Independent Oversight Review of the Hanford Site Waste Treatment and Immobilization Plant Construction Quality

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Acronyms

ASME	American Society of Mechanical Engineers
BOF	Balance of Facilities
BNI	Bechtel National, Inc.
C&I	Controls and Instrumentation
CDR	Construction Deficiency Report
CFR	Code of Federal Regulations
CM	Commercial Grade
CRAD	Criteria, Review and Approach Document
DOE	U.S. Department of Energy
FWCL	Field Welding Checklist
HLW	High-Level Waste
HSS	Office of Health, Safety and Security
LAB	Analytical Laboratory
LAW	Low-Activity Waste
LOI	Line of Inquiry
MSOW	Management Suspension of Work
MT	Magnetic Particle Examination
NCR	Nonconformance Report
NDE	Nondestructive Examination
NRC	Nuclear Regulatory Commission
OFI	Opportunity for Improvement
ORP	Office of River Protection
P&ID	Piping and Instrumentation Diagram
PICA	Post Installed Concrete Anchor
PIER	Project Issues Evaluation Report
psi	Pounds per Square Inch
Q	Quality
QA	Quality Assurance
QAM	BNI Quality Assurance Manual
QC	Quality Control
S/CI	Suspect/Counterfeit Item
SSC	Structures, Systems, and Components
UT	Ultrasonic Testing
WCD	WTP Construction Oversight and Assurance Division
WTP	Waste Treatment and Immobilization Plant

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1.0 PURPOSE

The U.S. Department of Energy (DOE) Office of Enforcement and Oversight (Independent Oversight), within the Office of Health, Safety and Security (HSS), conducted an independent review of selected aspects of construction quality at the Hanford Site Waste Treatment and Immobilization Plant (WTP). The review, which was performed September 9-13, 2013, was the latest in a series of ongoing quarterly assessments of construction quality performed by Independent Oversight at the WTP construction site.

2.0 SCOPE

The scope of this quarterly assessment of construction quality review included observations of ongoing work activities, review of the Bechtel National, Inc. (BNI) corrective action program, examination of implementation of selected requirements in the BNI quality assurance (QA) program, and follow-up on issues identified during previous assessments. Design and procurement programs are not included in the scope of the quarterly construction quality reviews. Ongoing work activities have been affected by design concerns that may result in redesign of some systems and/or structures and reductions in construction craft staffing. Work activities observed during the current review included observation of DOE Office of River Protection (ORP) welding inspections and two pneumatic pressure tests. Independent Oversight examined nonconformance reports (NCRs) and construction deficiency reports (CDRs) identified by BNI under its corrective action program, as well as corrective actions to address deficiencies identified in installation of post installed concrete anchors (PICAs). Independent Oversight also reviewed the BNI self-assessment program in the construction organization, and QA surveillance reports.

Independent Oversight reviewed various construction quality documents and conducted several construction site walkthroughs, concurrent with the ORP staff. During the walkthroughs, Independent Oversight observed inspections of welding activities and pressure testing of instrument tubing. Independent Oversight also examined specifications and procedures that control installation of PICAs, instrumentation systems, and pressure testing of piping and instrument tubing.

3.0 BACKGROUND

ORP was established in 1998 to manage the 56 million gallons of liquid or semi-solid radioactive and chemical waste stored in 177 underground tanks at the Hanford Site. ORP serves as DOE line management for two functions: the Tank Farms, which maintain the 177 underground storage tanks; and the WTP. WTP is an industrial complex for separating and vitrifying the radioactive and chemical waste in the underground tanks. The WTP complex consists of five major components: the Pretreatment Facility for separating the waste; the High-Level Waste (HLW) and Low-Activity Waste (LAW) facilities, where the waste will be immobilized in glass; the Analytical Laboratory (LAB) for sample testing; and the balance of facilities (BOF) that will house support functions. WTP is currently in the design and construction phase. Design and construction activities at WTP are managed by BNI under contract to ORP. Construction oversight is provided by ORP staff, specifically by the ORP WTP Construction Oversight and Assurance Division (WCD). Because of the safety significance of WTP

facilities, Independent Oversight has scheduled quarterly reviews to assess the quality of ongoing construction.

4.0 METHODOLOGY

This independent review of the WTP construction project was conducted in accordance with applicable sections of Nuclear Facility Construction Criteria, Review and Approach Documents (CRADs) HSS-CRAD-45-52, *Piping and Pipe Supports*; HSS-CRAD-45-53, *Mechanical Equipment Installation*; and HSS-CRAD-64-20, *Feedback and Continuous Improvement Inspection Criteria and Approach - Contractor*.

5.0 RESULTS

Activities examined by Independent Oversight during the review are discussed below. Each activity is briefly described, followed by a discussion of the review performed by Independent Oversight. Conclusions are summarized in Section 6 and items for follow-up are discussed in Section 7.

NCRs and CDRs

BNI Procedure 24590-WTP-GPP-MGT-044, *Nonconformance Reporting and Control*, defines the requirements for identifying, documenting, reporting, controlling, and dispositioning nonconforming conditions at the WTP associated with quality (Q) and commercial grade (CM) structures, systems, and components (SSC). NCRs are issued to document and disposition Q nonconforming conditions, while CDRs are used to document and disposition CM nonconforming conditions. SSC designated as Q (previously classified as QL) in the design documents are required to be constructed or manufactured in accordance with the WTP QA program, and the American Society of Mechanical Engineers (ASME) Nuclear Quality Assurance (NQA)-1 standard. SSC 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 are purchased as CM items from vendors who are qualified as CM suppliers.

Independent Oversight reviewed the 45 NCRs issued by BNI between June 11 and September 12, 2013, and a sample of 35 CDRs issued by BNI between August 1 and 15, 2013, to evaluate the type of nonconforming issues that were identified, their apparent causes, and subsequent corrective actions.

Approximately 20 percent of the NCRs were initiated to document construction or installation errors, or damage to installed components resulting from construction activities. NCRs issued to document and disposition problems identified with equipment and hardware as a result of procurement issues accounted for 75 percent of the NCRs. Examples of these procurement problems included hardware/components that were delivered to the site without the required supporting documentation demonstrating compliance with purchase specifications, improperly labeled hardware, hardware/equipment that did not comply with project specification requirements, and missing parts or damage that occurred during transit. Corrective actions to address the procurement problems varied from obtaining the required documentation from the vendor to performing rework on site. Some examples of rework performed on site were repairing deficient welds, replacing damaged gaskets in valves, and replacing incorrect fastener assemblies (bolts, nuts, and washers) in components. If extensive rework was required or if the item delivered to the site did not comply with the purchase specifications, the hardware was rejected and returned to the vendor. Design/engineering issues, such as drawing or design errors, accounted for the rest of the NCRs.

The CDRs that Independent Oversight reviewed were issued to document and disposition the following types of nonconforming conditions: 13 CDRs for procurement issues; 17 CDRs for deficiencies in installation of PICAs in the LAW and BOF; and 5 for other types of construction deficiencies. The CDRs related to deficiencies in installation of PICAs are discussed under Deficiencies in Installation of PICAs, below.

Independent Oversight determined that for the completed NCRs/CDRs that were reviewed, the BNI engineering organization developed appropriate corrective actions to disposition the identified problems. The NCR/CDR process and implementation successfully addressed the NCRs and CDRs sampled in this review. Closeout and resolution of some open NCRs may be difficult and may impact costs and the construction schedule.

Deficiencies in Installation of PICAs

PICAs are installed in the concrete structure after the concrete has hardened and attained its design strength to provide anchorage for equipment in locations where embedded plates and cast in-place anchor bolts are not available. The types of hardware and components supported by PICAs include structural steel platforms, pipe supports, instrument racks, transformers, electrical components, and conduit and instrument supports. During a review of CM pipe support installation records in September 2011, WCD personnel identified incorrect or missing data in the documentation of installation of CM PICAs. On September 21, 2011, BNI issued Project Issues Evaluation Report (PIER) Number 24590-WTP-PIER-MGT-11-0918-C, *Post Installed Concrete Anchor (PICA) Documentation*. The action items for this PIER required review of the PICA records for all anchors installed between July 19, 2010, and May 2012. After completing this review, Field Engineering determined that actual physical inspections of PICA installations were required to resolve the questions regarding PICA documentation deficiencies and possible installation errors. BNI issued PIER Number 24590-WTP-PIER-MGT-12-1246-B, Rev. 0, *Post Installed Anchor Bolt Installation and Documentation*, to perform additional actions, including reviewing installation documentation and re-inspecting all CM PICAs installed on the WTP project.

PICAs used in Q applications were not included in this review for the following reasons:

- The only types of PICAs used in Q applications on the WTP project are the undercut type (also used in some CM applications), which are installed by drilling a hole in the concrete using a special type of drill bit that flares out to form a cone shaped, or undercut, hole at the bottom of the drill hole; installing the anchor in the hole; and expanding it into the undercut area using a hydraulic jack so that the tensile load from the bolt is transferred into the concrete by the anchor bearing against the undercut hole.
- The location and anchor type (diameter and length) of the undercut anchors are shown on the design drawings, so the spacing between anchors is controlled.
- QC inspectors perform independent inspections of 100 percent of the Q anchors, during which they verify the correct hole depth and the use of correct load on the hydraulic jack to expand the anchor.

The results of the ongoing re-inspection program for CM PICAs were discussed with BNI engineers. There are approximately 1865 records documenting installation of CM PICAs in the LAW (1099), the LAB (303), and BOF (463). There are an additional 177 records that document CM PICAs installed in the HLW, which will be re-inspected at a later date. The number of PICAs represented by each record varies, typically between four and ten. As of September 1, 2013, re-inspections had been completed for the PICA installations documented on approximately 1741 records in the LAW (984), LAB (299), and BOF (458). Installation errors were identified on one or more PICAs documented on 610 of these records. BNI has initiated 610 CDRs (one for each record that had an installation error) related to PICA deficiencies since September 2011 to disposition the discrepancies. Design Engineering has completed evaluation of more than half of these CDRs. In most cases, Design Engineering determined the installed

PICAs could support the applied loads ("Use-as-is"), but some additional rework has been required to restore the design margin and required safety factors for PICA deficiencies documented in some (less than 10 percent) of the CDRs. The apparent causes of the installation deficiencies were inadequate installation instructions in the BNI PICA construction procedure and specification, and inadequate oversight of the PICA installations by Field Engineering. Quality control (QC) inspectors do not inspect CM PICAs. For CM PICAs, field engineers are responsible for ensuring that installation of CM PICAs classified as structural anchors was in compliance with project design documents. Structural CM PICAs are designed and specified by Design Engineering. Other CM PICAs are classified as nonstructural anchors, which are those that support light loads. Craft personnel were responsible for locating and installing the CM nonstructural anchors in accordance with the construction procedure. Until a recent change in procedures (discussed below), field engineers generally were not required to inspect installation of nonstructural anchors CM PICAs.

BNI Specification No. 24590-WTP-3PS-FA02-T0004, *Engineering Specification for Installation and Testing Post Installed Concrete Anchors and Drilling/Coring of Concrete*, and BNI Construction Procedure 24590-WTP-GPP-CON-3205, *Post Installed Concrete Anchors*, specify the technical requirements for installation, inspection, and testing of PICAs and are being revised. Installation of CM PICAs has been restricted by a construction management suspension of work (MSOW) until the revision is complete and field engineers and craft personnel receive training on the revised PICA installation and inspection instructions.

During the June 2013 construction quality quarterly review, Independent Oversight reviewed a draft copy of proposed changes to Revision 3C of the construction procedure and noted that it did not specify the minimum epoxy cure times before a tension test load could be applied to verify the capacity of the CM PICAs set in epoxy cement. This comment was resolved by incorporating minimum epoxy cure times into Revision 3D of Procedure 24590-WTP-GPP-CON-3205, dated August 21, 2013.

Revision 3D of the construction procedure also clarifies the installation requirements, methods, and inspection attributes for each different type of CM PICA used on the WTP project. This revision adds a requirement for field engineers to inspect nonstructural CM PICAs to verify minimum spacing between new PICAs and existing PICAs or embedded plates, and to verify minimum edge distances complies with procedure requirements. As noted above, previous revisions of the construction procedure did not require field engineers to inspect nonstructural CM PICAs. Additional revisions to the engineering specification and construction procedure are under development by BNI to further clarify PICA installation instructions.

Independent Oversight, in conjunction with WCD, performed a walkdown to examine PICAs installed in various locations at WTP. During the walkdown, Independent Oversight identified some PICAs installed for structural steel supports for electrical panels at the anhydrous ammonia storage facility that did not appear to meet specification requirements regarding minimum edge distance (distance between center of PICA and edge of concrete) for the size and length of PICA installed. Discussions with BNI field engineers and review of installation records disclosed that these PICAs had been installed in April and May 2013 after construction management issued approval per the partial release criteria of 24590-WTP-MSOW-MGT-12-0019. PICA Installation Record Number 24590-BOF-PICA-CON-13-0024 showed that 6 of the 12 PICAs for the supports for Panel LVE-PNL-23001 were installed in a location with less than the minimum edge distance required by BNI Specification No. 24590-WTP-3PS-FA02-T0004. This issue was identified before the PICAs were installed. Field Change Number 24590-WTP-FC-E-13-0257 was initiated prior to installation of the PICAs with the reduced edge distance and transmitted to Design Engineering. Design Engineering determined that although the reduced edge distance would reduce the design capacity of the six anchors, the anchors had sufficient design margin to support the electrical

panel. Design Engineering approved the field change, and construction was authorized to install the six PICAs at a reduced edge distance.

BNI is performing a causal analysis to determine the factors underlying the deficiencies in the installation of the PICAs. Independent Oversight determined that BNI's approach to determining the extent of condition is adequate.

Installation of Controls and Instrumentation

Independent Oversight reviewed BNI Specification No. 24590-WTP-3PS-JQ08-T0001, Rev. 2, *Engineering Specification for Construction and Installation of Controls and Instrumentation.* The specification defines the technical, quality, and construction requirements for installation of CM and Q controls and instrumentation (C&I) systems, including instrument tubing, supports, and instruments, as well as inspection, testing, and QA requirements. Types of instruments include flow meters, pressure instruments, instruments for measuring temperature and radiation, gas analyzers, and various laboratory and analytical instruments.

BNI Construction Procedure 24590-WTP-GPP-CON-3401, Rev. 3C, *Controls and Instrumentation Installation*, describes the process for installing and inspecting C&I components, including verification that instrument tubing and connections are fabricated using correct materials; internal cleanness of tubing is acceptable; tubing is free of surface defects; instrument tubing is sloped per specification requirements; tubing is properly routed; connections are complete; sample lines, drains, and vents are installed per specification requirements; configuration and location are in accordance with design documents; and an identification tag is attached. Other inspection details addressed in the procedure are verification that applicable weld records are complete; spacing and configuration of tubing clamps and supports are installed per design documents; mechanical connections are tightened/torqued per design; and correct instrument/instrument components are installed and identified. Field engineers are responsible for ensuring that CM C&I systems are installed in accordance with the project design documents, and QC inspectors perform acceptance inspections of Q C&I systems. The leak-tight integrity of C&I systems is determined by pressure tests performed in accordance with Construction Procedure 24590-WTP-GPP-CON-3504, *Pressure Testing of Piping, Tubing and Components.*

Independent Oversight concluded that Construction Procedure 24590-WTP-GPP-CON-3401 is adequate to control installation of C&I systems and includes specific work instructions and inspection requirements to ensure that the C&I components and systems comply with design documents and the engineering specification.

Pressure Testing of Piping

Independent Oversight observed two pneumatic pressure tests on instrument sensing lines in ventilation systems in the LAB. The WTP site work process for conducting leak testing is specified in Construction Procedure 24590-WTP-GPP-CON-3504, Rev. 9B, *Pressure Testing of Piping, Tubing and Components*. The requirements for pneumatic pressure testing are specified in ASME Code B31.3, Paragraph 345.5, Pneumatic Testing.

Independent Oversight attended the pre-test briefings, reviewed drawings and test data sheets, observed pressurization of the systems to the specified test pressure, observed the minimum hold times, and witnessed the system walkdown and inspection of the instrument lines within the test boundary. Pre-job briefings addressed safety guidelines, emergency plans, the size and setting of the pressure relief valve, test sequence, test boundaries, test pressure, system pressurization and de-pressurization, inspection activities, and work completion. The pressure test and inspection boundaries were shown on marked-up

piping and instrumentation diagrams (P&IDs), and the attached valve lineup sheets listed the test valve position and referenced test plug or blind flange locations. The locations of limited access/safety barriers were established in accordance with procedure requirements by calculating stored energy.

The requirements for pneumatic pressure tests of various sections of instrument sensing lines on the LAB plant service air system observed by Independent Oversight were specified in Pressure Test Packages 24590-LAB- PPTR-CON-13-0035, Lab Steam and Condensate System, LPS/SCW, and 24590-LAB-PPTR-CON-13-0043, LAB V&ID Inbleed, Hotcell & RLD Vessel C5V Exhaust. These test packages included the test data sheets, test information, test requirements, valve lineup sheets, and marked-up P&IDs for the pressure test performed on instrument lines (tubing). The instrument lines within the pressure test boundaries are classified as CM. The minimum test pressure was 148.5 psi, with a specified hold time of 10 minutes. Independent Oversight verified that the calibration stickers on the test pressure gauges were current and that whip restraints were installed on pressure hoses. The systems were pressurized to approximately 151 psi and held for 11 minutes, slightly in excess of the pressure test requirements. The walkdowns and inspections of the tubing and fittings were performed by Field Engineering personnel. Independent Oversight witnessed the walkdowns and inspections and observed the leak tests performed on the compression fittings used at joints between instrument tubing sections and to connect valves and other components to the instrument tubing. Some minor leaks were detected at a few fittings and were corrected by tightening the fittings in accordance with the test procedure. The tests were declared acceptable. The two pressure tests witnessed by Independent Oversight were completed in accordance with the requirements of Construction Procedure 24590-WTP-GPP-CON-3504, 9B. Although some small leaks were identified in a few instrument tubing fittings, these were repaired in accordance with the test procedure, and the tests were successfully completed.

WCD Welding Inspection Program

The WCD staff performs independent inspections of one or more inspection attributes for approximately 5 percent of quality-related welds and is currently reviewing 100 percent of the weld records. WCD randomly selects welds for examination, and also places witness points on weld inspection documentation to ensure that WCD inspects a variety of welds across all facilities. A witness point requires BNI construction to notify WCD when the work is scheduled to be performed; the work activity then cannot be performed or proceed past that point unless WCD inspects the construction process or waives the witness point. Welds selected by WCD for inspection include structural steel, piping, pipe supports, vessel (tank) welds, and weld repairs. Most of the welds examined by WCD are Q, but the WCD staff also includes some CM welds in their independent sample.

Independent Oversight observed the WCD staff's visual fit-up inspections for one three-inch pipe-to-pipe weld in the LAW primary offgas process system. Acceptance criteria for piping welds are specified in the BNI welding control manual and ASME B31.3. WCD pre-selected this weld as a DOE inspection witness point, and it was designated as a witness point on the field welding checklists (FWCLs). WCD also reviewed FWCLs and drawings associated with the welds. The contractor correctly notified WCD, and WCD witnessed the successful weld fit-up.

Management Self-Assessment Program

The BNI Quality Assurance Manual (QAM), Document 24590-WTP-QAM-QA-06-001, describes the management, performance, and assessment processes applied by BNI to ensure that WTP, subcontractors, and suppliers comply with the QA requirements of 10 CFR 830.120, *Subpart A, Quality Assurance Requirements*; DOE Order 414.1C, *Quality Assurance*; and DOE Order 226.1A, *Implementation of Department of Energy Oversight Policy*. DOE Order 226.1A , Attachment 1, Appendix A, Paragraph 2, Assessments, requires, in part, that contractors (e.g., BNI) develop, implement, and perform

comprehensive self-assessments on a recurring basis to evaluate performance at all levels to determine the effectiveness of policies, requirements, and standards and the implementation status. DOE Order 414.1C defines an assessment as a review, evaluation, inspection, test, check, surveillance, or audit to determine and document whether items, processes, systems, or services meet specified requirements and perform effectively.

Policy Q-02.2, *Management and Self-assessment*, of the BNI QAM, specifies the requirements for planning, developing, performing, and documenting management self-assessments. Paragraph 2.2.2.2.1 of Policy Q-02.2 states that line and support organizations shall perform self-assessments of their performance and the adequacy of their processes. Paragraph 2.2.2.2.4 of Policy Q-02.2 states that self-assessments shall be used to evaluate performance at all levels periodically and to determine the effectiveness of policies, requirements, and standards, and the implementation status.

BNI Construction Procedure 24590-WTP-GPP-MGT-036, *WTP Self-assessment*, is the implementing procedure that WTP personnel use to perform the self-assessments necessary to comply with the BNI QA program and DOE QA requirements. This procedure describes a process for managers and employees to use when performing self-critical evaluations of their work processes and activities to ensure that work is performed as expected and to monitor work results to ensure that completed work meets project requirements. The procedure describes compliance-based and performance-based self-assessments as the processes for evaluating performance at all levels to identify problems with work processes and completed work activities. A compliance-based assessment is defined as one that focuses primarily on determining whether work items were completed in accordance with a procedure, requirement, standard, or other implementing document. A compliance-based assessment typically includes a review of documentation to measure whether those performing the task are following the prescribed method or rule, with only minimal observation of work being performed. A performance-based assessment is defined as one that evaluates work being performed. In addition to ensuring that work items are completed in accordance with a procedure, requirement, standard, or other implementing document, a key objective of a performance-based assessment is actual observation of ongoing work activities, followed by an evaluation focused on improving the performance of that activity.

The last paragraph in the Overview section of the procedure states that: (1) typically, a self-assessment combines performance and compliance-based activities; (2) while both elements are essential, WTP places a high degree of importance on performance-based assessments; and (3) a performance-based assessment is an excellent means of positively affecting the products or services resulting from a process. The procedure recommends developing lines of inquiry (LOIs) related to the scope of the self-assessment.

The list of the 29 construction self-assessments completed through August 1, 2013, shows the following focus areas: 3 self-assessments of construction safety; 2 self-assessments of the construction training program; 3 self-assessments of implementation of contract administrative controls; and 21 self-assessments of completed construction records. The 21 self-assessments of construction records were the only self-assessments that Field Engineering completed in 2013.

Independent Oversight reviewed three of the construction records self-assessments completed in 2013 that reviewed records for work completed in 2012. The scope of these self-assessments was to determine whether the records were complete and accurate and whether any identified errors affected the completed work and document quality. The LOIs for these self-assessments were: (1) Are the records complete and accurate in accordance with procedural requirements? and (2) If errors were found, what type were they or what level of impact do they have on installation of equipment or overall document quality? The following self-assessments were reviewed:

- WTP Self-assessment Report 24590-WTP-SAR-CON-13-0031, Quarterly Mechanical Record Assessment for Second Quarter 2012 – Twenty of 165 mechanical records completed during the

second quarter of 2012 were reviewed. Seventeen errors were identified in the records reviewed. Thirteen of the errors were references to an incorrect document revision, while the remaining errors involved the failure to include a reference document in four of the records.

- WTP Self-assessment Report 24590-WTP-SAR-CON-13-0032, Quarterly Mechanical Record Assessment for Third Quarter 2012 – Twelve of 87 mechanical records completed during the third quarter of 2012 were reviewed. Seven errors were identified. Five of the errors were references to an incorrect document revision, one involved the failure to include a document revision number, and one was an error in transcribing a document number.
- WTP Self-assessment Report 24590-WTP-SAR-CON-13-0033, Quarterly Mechanical Record Assessment for Fourth Quarter 2012 – Thirteen of 45 records completed during the fourth quarter of 2012 were reviewed. The four errors identified were references to an incorrect document revision number.

All of the errors in the records identified during the three self-assessments were administrative and none affected the quality of equipment installation or completed work. In 2010, PIER 24590-WTP-PIER-MGT-10-1241-B was initiated to document continuing deficiencies in construction records. Corrections of the errors in the records disclosed during the quarterly self-assessments are tracked with the PIER. An enhanced review process for construction records is now in use for performing technical reviews of construction records prior to close out of the records and transmittal to the QA document vault for permanent storage. Discussions with the Manager of Field Engineering in June 2013 disclosed that the expectation for this enhanced review is that the technical reviewer(s) target performing field walkdowns to examine ten percent of the completed work activity documented in the record. However, this expectation is not specified in a procedure. Discussions with WCD personnel indicated that the quality of construction records has improved because of the increased attention to detail and emphasis on record accuracy and completeness.

In the May 2013 Construction Quality Quarterly Report issued on May 22, 2013, Independent Oversight identified an opportunity for improvement (OFI) in that Field Engineering's self-assessment process could rely more on performance-based assessments and/or completing a higher percentage of performance-based self-assessments. BNI initiated PIER 24590-WTP-PIER-MGT-13-0743-D to address this OFI in June 2013, and it was closed on July 31, 2013. The closure statement for the PIER states that discussion of the OFI with the WTP Field Engineering Manager determined that review of work in progress is part of the normal work process for Field Engineering, and although such work process assessments are not formally documented as assessments, they accomplish the same purpose. However, DOE Order 226.1A, Attachment 1, Appendix A, 2.a.(5) and Paragraph 2.2.2.2.3 of BNI QAM Policy Q-02.2 state that self-assessment results shall/will be documented commensurate with the significance of and risks associated with the activities being evaluated. Additionally, Field Engineering work observations conducted as part of normal Field Engineering duties are part of the work process, not a self-assessment of the work process.

The Field Engineering organization has not undertaken performance-based self-assessments to observe ongoing work activities and evaluate performance in construction activities, such as piping and pipe support installation, instrument tubing and support installation, and electrical cable and component installation. In 2012, a self-assessment, documented in Self-assessment Report 24590-WTP-SAR-CON-12-0012, evaluated corrective actions for PIER 24590-WTP-PIER-MGT-11-0511-B to repair incorrectly-installed rod hangers on pipe supports. The conclusions of this self-assessment were that corrective actions were considered to be effective in preventing recurrence. Independent Oversight noted that performance-based self-assessments are currently scheduled to observe structural steel erection and pressure testing of piping in October 2013. The structural steel erection self-assessment is being performed in response to DOE and BNI quality issues identified in 2008 through 2011. Structural steel erection on the WTP project is approximately 90 percent complete. Although pressure testing of piping

and instrument tubing has been under way for more than18 months, no performance-based self-assessments have been performed of this activity. Pressure testing activities are almost completed in the LAB and on many BOF systems, and on a significant quantity of piping within the LAW.

Through August 1, 2013, the Field Engineering organization had performed 21 compliance-based self-assessments in 2013, limited to reviewing completed construction records for completeness and accuracy. During these assessments, Field Engineering conducted no performance-based self-assessments, observed no work in progress, conducted no interviews, and collected/evaluated no data. Properly performed, the work of the Field Engineering organization is critical to the successful operation of the WTP. Field engineers are responsible for inspection (quality verification) of CM construction activities and installation of CM components to determine whether these activities are being performed in accordance with design requirements. Approximately 25 percent of the piping and vessels installed in the black cells and hard-to-reach areas are classified as CM, and field engineers are responsible for performing quality verification activities for these components (see the Independent Oversight review of construction quality for November 14-17, 2011, issued March 2012). Although CM components are not required for accident mitigation, CM components must operate properly to treat and dispose of the 56 million gallons of waste stored in the tank farm. The construction Field Engineering organization has not fully implemented a self-assessment program including performance-based as well as compliance based assessments as required by DOE Order 226.1A to evaluate processes and work in progress. The contractor has committed to ORP's WTP Construction Oversight and Assurance Division Director that BNI Field Engineer at the WTP will schedule and conduct performance-based self-assessments during 2014.

Quality Assurance Surveillances

BNI Procedure 24590-WTP-GPP-QA-601, *Quality Assurance Surveillance*, describes the process used to plan, conduct, and document QA surveillances of work activities at WTP. The onsite QA staff conducts these surveillances, which generally focus on observations of work activities to determine whether procedures are being followed. Approximately 24 QA surveillances were completed in June, July, and August 2013, covering a wide range of ongoing work activities including concrete placements, welding, piping installation, startup testing, pressure testing of piping and instrument systems, material storage, construction safety, and construction administration. Some of the surveillances included follow-up on externally identified issues, such as those identified by WCD or during QA audits performed by the BNI offsite QA organization. Independent Oversight randomly selected five of the 2013 QA surveillances for review:

- QA/QC Surveillance Report Number 24590-WTP-SV-QA-13-065, *Discovery of Subcontractor Installed Suspect/Counterfeit Items (Valves)*. The scope of this surveillance was to perform research on several unmarked valve bodies installed in the fire service water system to determine whether the valves were suspect/counterfeit items (S/CI). Visual inspection disclosed that four valves in this system appeared to be S/CI. Nonconformance Report NCR 24590-WTP-NCR-OP-23-0041 and PIER 24590-WRP-PIER-13-07776-C were initiated to disposition this issue. Notifications were made to the DOE Office of Inspector General and to other DOE organizations in accordance with contract requirements pertaining to BNI-identified issues that involve S/CI.

- QA/QC Surveillance Report Number 24590-WTP-SV-QA-13-068, *Review Completed Field Weld Checklist (WR-25) for LAW Activities*. The scope of this surveillance was to review a random sample of 20 completed FWCLs for LAW piping installation to validate that the FWCLs were legible, complete, and accurate in accordance with the BNI QAM and procedures that implement the welding program. The quality level of the welding activities documented in the records reviewed was CM. No inadequacies were identified in the records reviewed, and the surveillance was deemed satisfactory.

- QA/QC Surveillance Report Number 24590-WTP-SV-QA-13-077, *Review Completed Field Weld Checklist (WR-25) for LAW Activities*. The scope of this surveillance was to review an additional random sample of 30 completed FWCLs for LAW piping installation to validate that the FWCLs were legible, complete, and accurate in accordance with the BNI QAM and procedures that implement the welding program. The quality level of the welding activities documented in the records reviewed was CM. No inadequacies were identified in the records reviewed, and the surveillance was deemed satisfactory.

- QA/QC Surveillance Report Number 24590-WTP-SV-QA-13-081, *Ultrasonic Testing (UT) Measurements to Determine Length of Installed Anchor Bolts*. The scope of this surveillance was to observe a Level II nondestructive examination (NDE) subcontractor perform UT examinations to measure the length of PICAs installed in various type of CM supports to anchor CM equipment and/or supports in BOF buildings. These UT measurements are part of the PICA re-inspection program discussed above under Deficiencies in Installation of PICAs. The surveillance included the following activities: review of the certification records of the UT examiner, observation of UT equipment calibration and operability checks, preparation of the anchors for the UT exam, observation of the UT exams, and review of records documenting the UT results. The QA auditor concluded that the qualification records of the NDE subcontractor showed he was certified as a Level II UT examiner; calibration and operability tests of the UT equipment were performed prior to taking any readings; the ends of the PICAs were prepared to remove coating/paint and any other materials that could affect UT readings; the UT exams were performed in accordance with BNI procedures; proper UT techniques were used during testing observed by QA personnel; and UT readings were documented. No findings were identified, and the surveillance was deemed satisfactory.

- QA/QC Surveillance Report Number 24590-WTP-SV-QA-13-085, *Magnetic Particle (MT) Examination on Welded Plug Holes in the HLW - Quality Level Q*. The scope of this surveillance was to observe a BNI field engineer, certified as a Level II MT examiner, performing MT examinations on completed plug hole welds in various quality level Q liner plate assemblies. The surveillance included the following activities: observation of the MT equipment calibration and operability checks, verification that surfaces to be examined by MT were prepared in accordance with the BNI procedure, observation of the MT exams, and review of records documenting the MT results. The QA auditor concluded that operability/calibration tests of the MT equipment were performed prior to taking any readings; test blocks used for calibration checks were controlled as required by the BNI QA program; surfaces to be examined were prepared by grinding to remove any irregularities that could mask indications of unacceptable weld discontinuities that could affect MT readings; the MT exams were performed in accordance with BNI procedures; proper MT techniques were used during testing observed by QA personnel; lighting was adequate to ensure proper examination of MT results; surfaces were cleaned of magnetic particles after completion of the tests; and MT results were documented. Five relevant indications observed during the MT exams indicated welds that were unacceptable and required repair. FWCLs were prepared to document and schedule the repairs. The conclusions of this QA surveillance were that the MT exams were properly conducted and that the welds requiring repair were properly documented in accordance with the BNI QA program. It was not necessary to initiate an NCR to document and repair the welds since the BNI welding procedures address corrective actions to repair weld defects within the scope of routine NDE scheduled activities. The surveillance was deemed satisfactory.

Independent Oversight discussed Nuclear Regulatory Commission (NRC) Information Notice 2013-12, *Improperly Sloped Instrument Sensing Lines*, dated July 3, 2013, with the onsite QA staff. This Information Notice addresses improper design and installation of instrument lines at several commercial nuclear power plants in that instrument lines installed with an improper slope could allow water to

condense in the instrument line, resulting in biased instrument output signals. The onsite QA staff indicated that they would review the Information Notice and consider performing a QA surveillance to evaluate whether instrument lines are installed in accordance with the design criteria for instrument tubing slope as described in paragraph 3.2.3 of BNI Specification No. 24590-WTP-3PS-JQ08-T0001.

The sample of BNI QA surveillance program activities reviewed by Independent Oversight was found to be satisfactory. QA surveillances were generally performed to observe the full range of ongoing work activities, and were also performed to follow up on issues identified by external organizations.

Structural Steel Installation

Independent Oversight and ORP staff observed installation of a steel beam on the HLW. The elevation of the installation required the iron workers to work from man-lift baskets, one on each end of the beam being installed. The men were wearing fall protection gear and were assisted by spotters who were in radio communication with the men and the crane operator as the beam was hoisted into place and supported while the iron workers fastened it to the vertical steel assembly in place. The steel erection activity observed was performed in accordance with requirements.

6.0 CONCLUSIONS

Independent Oversight determined that construction quality at WTP is adequate in the areas that were reviewed. BNI Engineering has developed appropriate corrective actions to resolve construction quality NCRs and CDRs. BNI continues to perform corrective actions necessary to address errors in installation of PICAs. The BNI procedure and specification are appropriate for installation and inspection of C&I systems and components.

However, the self-assessment program in the BNI construction Field Engineering organization still consists of mostly compliance-based assessments rather than a mixture of compliance-based and performance based assessments. Almost all self-assessments conducted by this organization since 2011 have been reviews to determine the completeness and accuracy of completed construction records. Field Engineering conducted no performance-based self-assessments of work in progress during the first eight months of 2013, and only three performance-based self-assessments in 2011 and 2012. The self-assessment program implemented in the construction Field Engineering organization still needs improvement as identified in the May 2013 Independent Oversight Review of WTP Construction Quality.

7.0 ITEMS FOR FOLLOW-UP

Independent Oversight will continue to follow up on inspection of welding activities, piping and pipe supports, instrument tubing and supports, pressure testing of piping and instrument systems, cable pulling, and cable terminations. Independent Oversight will also continue to review corrective actions to address identified discrepancies in the PICA installation process and will perform additional reviews of self-assessments conducted by Field Engineering. Independent Oversight will review contractor progress improving the field engineering organization self-assessment function.

Appendix A
Supplemental Information

Review Dates

September 9-13, 2013

Office of Health, Safety and Security Management

Glenn S. Podonsky, Chief Health, Safety and Security Officer
William A. Eckroade, Principal Deputy Chief for Mission Support Operations
John S. Boulden III, Director, Office of Enforcement and Oversight
Thomas R. Staker, Deputy Director for Oversight
William E. Miller, Deputy Director, Office of Safety and Emergency Management Evaluations

Quality Review Board

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

Independent Oversight Site Lead for Hanford Site

Robert Farrell

Independent Oversight Team Composition

Joseph Lenahan

Appendix B
Documents Reviewed

- Construction Procedure 24590-WTP-GPP-CON-3503, Rev. 6C, Aboveground Piping Installation, August 29, 2013
- Construction Procedure 24590-WTP-GPP-CON-3509, Rev. 2D, Pipe Support Installation, February 28, 2013
- Construction Procedure 24590-WTP-GPP-CON-3504, Rev. 9B, Pressure Testing of Piping, Tubing and Components, August 21, 2013
- Construction Procedure 24590-WTP-GPP-CON-3205, Rev. 3D, Post Installed Concrete Anchors, August 21, 2013
- Construction Procedure 24590-WTP-GPP-CON-3401, Rev. 3C, Controls and Instrumentation Installation, August 15, 2013
- Specification No. 24590-WTP-3PS-JQ08-T0001, Rev. 2, Engineering Specification for Construction and Installation of Controls and Instrumentation, August 3, 2010
- Specification No. 24590-WTP-3PS-FA02-T0004, Rev. 5, Engineering Specification for Installation and Testing Post Installed Concrete Anchors and Drilling/Coring of Concrete, July 7, 2010
- Construction Procedure 24590-WTP-GPP-MGT-043, Rev. 5, Corrective Action Management, July 31, 2013
- Construction Procedure 24590-WTP-GPP-MGT-044, Rev. 1D, Nonconformance Reporting and Control, July 29, 2013
- Construction Procedure 24590-WTP-GPP-MGT-036, Rev. 2A, WTP Self-assessment, October 8 , 2012
- Construction Procedure 24590-WTP-GPP-QA-601, Rev. 6C, Quality Assurance Surveillance, May 1, 2013
- Design Guide 24590-WTP-GPG-M-017, Rev. 8E, Design Parameters & Test Pressures for Equipment & Piping, February 14, 2013
- Procedure Number 24590-WTP-MN-CON-01-001-10-10. Rev. 6, Bechtel Nondestructive Examination Standard Visual Examination VT-AWS D1.1
- Document No. 24590-WTP-QAM-QA-06-001, Rev. 12, Quality Assurance Manual, March 22, 2013
- Construction Deficiency Report numbers 24590-WTP-CDR-CON-13-0655 through 13-0680 and 13-0682 through 13-0690. Number 24590-WTP-CDR-CON-13-0681 was not issued. The following Construction Deficiency Reports document nonconforming PICAs, numbers 24590-WTP-CDR-CON-13-0657 through 13 -0661, 13-0663, 13-0665 through 13-0667, 13-671, 13-0672, 13-0679, 13-0680, 13-0686 through 13-0688, and 13-0690.
- Nonconformance Report numbers 24590-WTP-NCR-CON-13-092 through -0136
- WTP Self-assessment Report 24590-WTP-SAR-CON-13-0031, Quarterly Mechanical Record Assessment for Second Quarter 2012
- WTP Self-assessment Report 24590-WTP-SAR-CON-13-0032, Quarterly Mechanical Record Assessment for 3rd Qtr 2012
- WTP Self-assessment Report 24590-WTP-SAR-CON-13-0033, Quarterly Mechanical Record Assessment for 4th Qtr 2012
- WTP Self-assessment Report 24590-WTP-SAR-CON-12-0012, Effectiveness review for 24590-WTP-PIER-MGT-11-0511-B, Rod Hangers Installed/Accepted Incorrectly
- QA/QC Surveillance Report Number 24590-WTP-SV -QA-13-068, Review Completed Field Weld Checklist (FWCL) WR-25 for LAW Activities
- QA/QC Surveillance Report Number 24590-WTP-SV -QA-13-077, Review Completed Field Weld Checklist (FWCL) WR-25 for LAW Activities

- QA/QC Surveillance Report Number 24590-WTP-SV -QA-13-081, Ultrasonic Thickness Measurement of Installed Anchor Bolts
- QA/QC Surveillance Report Number 24590-WTP-SV -QA-13-085, Magnetic Particle Examination on Welded Plugs in the HLW - Quality Level Q
- PIER 24590-WTP-PIER-MGT-11-0511-B, Rod Hangers Installed/Accepted Incorrectly
- System Pressure Test Document No. 24590-LAW-PPTR-CON-13-0035, Plant Service Air System Analytical Laboratory Main Distribution and Steam & Condensate System
- System Pressure Test Document No. 24590-LAB-PPTR-CON-13-0043, Plant Service Air System Analytical Laboratory Main Distribution and Inbleed, Hotcell, & RLD Vessel C5V Exhaust
- NRC Information Notice 2013-12, Improperly Sloped Instrument Sensing Lines, dated July 3, 2013