such as the Uniform Building Code, or purchased as CM items from vendors who are qualified CM suppliers.

EA reviewed the 44 NCRs that BNI issued between June 27 and September 22, 2016, and the 31 CDRs that BNI issued between September 2 and 22, 2016, to evaluate the types of non-conforming issues and their apparent causes. Most of these NCRs and CDRs were still open and being evaluated by BNI Design Engineering.

The NCRs included four related to construction or installation errors, including damage to installed components resulting from construction activities; 5 for engineering design deficiencies; 3 for materials handling issues, such as expired shelf life; and 32 for procurement and supplier deficiencies. Approximately half of the 32 procurement and supplier NCRs concern documentation deficiencies with various components for the 2 LAW melters. BNI categorized the 31 CDRs as follows: 8 for BNI construction deficiencies, 11 for procurement and supplier deficiencies, 7 for engineering errors, and 5 for deficiencies in subcontractor work.

For closed NCRs and CDRs, EA determined that the records document the completed corrective actions and provide evidence that corrective actions were satisfactorily implemented. However, as noted in previous EA assessments, corrective actions necessary to disposition open NCRs and CDRs have not always been timely, resulting in a significant backlog of open CDRs and NCRs. Procurement deficiencies continue to challenge the BNI Design Engineering organization.

5.2 Pressure Testing Program

Criterion:

Construction and pre-operational tests, such as pressure testing operations for piping systems, shall be conducted in accordance with methods approved by the design organization. Test procedures shall include test requirements, acceptance criteria, test prerequisites, inspection hold points, and instructions for recording data. Testing shall be observed by qualified inspection personnel. Test results shall be recorded and evaluated by qualified personnel. (NQA-1, Requirement 11; Policy Q-11.1 of the WTP QAM; and DOE Order 414.1C)

EA observed a segment of a pneumatic pressure test that was performed on 18 quick disconnect instrumentation piping lines on the Melter 1 lid in the LAW. BNI Construction Procedure 24590-WTP-GPP-CON-3504, *Pressure Testing of Piping, Tubing and Components*, specifies the generic work process and quality requirements for pressure testing, including the test requirements, test prerequisites, hold points, inspection requirements, test sequence, instructions for recording and evaluating data, and acceptance criteria. This procedure references the appropriate codes and documents approved by BNI Design Engineering for conduct of pressure testing. The procedure was adequate.

The requirements for the pneumatic pressure test that EA observed were specified in Step 4.8.7 of Engineering Specification 24590-WTP-LAW-3PS-LMT-T0002, *Engineering Specification for MLTR-00001, Site Assembly of Melters*. EA reviewed the pressure test package, number 24590-LAW-PPTR-CON-16-004, that specified the test steps. The test procedure required each of the 18 instrument lines to be pressurized between 7 and 10 pounds per square inch (psi) and held for two minutes. Acceptance criteria was no loss (reduction) in pressure. EA witnessed pressure testing of 10 of the 18 instrument lines and verified that calibrated pressure gauges were utilized in the test, that designated test pressure was applied to each line, and that pressure was maintained for at least two minutes with no pressure loss. Qualified personnel witnessed, recorded, and evaluated the test results.

The implementation of the pressure testing program was satisfactory for the sample that EA reviewed.

5.3 Manufacture and Placement of Concrete

Criteria:

Work, such as concrete construction, shall be performed in accordance with approved procedures, design drawings, and other design basis documents, including applicable codes and standards. The procedures,

instructions, and drawings shall include or reference appropriate quantitative or qualitative acceptance criteria for determining that prescribed results have been satisfactorily attained. (NQA-1, Criterion 5; Policy Q-5.1 of the WTP QAM; and DOE Order 414.1C)

Records shall furnish documentary evidence that items or activities meet specified quality requirements. (NQA-1, Requirement 17; Policy Q-17.1 of the WTP QAM; and DOE Order 414.1C)

EA reviewed the results of QC tests performed on concrete samples from Q concrete placements for two HLW walls poured on July 13, Wall HCC 4106, and August 29, 2016, Wall HCC 3134. Test acceptance criteria are specified in BNI Specification No. 24590-WTP-3PS-DB01-T0001, *Engineering Specification for Furnishing and Delivery of Ready Mixed Concrete*. The tests included slump, temperature, and unit weight testing of the freshly mixed concrete and unconfined compression testing of concrete cylinders that were moist cured in the concrete laboratory. Unconfined compression tests are used to determine whether the strength of the concrete meets the specified design strength, which is the test acceptance criteria. In addition to unconfined compression tests (for concrete strength) on two concrete test cylinders that are moist cured in the concrete field laboratory for 28 days, one concrete cylinder is also tested at seven days to provide an early indication of the 28-day concrete strength and show that the concrete that was placed can be expected to meet design requirements. The methods for sampling the concrete, casting and curing the cylinders, and performing the unconfined compression tests are specified in ASTM International standards.

The results of the unconfined compression tests performed on four test cylinders at 28 days of age from the July 13 HLW wall placement exceeded the 5,000psi design strength. The 28-day test results for Wall HCC 3134, placed on August 29, were not available for review during this assessment because the test cylinders would not reach 28 days of age until September 26. However, the results of the unconfined compression test of the three cylinders tested at seven days of age (actually tested at age of eight days because the test was delayed due to the Labor Day holiday) for Wall HCC 3134 ranged from 4,630 to 5,260psi, with an average 4,990psi, provided an early indication that the concrete for Wall HCC 3134 would be well above design strength.

The concrete testing records demonstrated that the concrete meets the requirements specified in BNI Specification No. 24590-WTP-3PS-DB01-T0001.

5.4 Structural Steel

Criteria:

Work, such as structural steel construction, shall be performed in accordance with approved procedures, design drawings, and other design basis documents, including applicable codes and standards. The procedures, instructions, and drawings shall include or reference appropriate quantitative or qualitative acceptance criteria for determining that prescribed results have been satisfactorily attained. (NQA-1, Criterion 5; Policy Q-5.1 of the WTP QAM; and DOE Order 414.1C)

Records shall furnish documentary evidence that items or activities meet specified quality requirements. (NQA-1, Requirement 17; Policy Q-17.1 of the WTP QAM; and DOE Order 414.1C)

EA reviewed quality records documenting erection of structural steel in the HLW at column lines B-15 through B-20, C-20, and D-20 above Elevation 40’0”. EA was informed that the tension-control (TC) high-strength structural steel bolts in these areas had been installed in the structure for several weeks prior to final tensioning because of changes in the construction schedule. During the June 2016 assessment, EA and a WCD site inspector examined bolts in these areas and noted that several bolts were slightly

rusty. Subsequent to the June assessment, a representative sample of 30 bolts were removed from several columns and tested on a Skidmore/Wilhelm bolt tensioning device. Thirteen of the 30 bolts failed to achieve the required minimum tension. These test results were documented on an in-process verification report, Document No. 24590-HLW-TCB-CON-16-012.

In accordance with BNI Construction Procedure 24590-WTP-GPP-CON-3206, *Structural Steel Installation and On-Site Fabrication,* Appendix 8, Section 2.3, if one or more bolts tested do not achieve the required tension, then all of the incomplete bolt assemblies in the associated work area are deemed unacceptable and are required to be replaced. EA reviewed the structural steel connection tracker forms associated with the work areas where bolts failed to achieve the required minimum tension. These records indicate that the bolt assemblies that had not been tensioned in these areas were removed and replaced with new assemblies that were subsequently tensioned and accepted by QC. Approximately 1,550 1 1/8" diameter and 950 7/8" diameter bolts were replaced with new bolt assemblies.

Research sponsored by the steel industry and the Research Council on Structural Connections has shown that TC bolts are affected by environmental conditions after removal from storage and exposure prior to final tensioning of the bolts. Research performed at the University of Toronto showed that the average pretensions in TC bolts exposed to the weather before final tensioning progressively declined after two, four, and eight weeks of exposure. For bolts exposed to weather, TC bolt pretension values appeared to decrease as the time delay between installation and final tensioning increased. Deterioration of the lubricant is the primary cause of reduced pretension load. For TC bolts, adherence to requirements for storage, cleanliness, and verification is necessary for proper use. It is also important to limit the time between removal from protected storage and final twist-off of the splined end. Educational Bulletin Number 4 published by the Research Council on Structural Connections states: "Specific and proper lubrication of TC bolts is essential to reliable use of these fasteners." However, for TC bolt assemblies, re-lubrication is specifically prohibited by AISC 348, *Specification for Structural joints Using ASTM A325 or A490 Bolts*, and ASTM F1852, recently replaced by ASTM F3125, *Standard Specification for "Twist Off" type Tension Control Bolt/Nut/Washer Assemblies*, unless re-lubrication is performed by the manufacturer.

Procedure 24590-WTP-GPP-CON-3206, Appendix 8, Section 2.3, states that when the time of exposure between placement of the TC bolt assemblies in the field and the subsequent pre-tensioning of the assemblies is of concern, the QC inspectors visually inspect the condition of the bolt assemblies for signs of deterioration of lubrication (such as rust) or lack of snug tightness. However, the manufacturer applied lubricant on the bolts may become degraded significantly enough to affect pre-tensioning, prior to any visual indication such as presence of rust on the bolts. The statement, "Time of exposure … is of concern," is undefined and does not indicate a specific time limit. (See **OFI-WTP-01**.)

BNI has taken appropriate corrective actions to address corroded HLW TC high-strength structural steel bolts. The deficient bolts were replaced. Improvement is needed in clarifying the requirements in the procedure on structural steel installation to address the time limit for TC bolt exposure to the elements prior to final pre-tensioning.

5.5 Electrical Construction Activities

Criterion:

Electrical equipment that performs a safety function shall be installed in accordance with approved procedures, design drawings, manufacturer's instructions, and other design basis documents, including applicable codes and standards. The procedures, instructions, and drawings shall include or reference appropriate quantitative or qualitative acceptance criteria for determining that prescribed results have

been satisfactorily attained. (NQA-1, Requirement 5; Policy Q-5.1 of the WTP QAM; and DOE Order 414.1C)

Electrical Equipment Installation

EA performed walkdowns in the LAW and Water Treatment Building to examine installation of electrical equipment and cables. Acceptance criteria for electrical construction and quality requirements were based on BNI specifications and construction procedures and the National Electrical Code (NEC). In the LAW, EA and the WCD site inspectors examined Cabinet LVE-PSUP-20001, a Melter Startup Heater Power Supply located in the Melter Power Supply room. This cabinet is fed by three 500-kcmil conductors. NEC Table 373-6(b) specifies a minimum bending space of 15" for this size conductor. This cabinet has only 6" of bending space. Further investigation into this issue revealed that BNI had already identified a similar issue in Cabinet LVE-PSUP-20101 and documented it in CDR-CON-16-0039. The scope of the CDR has already been expanded to include Cabinet LVE-PSUP-20001. This is an example of an adequate implementation of the BNI corrective action system.

In addition to the wire bending space concern, piping was installed in the dedicated space above Cabinet LVE-PSUP-20001. Article 110-26 of the NEC requires this dedicated space to be clear of any piping, ducts, or equipment foreign to the electrical installation. WCD and BNI are reviewing options to address the deficiency.

On the +3 elevation of the LAW, EA and WCD observed that panel 24590-LAW-JC-LRH-PNL-00012, Conveyor Panel North, has a 480 VAC power supply and many 24 VDC control and signal cables. Section 4.1.3 of BNI Specification 24590-WTP-3PS-EKPO-T0001, *Electrical Requirements for Packaged Systems*, states that AC power and 24 VDC wiring must be routed at 90 degree angles to one another and separated by at least 1/4". Although the wires were routed at 90 degree angles, they did not comply with the minimum separation requirement. BNI electricians immediately corrected the wiring issue by re-routing the signal and power cables to maintain the proper separation.

The Melter power supplies have been removed from the -21' elevation of the LAW for return to the vendor to address concerns identified by WCD more than 2 1/2 years ago regarding design and certification of the equipment. Also, during walkdowns in the Water Treatment Building electrical room, EA and the WCD site inspectors observed that the fire protection system sprinkler heads were installed in the dedicated space above a motor control center contrary to NEC requirements. BNI had previously identified this issue and is planning to relocate the sprinkler heads away from the dedicated space. EA intends to follow the resolutions of these concerns.

During the March 2014 construction quality assessment, EA observed that the indicator lights on the Domestic Water and Plant Service Water Control panels in the Water Treatment Building did not conform to BNI Specification 24590-WTP-3PS-JQ07-T0001, *Engineering Specification for Instrumentation for Packaged Systems*. BNI documented this issue in a CDR. During this current assessment, EA re-examined the panels and observed that the indicator lights were modified and now conform to BNI Specification 24590-WTP-3PS-JQ07-T0001.

Authority Having Jurisdiction (AHJ) to Interpret the NEC

The AHJ referenced in Section 90-4 of the NEC provides a facility, municipality, or government entity the authority to approve electrical installations and the authority to interpret parts of the NEC. In 2003, DOE delegated partial AHJ to BNI to interpret the NEC regarding some electrical design details. Although this expansion was not the intent of the partial DOE AHJ delegation in 2003, through years of practice with no opposition from ORP, BNI's partial AHJ expanded into full and final authority on all

interpretations of the NEC at the WTP site.

This conflict of interest was identified by EA in 2015. On February 24, 2016, BNI/WTP modified their AHJ process requiring that DOE approve all cases where, "Equivalent but alternate methods of achieving specific code requirements and meeting their safety objectives," are involved. The revision to BNI procedure 24590-WTP-GPP-RADA-DA-0001, *Authority Having Jurisdiction (AHJ) Procedure* that is in Section 6.2 *SPECIFIC AHJ RESPONSIBILITY IMPLEMENTATION* includes a new requirement in Subsection 6.2.1 Electrical Responsibility Implementation Statements, which reads, "The WTP Electrical AHJ develops, reviews, pre-approves, and **submits for ORP-DOE final approval** of equivalent but alternate methods of achieving specific code requirements and meeting their safety objectives. (See *WTP- GPP-RADA-DA-0001)."*

EA will review implementation of this modification and the effectiveness of this modification in resolving the conflict of interest via DOE/ORP exercising final AHJ on alternate methods of achieving specific code requirements and meeting safety objectives in future assessments.

Additionally, ORP has retained an independent third party contractor, Parsons, to perform a review of the AHJ delegation to BNI. Parsons has issued a draft report and is resolving ORP comments.

BNI Self-Assessment of Electrical Inspection Process

EA reviewed BNI Self-Assessment Report 24590-WTP-SAR-ENG-16-0005EE4, *Self-Assessment Report on Electrical Safety*. This self-assessment, performed in June 2016, identified several inconsistencies and deficiencies in BNI's electrical inspection process, and identified 13 recommended corrective actions, including recommendations for streamlining various processes and clarifying the roles and responsibilities of the AHJ, field engineers, and the Electrical Safety Committee. This self-assessment contained many helpful recommendations to enhance the safety and quality of the electrical installations and equipment. BNI's issues managements system is tracking the resolution of these issues.

5.6 Maintenance, Preservation, and Protection of Stored and Installed Equipment

Criterion:

Equipment that performs a safety function shall be sufficiently maintained before, during, and following installation to ensure it provides the necessary reliability and availability to perform its intended safety function, and to prevent damage, loss, or deterioration. Handling, storage, cleaning, packaging, shipping, housekeeping, and preservation of items shall be controlled to prevent damage or loss and to minimize deterioration. (NQA -1 Requirement 13; Policy Q -13.1 of the WTP QAM; and DOE Order 414.1C)

EA examined BNI preventive maintenance (PM) implementing processes, material receipt operations, the preservation maintenance (PvM) evaluation process, material and site storage conditions, and PvM planning and scheduling. Personnel were interviewed and facility operations observed, including the MHF/South 40 Laydown Yard, WTP Site T52 Warehouse/4 1/2 Laydown Yard, HLW, PTF, LAB, and LAW.

Implementing Processes

BNI's implementing procedures and documented program to maintain, preserve, and protect stored and installed equipment complies with NQA-1 requirements. BNI Procedure 24590-WTP-GPP-MGT-031, *Asset Preservation Maintenance*, specifies the overall PvM process. The current version of Procedure

24590-WTP-GPP-MGT-031 is sufficient for BNI work performance. The key PvM implementing directive, BNI Procedure 24590-WTP-GPP-CMNT-004, *Periodic Maintenance and Surveillance Process*, provides an effective process for establishing equipment PvM requirements, performance, changes, and implementation review.

BNI Field Material Management (FMM), BNI Plant Operations Maintenance (POM), and BNI CON implement the PvM program from the point of equipment/material receipt to turnover for operations. Once operable equipment is "turned over" from CON to Start-up/Operations, PvM ends and PM/Calibration/Surveillance begins. BNI assigns the responsibility for PvM requirements to subcontractors through a subcontract General Condition Clause requiring subcontractors to maintain all their completed work in accordance with the manufacturer's recommendations. BNI monitors subcontractor PvM performance through periodic surveillances in accordance with BNI Procedure 24590-WTP-GPP-CON-4103, *Subcontract Surveillance, Inspection, and Quality Verification*. When subcontract work is complete and ready for turnover, CON notifies POM, who develops the maintenance strategy, enters the information into the Computerized Maintenance Management System (CMMS), and confirms their readiness to perform maintenance. FMM, POM, and CON lower-level procedures provide a satisfactory implementing framework.

Materials Receipt

BNI-procured materials enter the project via the MHF in Richland, Washington, or are directly shipped to the WTP site. FMM assumes responsibility for all materials received by the project until the CON organization formally withdraws the materials for installation. Operations were well organized, and housekeeping in the MHF and WTP site Warehouse T52 receiving areas was tidy. FMM receiving personnel were able to communicate and demonstrate their expertise and process knowledge through walkdowns and efficient retrieval of records. A sample of worker training records confirmed that job-specific training and qualification requirements, including Suspect/Counterfeit Item (S/CI) training, have been completed.

BNI FMM receiving personnel demonstrated proficient use of the BNI Procurement System (BPS) database, which provides the purchase order information. Material Receiving Reports (MRR) or Site Receiving Reports (SRR) for jobsite receipt are completed by FMM material specialists based on criteria established in the purchase order with an attached Material Acceptance Plan. All MRRs and SRRs that EA reviewed complied with BNI Procedure 24590-WTP-GPP-GCB-00101, *Field Material Receiving*. Once material is accepted through MHF or WTP site receiving, BPS transmits an automated email to POM alerting them of the material receipt. This email notification prompts POM's evaluation of the material for PvM requirements based on vendor recommendations or changes authorized by the system engineer (SE). The POM receipt of email transmittals by the POM Work Control Coordinator indicate that consistent notification is provided. FMM maintains materials in proper storage locations until requested by CON for issuance.

Item Evaluation for PvM Requirements and Initial Work Planning

AECOM, the WTP Operations Contractor, is responsible for equipment PvM, PM, Corrective Maintenance, and Predictive Maintenance from receipt through turnover. AECOM indicated that this strategy precludes concerns for the adequacy of such equipment/material maintenance at turnover. POM has placed two full-time equipment evaluators and one maintenance planner at the MHF, embedded with the FMM receiving personnel. These individuals evaluate all received equipment/materials (at the MHF and WTP Site) and develop initial PvM requirements, frequencies, and work instructions. The maintenance evaluators and maintenance planners are qualified through job-specific qualification standards, which also include S/CI training.

The AECOM maintenance evaluator demonstrated effective use of the daily "On-the-Road" report that BNI Procurement and Subcontracts send to alert POM of pending material shipment arrivals. Once items are received, the POM maintenance evaluators have 48 hours to inspect the shipment and 60 days to complete the maintenance evaluations on a Periodic Maintenance and Surveillance Task Form (PMTF). Equipment and materials are evaluated with reference to vendor manuals attached to the purchase order in the BPS. Since the WTP construction schedule has been extended, BNI now requires vendors to provide recommendations for extended storage greater than five years. The PMTF is required to be reviewed and approved by the assigned SE. EA sampled random records of PMTFs and found these records had been signed by an SE and were consistent with PvM requirements, including extended storage recommendations.

Maintenance planners also examine the approved PMTF and ensure that the work instructions are current or develop new work instructions for new, specific PMTFs. EA reviewed a sample of PMTFs and found that item identifiers, maintenance strategy, task intervals, task instructions, Job Hazards Analyses, critical steps, inspection/test acceptance criteria, documented approvals, and other information were recorded and entered into the CMMS for POM PvM tracking and scheduling in accordance with Procedure 24590-WTP-GPP-CMNT-004. Sampled records demonstrate BNI's systematic implementation of the PvM maintenance program for BNI procured and receipt/accepted items.

Subcontractor material turnover is another way in which material can enter the WTP project. Subcontract work is managed by the CON subcontract group. When subcontract work is ready for turnover, CON requires POM to provide advanced notification to develop the PMTFs and enter information into CMMS, as described above. However, in March 2016, BNI identified CR 16-00524, *Subcontract Equipment - Preservation and Preventive Maintenance*, Significance Level B (Level A is the highest issue significance level), after a review of six closed subcontracts disclosed that of 2,918 equipment items supplied by the six subcontractors, only 2,146 were listed in Teamworks, the BNI inventory tracking system. The CR states that only 169 of the 2,146 equipment items had the required fields completed for entering the piece of equipment into the CMMS, and 52 had overdue PM. This performance is indicative of a systemic weakness, which BNI is addressing.

Re-evaluation of PvM requirements by POM occurs as a result of asset movement, results of periodic walkdowns, reevaluated needs, return to stock items, and design changes in accordance with CMNT-004. Some re-evaluation examples include a location change resulting from the movement of a crane from the MTF to the WTP site; missed evaluations that resulted when two tag identification numbers were added to a component; and SE-initiated changes to modify a PvM frequency from quarterly to annually. When installed material is turned over to Operations, PvM is redefined as PM on the PMTF. All EA-sampled PMTF changes displayed completion of requisite reviews and approvals.

Material Storage

BN has implemented a four-level (Levels A, B, C, and D) graded storage control program. Level A storage, the highest level, requires temperature and humidity controls, whereas Level D is an outside unprotected environment. The designated storage Levels are consistent with the requirements of NQA-1-2000, Subpart 2.2, Section 202. FMM uses several facilities for material storage: the MHF (Level A and B)/South 40 Laydown Yard (Level D), which is the main storage facility; the WTP Site T52 Warehouse (Level B) and Laydown Yards (Level C and D); and the Yakima Warehouse (Level A). The South 40 Laydown Yard stores over 100,000 items, approximately 98% of which are destined for the HLW (significantly reduced construction activities) and PTF (halted construction).

In April 2015, the Defense Nuclear Facilities Safety Board (DNFSB) conducted a review of warehouse and storage facilities at the WTP site and two offsite facilities (the MHF and the Yakima Warehouse). The DNFSB identified 11 deficiencies pertaining to storage, material control, and the material control program. The results of the review are documented in a DNFSB Staff Issue report dated February 18, 2016, Subject: *Waste Treatment and Immobilization Plant Quality Assurance Review*. BNI CON scheduled and performed a reactive self-assessment from September 1–15, 2015, prior to receipt of the formal DNFSB report, to follow-up on the DNFSB findings. The BNI self-assessment results are documented in BNI Self-Assessment Report 24590-SAR-CON-15-0028, *Construction Level C Storage*. During this self-assessment, the 44 WTP construction storage structures were inspected using a detailed template of over 30 attributes in such topical areas as structure type, structure requirements, repairs required, content identification, and storage conditions. Ten storage structures were identified as needing some level of repair. Results were identified in CR 15-01734, corrective actions were completed, and the CR is awaiting closure approval.

EA walked down the MHF, South 40 Laydown Yard, T52 Warehouse, and the SW 4 1/2 Laydown Yard. Only a small area of the MHF Laydown Yard exhibited sand infiltration among some pipe in storage, but efforts were underway to resolve this issue (e.g., no storage tents were found to have rips or tears). At the WTP Site SW 4 1/2 Laydown Yard, EA noted one concern with PTF Shield Doors improperly protected from the elements. BNI immediately resolved this observation. EA concluded that BNI corrective actions were effective to resolve the findings identified by the DNFSB regarding storage of hardware, equipment, and materials.

Construction Field Interim Storage and Monitoring of Installed Equipment

Inventory and tracking of materials removed from storage for use in construction are managed by POM using the CMMS database. CON is required to issue a Material Withdrawal Request to POM, who is required to update the CMMS storage location data and arrange for material movement. These CON "interim" storage locations allow materials to be placed closer to the work for easy access. Once materials are withdrawn from inventory, withdrawn material storage becomes the responsibility of CON.

EA walked down the LAB and LAW to examine field storage of materials and general preservation of installed equipment. The LAB is nearly complete, and the LAW is in an advanced stage of construction. Both facilities are weather tight, but construction in LAW still generates construction dust that can damage installed equipment. With the exception of instrument racks with installed instruments and some electrical panels, EA observed that motors and other electrical equipment were covered in nylon reinforced material to prevent dust damage as required by MGT-031. EA did not observe any materials in interim storage at LAB as construction is nearing completion. EA found multiple examples of field stored materials in the LAW, but none that required PvM. All field stored construction material containers that EA examined were either tagged individually or grouped together in a roped off area with a sign indicating the name of the individual responsible for the material.

CON has developed Desk Instruction, PTF-DI-13-0001, *PTF Long Term Layup and Preventive Maintenance*, for conducting monthly walkdowns of the PTF while construction is halted. The Desk Instruction includes a checklist to ensure that the largest vulnerabilities are monitored. Walkdown reports over the past 12 months contained detailed observations and action items to resolve adverse conditions. EA confirmed that actions had been taken to address the non-conforming items. The PTF was clean and free from weeds, with tarps covering tanks, vessels, and sensitive equipment, with pipes and ducts capped, and with fully intact penetration covers and a dewatering system to address rain infiltration due to incomplete roof structures.

Some limited construction is ongoing in the HLW, but, overall, the HLW is clean and in adequate

condition. However, some joggles penetrating a wall being prepared for concrete placement were missing pipe caps. The WCD site inspector notified BNI, and the pipe caps were installed within 24 hours.

PvM Planning and Scheduling Performance

POM schedules and tracks required maintenance using the CMMS. CMMS automatically generates a "DO LIST" eight weeks and four weeks ahead of required PvM maintenance on each item in the database. The DO LIST is designed to alert PvM planners of upcoming PvM requirements to allow ample time for completion of work planning in accordance with GPP-WPHA-001, *Work Control*. DO LIST items sampled by EA had been appropriately assigned to planners to review all PMTFs and associated work instructions for needed development or update. Work planners are also required to identify setup requirements (e.g., scaffolding, temporary power) as a prerequisite in the work package, as needed. A sample of final work packages were approved by requisite personnel.

BNI Procedure 245090-WTP-GPP-CMNT-004 requires POM to track in-process work orders (including work packages) until completion or otherwise dispositioned. If grace periods are about to be missed, Procedure 245090-WTP-GPP-CMNT-004 requires BNI to complete a Delinquent PM Disposition Form (PMDF). Delinquencies result from various causes, such as damaged equipment, failed M&TE, work package issues, lack of electrical power, and component NCR tags. POM has established a key company performance metric, "[PM] Work orders performed Delinquent," which is monitored by senior management. EA reviewed 38 PMDFs issued since January 2016. Each PMDF was signed by a cognizant SE and contained a satisfactory technical assessment and final disposition. For example, PMDF-CMNT-16-0009, March 14, 2016, indicated, "Current vapor-phase corrosion inhibitor is not compatible with chiller units." The reviewing SE identified a previous issue, CR 15-00657, *B82 Chiller Unit Boiler Lizard Incompatibility*, as the basis for wavier. CR 15-00657 recommends holding off on any upcoming maintenance until the issue is resolved. The sampled documents demonstrate the involvement of the SE with sufficient current system knowledge, who, after researching related issues, was able to make a timely determination for the waiver.

BNI procedures and work processes provide a satisfactory framework for PvM of stored and installed equipment purchased by BNI and supplied through subcontractors. With the exception of the weakness discussed above that BNI identified regarding failure to enter some subcontractor supplied equipment into their computerized maintenance management system after close out of the subcontracts, equipment and received materials are systematically evaluated for PvM needs. PvM requirements are consistently documented and tracked. Corrective actions to address storage issues identified by the DNSFB appear to have been effective. Storage facilities were well maintained. Methodical PvM scheduling and work order issuance ensures timely execution of most required PvM. Scheduled PvM that cannot be performed for various reasons is promptly evaluated by the SE for appropriate disposition. Overall, BNI handling, storage, cleaning, packaging, shipping, housekeeping, and preservation of EA-observed items are controlled to prevent damage or loss and to minimize deterioration. Due to the magnitude of ongoing PvM and PM work activities at WTP, EA intends to review PvM performance during the next quarterly WTP Construction Quality Assessment scheduled for December 2016.

5.7 Quality Assurance Audits and Surveillances

Criteria:

QA surveillances shall be scheduled to provide coverage, consistency, and coordination of ongoing work and shall be performed by personnel not directly responsible for the work under surveillance. Conditions adverse to quality identified during the surveillances shall be entered into the corrective action program. Surveillance results shall be documented in sufficient detail in a report to management. (NQA-1

Requirement 18; Policy Q-02.3of the WTP QAM; and DOE Order 414.1C)

QA audits shall be of sufficient scope and depth to verify that performance criteria are met. Audit results shall be documented in sufficient detail to identify the activity covered, to identify the individual(s) performing the surveillance/assessment, and to document results and any necessary compensatory corrective actions. (NQA-1 Requirement 18; Policy Q-18.1of the WTP QAM; and DOE Order 414.1C)

EA reviewed PvM-related surveillances/assessments conducted by FMM, POM, CON, and BNI/QA during the past 12 months. Each of the sampled surveillance and audit reports identified the personnel performing the surveillance or audit.

FMM personnel implement a standard reporting form, GCB-00002, *Field Material Management Storage Observation Checklist*, to record periodic assessments of storage facility conditions. The report format satisfactorily addresses key areas of concern, including pipe caps, flange covers/plugs, shrink wraps/tarps, vegetation/sand buildup, and material segregation. Subsequent to the review performed by the DFNSB discussed above, BNI completed 92 FMM field walkdowns that were documented in reports covering all FMM material storage areas. This corrective action is effective at preventing recurrence by using a consistent and methodical approach to monitoring storage conditions. Ten sampled reports indicate that unsatisfactory results are specifically identified in the report as, "Corrected on the spot," or needing follow-up. SV-MATL-16-054, *Field Material Management Storage Observation Checklist*, performed June 7, 2016, did not complete observation section B, *Torn/damaged shrink wrap or tarps*, and did not address the severely degraded tarp condition that EA identified during this current assessment. EA discussed this condition with the supervisor, who indicated that all report sections should be completed. Other than this isolated issue, FMM is effectively monitoring storage conditions, identifying weaknesses, and addressing non-conforming conditions.

Over the past 12 months, AECOM personnel completed three POM surveillances associated with technical work documents, maintenance work packages, and assets held in receiving (SAR-CMNT-16-0001, 2, and 3, respectively). The assessment reports had a defined scope, lines of inquiry, reference to previous related issues, and well-supported conclusions, and identified issues with CR numbers.

Two CON surveillances were completed as scheduled in the FY 2016 WTP Integrated Assessment Plan (SC-OE-16-001, *FY2016 WTP Integrated Assessment Plan April 25, 2016*), both associated with liner plates (SV-CON-15-002 and SV-CON-16-001). These semiannual liner plate assessments appropriately examine 53 high-risk locations in the LAB, LAW, HLW, and PTF for adequate signage, physical protection, and potential degradation of stainless steel secondary container liner plates. The CON QC organization completed 15 surveillances of WTP facilities over the past 12 months. Assessment report content was generally satisfactory. When issues are identified, NCRs, CDRs or CRs are required. For example, SV-QC-16-063, *HLW Material Storage Surveillance*, identified an issue with weed control and trash in contact with stored material. CR 16-01097, addressing the issue, was entered into the BNI Corrective Action Management Program (CAMP). EA's walkdown of this facility found no evidence of this issue.

BNI Procurement and Subcontracts is responsible for ensuring compliance with the approved government property plan per Procedure 24590-WTP-GPP-GPA-025, *Control of Government Property*. In the course of subcontract monitoring, the CON subcontractor oversight group found that the "[PvM and PM] requirements for subcontractor commodities stored and installed at WTP may not have been identified, maintained, and documented by subcontractors as required per subcontract requirements." These issues involving a substantial number of equipment items were entered into the CAMP on March 28, 2016, as CR 16-00524.
BNI QA performed several PvM-related independent QA surveillances, documented in SV reports and

internal audits documented in internal audit reports over the past three years, in addition to one QA surveillance of the Yakima Warehouse (SV-QA-13-095), one surveillance of Material Control (SV-QA-15-035), and one surveillance of piping storage (SV-QA-16-088). The most recent QA surveillance, SV-QA-16-088, *Report for Surveillance of Field Material Management - Outdoor Storage/Staging Areas*, addressing LAW and HLW, found no issues or concerns, consistent with EA's walkdown observations. These reports are well-written, detailed, performance-based reviews, with results based on objective evidence and appropriate issues identified.

The most recent BNI QA independent audit directly related to PvM was IAR-QA-15-0007, *Internal Audit of Handling, Storage, and Shipping*, a performance-based audit that included examination of the storage preservation and maintenance process in accordance with requisite procedures. The BNI QA audit team observed 30 field samples at the Yakima Warehouse, LAW, LAB, and HLW and reviewed the associated PMTFs for conformance with manufacturers' storage recommendations. IAR-QA-15-0007 identified some insightful PvM-related issues, which have since been satisfactorily addressed.

The BNI QA organization is performing QA audits and surveillances of PvM in accordance with the BNI QAM. A review of 30 sampled audits and surveillances indicates that BNI is effectively identifying deficiencies in the PvM program. FMM's established surveillance checklist addresses appropriate storage condition attributes. CON QC surveillances indicate proper focus and facility coverage. BNI has recognized that some subcontract commodities that have been turned over are not being identified, maintained, and documented in accordance with requirements. BNI QA is providing independent oversight resulting in insightful issue identification. The QC surveillances and QA audits are performed by personnel not directly responsible for the work. Overall, BNI's PvM audit and surveillance program is satisfactory.

5.8 BNI Response to Internal and External Assessments

Criterion:

Review item characteristics, process implementation, and other quality related information to identify items, services, and processes needing improvement. (DOE Order 414.1C, Attachment 2, Criterion 3)

BNI demonstrated responsiveness to self-identified and externally identified issues. EA reviewed 30 BNI surveillance and QA audit reports (internal and external) and found that all issues were entered into the CAMP as required. BNI and ORP identified about 38 PvM-related CRs over the past 12 months addressing such areas as storage conditions, in-place degradation, improper tagging/labeling, and missed/deferred PvM performance; there is no evidence of a predominate issue-type frequency. Also, two separately identified issues with the PvM program were being assigned to the correct CR level determination. BNI's analysis of CR 16-00524 includes the justification to raise the significance level from C to B, partially based on the recognition that there are procedural or administrative control problems. The BNI Field Subcontractor Coordinator Manager indicated that BNI was still in the process of evaluating this weakness and developing corrective actions. ORP identified that the permanent plant equipment of the HLW and PTF that had not been maintained in a manner that prevented deterioration was documented in CR 16-00417. BNI categorized this issue as Level B and conducted an extensive apparent cause analysis identifying weakness in the PvM of untagged commodities. BNI identified corrective actions for completion in 2017, including revisions to PvM implementing procedural requirements to address untagged commodities and establishment of additional requirements for long-term interim material installation and layup.

BNI has two performance metrics associated with the PvM program, the delinquent PM and the corrective maintenance backlog (CMB), both of which are indicating "good performance." The delinquent PM is

designed to alert management to growing PvM delays that may adversely impact equipment condition. The CMB indicated 78 events for August and is trending upwards. The WTP Mechanical Superintendent is working with Lean Six Sigma personnel to address this trend.

Issues identified in 30 sampled surveillance and audit reports (internal and external) were properly entered into the CAMP, as required. BNI is addressing two PvM Program Level B CRs identified in FY2016. Both received the proper significance level determinations. One of these CRs is in the process of analysis and corrective action development. BNI's response to the Level B CRs illustrates comprehensive analysis and accurate corrective actions to improve the PvM of untagged commodities. BNI management is using the CMB metric to identify and address trends. Overall, this performance indicates that BNI is using feedback information to improve the PvM program.

5.9 Personnel Training and Qualification Program

Criterion:

Each organization shall provide for indoctrination, training, and formal qualification of personnel performing activities affecting quality. The responsible organization shall establish written procedures for the qualification of personnel, and training shall be documented in appropriate records. (NQA-1, Requirement 2; Policy Q-02.4 of the WTP QAM; and DOE Order 414.1C)

EA reviewed the training and qualification program for BNI QC inspectors, field engineers, and subcontract coordinators.

Review of Procedures

EA reviewed the BNI procedures that establish the requirements for training and qualification of personnel who perform inspection and test activities. The procedures reviewed are listed in Appendix B of this report. The BNI procedures reviewed establish an adequate program for indoctrination, training, and formal qualification of personnel performing activities affecting quality, as required by the QAM and NQA-1.

Review of Training and Qualification Records

EA reviewed the records that document training, qualification, and if appropriate, certification of sixteen personnel who perform inspection and test activities. Records reviewed demonstrated personnel performing inspection and test activities are trained and qualified or certified in accordance with the QA program requirements.

NDE Subcontractor Inspection Personnel

BNI has retained a subcontractor to perform some NDE activities, such as radiographing (x-raying) welds. Although interpretation of the radiographs is performed by BNI personnel who meet the qualification of SNT-TC-1A Level III, some activities performed by Northwest Inspection, Inc. (NWII). NWII are quality related. During the June 2016 assessment, EA reviewed QC Surveillance Report 24590-WTP-SV-QC-16-027, *NWII Qualification and Certification of NDE Personnel*, dated February 23, 2016. The purpose of this surveillance, which was performed by a BNI Level III welding QC inspector, was to review the qualifications of NWII NDE personnel and verify that they were qualified and certified in accordance with SNT-TC-1A. The surveillance adequately demonstrated that the four NWII NDE personnel assigned to the WTP site were qualified in accordance with SNT-TC-1A.
A BNI audit of NWII's QA program concluded that the NWII QA program was deficient in some areas;

EA performed a follow-up review to determine the administrative controls used by BNI to oversee any quality-related activities performed by NWII. Specification No. 24590-WTP-3PS-NE00-T0002, *Engineering Specification for NDE Subcontractor Quality Requirements*, establishes the QA program requirements for subcontractors performing NDE services at WTP. This Specification requires the NDE subcontractor to establish and implement an SNT-TC-1A written practice and provide SNT-TC-1A qualified personnel. All work at WTP performed by subcontractor NDE personnel is done in accordance with BNI procedures under the direct supervision of BNI personnel and in accordance with the BNI QA program. In addition, the NWII personnel are required to complete WTP site-specific training for NDE personnel. EA reviewed the certification and training records for the four NWII NDE inspectors at WTP and concluded that these individuals were qualified and certified in accordance with SNT-TC-1A and had completed the WTP-required training.

The NWII NDE personnel are qualified in accordance with SNT-TC-1A, and their training, qualification, and certification records are complete.

5.10 ORP WCD Welding and Electrical Assessments

Criteria:

Special processes that control or verify quality, such as those used in welding, shall be performed by qualified personnel using qualified procedures in accordance with specified requirements. (NQA-1, Requirement 9; Policy Q-9.1 of the WTP QAM; and DOE Order 414.1C)

Electrical equipment that performs a safety function shall be installed in accordance with approved procedures, design drawings, manufacturer's instructions, and other design basis documents, including applicable codes and standards. The procedures, instructions, and drawings shall include or reference appropriate quantitative or qualitative acceptance criteria for determining that prescribed results have been satisfactorily attained. (NQA-1, Requirement 5; Policy Q-5.1 of the WTP QAM; and DOE Order 414.1C)

WCD Welding Assessments

The WCD site inspectors perform independent inspections of one or more inspection attributes on approximately 5% of Q welds they select at random. Welds selected for inspection include structural steel, piping, pipe supports, vessel (tank) welds, and weld repairs. Most welds that WCD examines are Q, but the WCD staff also includes some CM welds in its independent sample. The site inspectors also examine some welds that have unique configurations or geometry and differ in some respect from routine site-welding operations.

EA observed a WCD site inspector performing visual inspections of three final pipe welds, one on a section of the C2 ventilation piping in the LAW, and two on supports for the LAW secondary offgas/vessel vent process system. EA also performed an independent inspection of the welds. The three welds complied with design and ASME Code requirements.

The WCD site inspector had pre-selected these welds (listed in Appendix B) as DOE-designated witness points. The WCD site inspector verified that the acceptance criteria for visual examination of the piping welds specified in 24590-WTP-MN-CON-01-001-10-09, Rev. 8, *Bechtel Nondestructive Examination Standard, Visual Examination VT-ASME*, were met; reviewed the field welding checklists, weld wire draw slips, and drawings associated with the welds inspected; and verified that the correct filler materials and weld processes were used to complete the welds and that the size and type of welds matched the

construction drawings. Welding procedures and welder qualification records were reviewed during previous EA assessments.

The implementation of the WCD welding inspection program was satisfactory for the sample that EA reviewed.

WCD Electrical Assessments

EA reviewed 11 assessment reports documenting inspections of electrical work performed by WCD site inspectors between April and August 2016. Two of the reports documented walkdowns that identified no issues. One report documented the closure of a previously identified deficiency. Five of the reports documented system walkdowns that had been performed before system turnover from BNI CON to Operations. The WCD site inspectors identified several issues during each of the walkdowns and documented the issues in five reports that are being evaluated by BNI construction and/or engineering. Another report documented a review conducted by WCD site inspectors of BNI electrical construction procedures and associated data sheets for testing cables after installation. The site inspectors identified several discrepancies in some of the procedures reviewed. The WCD site inspectors also found several data sheets that had been completed erroneously. WCD issued three findings concerning these errors. The remaining two reports documented the review of potential deviations from the NEC that WEC site inspectors had identified. These issues involved differences between BNI and WCD interpretation of the NEC and have been discussed previously with BNI but have not been resolved. BNI is evaluating the deviations from the NEC and may resolve them with an AHJ ruling. Overall, WCD is conducting adequate oversight of the electrical construction work performed by BNI within the scope of these inspections.

5.11 ORP Review of Contractor Performance

Criterion:

Evaluate contractor and DOE programs and management systems, including site assurance systems, for effectiveness of performance (including compliance with requirements). Such evaluations must be based on the results of operational awareness activities; assessments of facilities, operations, and programs; and assessments of the contractor's assurance system. The level and/or mix (i.e., rigor or frequency in a particular area) of oversight may be tailored based on considerations of hazards and the maturity and operational performance of the contractor's programs and management systems. (DOE Order 226.1B, 4b(1))

In 2015, ORP performed a comprehensive assessment of 13 of 26 major systems in the LAW (REF: 15-WTP-0151, *Low-Activity Waste (LAW) Design and Operability Review and Recommendation*). This was a performance-based assessment using 35 independent consultants. Over 500 vulnerabilities were identified, with a technical basis, consequence analysis, and OFIs for each. Among these vulnerabilities, the report identifies BNI weakness in PvM funding and resource allocation and some equipment degradation, such as corrosion and false brinelling (material wear or removal that occurs over an extended time from vibration and light loads).

The February 2016 DNFSB report is critical of BNI PvM, stating, "Deficiencies appear to have existed for several years, which indicates a need to improve DOE QA oversight in preservation and storage of SSCs." WCD facility representatives scheduled several PvM surveillances, including HLW, LAW, LAB, and BOF in the *FY2016 WTP Integrated Assessment Plan*, (SC-OE-15-002) and an April 2016 revision of the plan (SC-OE-16-001). Over the past 12 months, WCD conducted each of these planned surveillances and documented Facility Representative operational awareness-related PvM results. Over the past three

years, 19 assessments/surveillances have addressed PvM across all buildings and storage facilities except the MHF and Yakima Warehouse. (See **OFI-WCD-01**.)

EA's sample review of WCD assessments/surveillances found a balance of performance-based and compliance-based assessments of work performed in accordance with approved instructions and communicated results based on objective evidence.

WCD oversight has been effective in identifying some significant issues. For example, WCD surveillances have identified potential damage to an HLW floor plug, which could cause failure in the shoring system, water intrusions into several areas, and sludge/standing water in contact with anchor bolts and tank skirts, and active corrosion was found on underground transfer lines. The Level B CR 16-00417, discussed in Section 5.8 of this report, is attributed to a WCD surveillance report (S-16-WCD-RPPWTP-001-F01). Operational awareness reports have identified stainless steel piping stored in an HLW laydown area in direct contact with corroded carbon steel supports, resulting in pitting and galvanic corrosion, wall liner oxidation, and animal droppings on some important items.

ORP conducted a thorough and effective design and operability review of the LAW. With the exception of the MHF and Yakima Warehouse, ORP (through WCD) has recently performed effective oversight and evaluation of BNI PvM of stored and installed equipment at the WTP site, resulting in the identification of significant findings. WCD has also been adequate in overseeing welding and electrical installation work.

6.0 FINDINGS

EA identified no findings during this assessment.

7.0 OPPORTUNITIES FOR IMPROVEMENT

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

WTP

OFI-WTP-01: BNI should consider revising Procedure 24590-WTP-GPP-CON-3206, Appendix 8, Section 2.3, to define a specific maximum time of exposure between placement of TC bolt assemblies in the structure and final tensioning.

WCD

OFI-WCD-01: ORP and/or WCD should consider performing surveillances of PvM at the MHF and Yakima Warehouse.

8.0 ITEMS FOR FOLLOW-UP

EA previously identified that the AHJ in the electrical area was delegated to BNI before ORP management around 2003, and identified this situation as a conflict of interest. ORP staff reviewed the issue and made recommendations to ORP management. At the time of this current assessment, those recommendations were under ORP management review. EA will continue to follow ORP's resolution of this issue in subsequent assessments of WTP construction quality.

EA will perform additional assessments of the BNI subcontractor oversight program and will evaluate resolution of open CRs, NCRs, and CDRs. EA plans to continue to monitor BNI's progress in addressing identified issues and its efforts to reduce the backlog of unresolved issues. EA also intends to continue to follow-up on inspection of welding activities, piping and pipe supports, structural steel erection, pressure testing of piping, cable pulling, and installation of electrical and mechanical equipment. EA also intends to perform additional assessments of the program for preservation and maintenance of plant equipment.

Appendix A
Supplemental Information

Assessment Dates

Onsite visit: September 12-22, 2016

Office of Enterprise Assessments (EA) Management

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

Quality Review Board

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

EA Site Lead for Hanford Site

Robert E. Farrell

EA Team Composition

Robert E. Farrell – Team Lead, June 12-22
James M. Boyd, June 19-22
Joseph J. Lenahan, June 19-22
Michael A. Marelli, June 12-15

Appendix B
Documents Reviewed, Interviews, and Observations

Documents Reviewed

- Construction Procedure 24590-WTP-GPP-CON-3504, Rev. 13, Pressure Testing of Piping, Tubing and Components, February 25, 2016
- Construction Procedure 24590-WTP-GPP-CON-3205, Rev. 5, Post Installed Concrete Anchors, January 28, 2016
- Construction Procedure 24590-WTP-GPP-CON-3203, Rev. 10, Concrete Operations (Including Supply), August 20, 2015
- Construction Procedure 24590-WTP-GPP-CON-3206, Rev. 6, Structural Steel Installation & On-Site Fabrication, January 28, 2016
- Specification No. 24590-WTP-3PS-FA02-T0004, Rev. 7, Engineering Specification for Installation and Testing of Post Installed Concrete Anchors and Drilling/Coring of Concrete, April 29, 2014
- Specification No. 24590-WTP-3PS-DB01-T0001, Rev. 8, Engineering Specification for Furnishing and Delivery of Ready Mixed Concrete, March 26, 2007
- Specification No. 24590- LAW-3PS-LMP-T0002, Rev 3, Engineering Specification for MLTR-00001, Site Assembly of Melters, June 6, 2016
- Specification No. 24590-WTP-3PS-EKPO-T0001, Rev. 5, Electrical Requirements for Packaged Systems
- Specification No. 24590-WTP-3PS-JQ07-T0001, Engineering Specification for Instrumentation for Packaged Systems
- Procedure 24590-WTP-GPP-MGT-044, Rev. 7, Nonconformance Reporting and Control, September 1, 2016
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- Qualification records for three field engineers
- Certification records for four welding field engineers
- Qualification records for three subcontract coordinators

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Interviews

- BNI WTP Site Manager
- BNI Field Material Management Manager
- BNI Warehouse Personnel
- Plant Operations Maintenance (POM) Equipment Evaluator
- BNI Maintenance Managers, Planners, and Material Specialists
- BNI Field Engineering Manager
- BNI Field Engineers
- BNI Welding Engineers
- BNI QA Manager
- BNI QC Manager
- BNI QC Inspectors
- WCD Division Director
- WCD Site Inspectors and Facility Representatives

Observations

- MTF/ South 40 Laydown Yard Walkdown
- T53 Warehouse Walkdown
- 4 1/2 Laydown Walkdown
- Storage and preservation of equipment in the LAB, LAW, HLW, and PTF
- Observed performance of portions of a pneumatic pressure test performed on instrument piping in LAW MLTR-00001, recorded on document numbers 24590-LAW-PPTR-CON-16-0041
- Witnessed a WCD site inspector performing final visual inspections of three piping welds: pipe to fitting weld GB005 C2 Ventilation (C2V) on FWCL 24590-LAW-FWCL-CON-01441, pipe to flange weld GB013C1 LVP system piping on FWCL 24590-LAW-FWCL-CON-16-01262, and stanchion to plate weld FW-01 for LVP system pipe support LAW-LVP-H30172, FWCL 24590-LAW-FWCL-CON-13-00673.
- Examined installation of electrical equipment in the LAW and Water Treatment Building