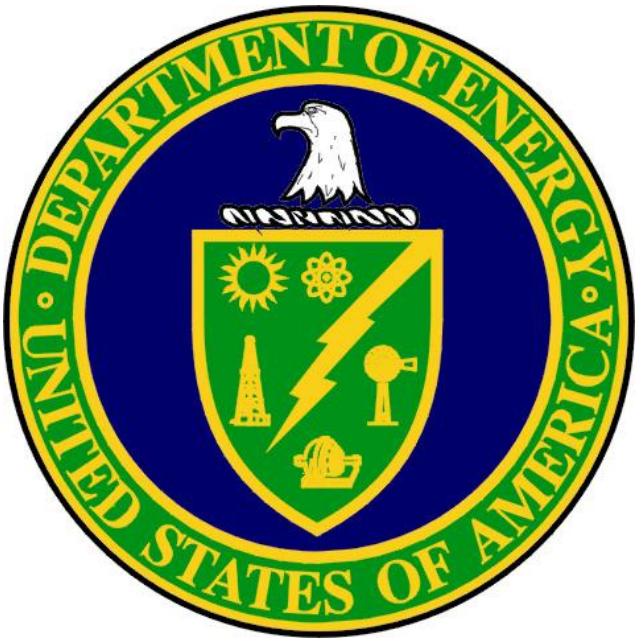
Independent Oversight Review of the Hanford Site Waste Treatment and Immobilization Plant Construction Quality



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Office of Environment, Safety and Health Assessments
Office of Independent Enterprise Assessments
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Acronyms

ASME	American Society of Mechanical Engineers
ASTM	ASTM International
BNI	Bechtel National, Inc.
BOF	Balance of Facilities
CDR	Construction Deficiency Report
CM	Commercial Grade
CRAD	Criteria, Review and Approach Document
DOE	U.S. Department of Energy
DOW	Domestic (Potable) Water System
HLW	High-Level Waste Facility
HSS	Office of Health, Safety and Security
IEA	Office of Independent Enterprise Assessments
LAB	Analytical Laboratory
LAW	Low-Activity Waste Facility
LEFE	Lead Electrical Field Engineer
MSOW	Management Suspensions of Work
MVE	Medium Voltage Electric
NCR	Nonconformance Report
NQA	Nuclear Quality Assurance
OFI	Opportunity for Improvement
ORP	Office of River Protection
P&ID	Piping and Instrumentation Diagram
PDSA	Preliminary Documented Safety Analysis
PICA	Post Installed Concrete Anchor
PIER	Project Issues Evaluation Report
psi	Pounds per Square Inch
PSW	Process Service Water System
PTF	Pretreatment Facility
Q	Quality Related
QA	Quality Assurance
QAM	Quality Assurance Manual
QC	Quality Control
RS	Responsible Superintendent
SSC	Structure, System, and Component
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 Independent Enterprise Assessments was established in May 2014 and assumed responsibility for managing the Department's Independent Oversight Program from the Department's former Office of Health, Safety and Security (HSS). HSS conducted this independent review of selected aspects of construction quality at the Hanford Site Waste Treatment and Immobilization Plant (WTP) prior to the creation of IEA. HSS performed this review March 3-6, 2014, and was the latest in a series of ongoing quarterly assessments of construction quality performed by Independent Oversight at the WTP construction site.

2.0 BACKGROUND

The Office of River Protection (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, which 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 (PTF) 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 Bechtel National, Inc. (BNI) under contract to ORP. BNI prepared a preliminary documented safety analysis (PDSA) for the WTP that describes the facility design codes, safety systems, design basis accident analysis, pre-operational testing program, operational safety, and the quality assurance (QA) program. The QA program requirements for design, construction, and operation of the WTP, referenced in the PDSA and cited in the BNI contract, are specified in American Society of Mechanical Engineers (ASME) Nuclear Quality Assurance (NQA)-1-2000, *Quality Assurance Requirements for Nuclear Facility Applications*, and DOE Order 414.1C, *Quality Assurance*. Construction work is classified as essentially complete for the BOF and LAB. The estimated date for essential completion of the LAW is mid-2015. All construction work activities have been deferred in the PTF due to questions regarding separation and processing of the waste and the design life of equipment. Construction continues in the HLW, but at a slow pace due to reductions in construction craft staffing. 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.

3.0 SCOPE

The scope of this quarterly assessment of construction quality review included observations of ongoing work activities, review of the BNI corrective action program, examination of implementation of selected requirements in the BNI QA program, and follow-up on issues identified during previous assessments. Design and procurement programs are not included in the scope of these reviews. Ongoing work

activities have been affected by reductions in construction craft staffing and design concerns that may result in redesign of some systems and/or structures.

Work activities observed during Independent Oversight's March 2014 review included two hydrostatic pressure tests, the uniformity test performed on the concrete batch plant after replacement of the drum mixer, electrical cable installation, installed electrical equipment, and preservation and maintenance of installed equipment. Independent Oversight examined nonconformance reports (NCRs) identified by BNI under its corrective action program, as well as ongoing corrective actions to address deficiencies identified in installation of post installed concrete anchors (PICAs). Independent Oversight also reviewed the results of quality control (QC) tests performed on samples of concrete placed in the HLW, the BNI construction organization's self-assessment program, and BNI QA and QC surveillance reports.

Independent Oversight reviewed various construction quality documents and conducted several construction site walkthroughs, concurrent with WCD staff. During the walkthroughs, Independent Oversight observed pressure testing of piping for the cooling system in the LAW Melter 2 lid and performance of a concrete uniformity test on the concrete batch plant, and examined electrical equipment, cable tray and cable installation, and preservation of electrical equipment. Independent Oversight also examined drawings, specifications, and procedures that control installation of PICAs, pressure testing of piping and instrument tubing, manufacture of concrete, and installation of electrical cables and electrical equipment.

4.0 METHODOLOGY

This independent review of the WTP construction quality processes was conducted in accordance with the Plan for the Independent Oversight Review of the Hanford Site Waste Treatment and Immobilization Plant Construction Quality, dated March 2014. The review included examination of documents (e.g., work instructions, procedures, specifications, drawings, and records); interviews of key personnel responsible for performing construction and inspection work activities; and site walkdowns to observe work activities and inspect WTP components. The review considered the requirements of 10 CFR 830, Subpart A, *Quality Assurance Requirement*, and DOE Order 414.1C, *Quality Assurance*. Title 10 CFR 830 and DOE Order 414.1C require the contractor to utilize appropriate national consensus standards to implement DOE QA requirements. The PDSA references ASME NQA-1-2000, *Quality Assurance Requirements for Nuclear Facility Applications*, as the national consensus standard that BNI will follow as the basis for the WTP QA program. The QA requirements in ASME NQA-1 are specified in 18 basic and supplemental criteria. BNI Document number 245909-WTP-QAM-QA-06-001, *Quality Assurance Manual*, describes in detail the application of the 18 NQA-1 requirements to the WTP. The Quality Assurance Manual (QAM) establishes the planned and systemic actions necessary to provide adequate confidence that a structure, system, or component (SSC) will perform satisfactorily in service. The WTP QAM incorporates the basic and amplified requirements of the supplemental criteria from NQA-1.

This Independent Oversight review focused on electrical cable installation, installed electrical equipment, and certain portions of the following criteria, review and approach documents (CRADs):

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

Supplemental information on the review, including the members of the Independent Oversight team, the Quality Review Board, and HSS management, is provided in Appendix A. Listings of key documents reviewed, interviews conducted, and evolutions observed are provided in Appendix B.

5.0 RESULTS

The Results section includes a brief description of activities examined by Independent Oversight during the assessment, followed by a discussion of the review performed by Independent Oversight. Conclusions are summarized in Section 6; opportunities for improvement (OFIs) are included in Section 7; and items for follow-up are discussed in Section 8.

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)

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 related (Q) and commercial grade (CM) SSCs. NCRs are issued to document and disposition Q nonconforming conditions, while construction deficiency reports (CDRs) are used to document and disposition CM nonconforming conditions. SSCs 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 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 are purchased as CM items from vendors who are qualified CM suppliers.

Independent Oversight reviewed the 75 NCRs issued by BNI between November 18, 2013, and March 3, 2014, and a random sample of 20 CDRs issued by BNI in 2014, to evaluate the types of nonconforming issues that were identified, their apparent causes, and subsequent corrective actions. Approximately 14 percent of the NCRs were initiated to document construction or installation errors, damage to installed components resulting from construction activities, or subcontractor deficiencies. NCRs issued to document and disposition equipment and hardware problems resulting from procurement issues accounted for 58 percent of the NCRs. 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. Maintenance and material handling issues, such as outdated materials or inadequate preventive maintenance on installed or stored equipment, accounted for another 6 percent of the NCRs. Design/engineering issues, such as drawing or design errors or failure to perform independent quality verification on equipment delivered to the WTP project, accounted for the remaining 22 percent of the NCRs. The CDRs that Independent Oversight reviewed were issued to document and disposition construction errors, design engineering issues, and procurement discrepancies.

The BNI engineering organizations have developed appropriate corrective actions to disposition the specific problems identified in the completed NCRs/CDRs that Independent Oversight reviewed. The NCR/CDR process and implementation appear adequate to address and resolve specific construction quality deficiencies.

Deficiencies in Installation of PICAs

Criteria: *A process shall be established to identify, control, document, evaluate, and correct conditions adverse to quality. Management shall determine the extent of the adverse condition and complete corrective action, including assigning responsibilities and establishing milestones to ensure timely completion of corrective actions. 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)*

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, DOE 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*, to follow up on concerns identified by WCD. 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, BNI Field Engineering determined that actual physical inspections of PICA installations were needed 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.

Independent Oversight reviewed the status of the CM PICA re-inspection program and found that, as of January 31, 2014, BNI Field Engineering had identified 1995 records documenting installation of CM PICAs in the LAW (1212), the LAB (305), and BOF (478). An additional 177 records document CM PICAs installed in the HLW that will be inspected at a later date. The number of PICAs represented by each record varies, typically between 4 and 10. Re-inspections of the PICA installations documented on 1910 records were completed as of January 31, 2014. These re-inspections included 1142 records in the LAW, 303 records in the LAB, and 465 records in the BOF. Installation errors were identified with one or more PICAs documented on 751 of these records. BNI initiated 749 CDRs (one for each record that contained an installation error) related to PICA deficiencies since September 2011 to disposition the discrepancies (two additional CDRs were in preparation). BNI Design Engineering has completed evaluation of more than half of the CDRs. In most cases, BNI Design Engineering determined that 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 involved inadequate installation instructions in the BNI PICA Construction procedure and specification, and inadequate oversight of PICA installations by BNI Field Engineering. PICAs used in Q applications were not included in the re-inspection program because the location and anchor type (diameter and length) are shown on the design drawings, so the spacing between Q PICAs is controlled, and QC inspectors perform independent inspections of 100 percent of the Q PICAs to verify the location, correct anchor type, and appropriate installation method. QC inspectors do not inspect 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*, contain the requirements for installation, inspection, and testing of PICAs. BNI Specification No. 24590-WTP-3PS-FA02-T0004 was

revised on October 7, 2013, and BNI Construction Procedure 24590-WTP-GPP-CON-3205 was revised on October 8, 2013; both revisions addressed actions required by PIER Numbers 24590-WTP-PIER-MGT-11-0918-C and 24590-WTP-PIER-MGT-12-1246-B to clarify PICA installation and inspection requirements. In Section 3.16 and Appendix C of Revision 6 of the specification, the minimum spacing requirements between adjacent CM PICAs, between CM PICAs and Q PICAs, and between CM PICAs and embed plates are more conservative than those cited in previous revisions of the specification, and these requirements are retroactive (see Revision History for Revision 6, page ii of Specification No. 24590-WTP-3PS-FA02-T0004). In discussions with Independent Oversight regarding the impact of the retroactive changes to the spacing requirements, the Lead Civil Field Engineer indicated that since Revision 6 of the specification increases the minimum spacing between adjacent PICAs, another re-inspection program may be required for the PICAs installed to date. BNI Design Engineering is reviewing the need for such a re-inspection program.

Section 2.0 of the Construction procedure, titled Scope, states that the procedure for PICA installation applies only to WTP direct-hire employees. Discussions with BNI field engineers and contract technical representatives disclosed that subcontractors use their own construction procedures for installing PICAs. Currently, subcontractors are limited to installation of CM PICAs only. Any Q anchors required to support equipment and hardware in the subcontractors' scope of work are installed and inspected by BNI. The subcontractor PICA installation procedures are required to be approved by BNI Design Engineering.

Independent Oversight reviewed the current revisions of the PICA installation procedures for two subcontractors installing PICAs at WTP, including Intermech Procedure W/IP WTP 9.70, Rev. 0, *Post Installed Expansion Anchor Installation Procedure*, dated November 11, 2011, and Patriot Fire Protection, Inc. Work Procedure P046, Rev. 5, *Post Installed Concrete Anchors*, dated May 22, 2013. Only one other subcontractor at WTP installs CM PICAs, and the PICAs installed by this subcontractor cover only architectural commodities such as sheetrock walls and miscellaneous small electrical components.

Independent Oversight noted that the Intermech and Patriot Fire Protection, Inc. PICA installation procedures have not been revised to incorporate the changes to the minimum spacing requirements between adjacent CM PICAs, between CM PICAs and Q PICAs, and between CM PICAs and embed plates required by Revision 6 to BNI Specification No. 24590-WTP-3PS-FA02-T0004. (**See OFI-WTP-1.)**

BNI construction management previously issued two management suspensions of work (MSOWs) that restricted installation of CM PICAs until the construction procedure and engineering specification were revised and BNI field engineers and craft personnel completed training on the revised PICA installation and inspection instructions. The MSOWs were closed in January 2014, and BNI is performing a causal analysis to determine the factors underlying the deficiencies in the installation of PICAs. Independent Oversight determined that BNI's approach to determining the extent of condition was adequate; however, corrective actions have not been timely to resolve the PICA installation errors. The revision of BNI Specification No. 24590-WTP-3PS-FA02-T0004 to incorporate changes necessary to clarify PICA installation criteria and to address issues such as PICA spacing requirements that resulted in the previously identified PICA installation errors was not issued for more than two years after the problems were identified. More than 30 months have elapsed since the problems were identified, and some corrective actions had yet to be completed as of March 6, 2014, such as updating the subcontractor PICA installation procedures to comply with Revision 6 of BNI Specification No. 24590-WTP-3PS-FA02-T0004, completing the PICA re-inspection programs, and determining whether additional re-inspections of previously accepted PICA installations are required.

Pressure Testing of Piping

Criteria: *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)*

Independent Oversight observed two hydrostatic pressure tests on piping for the LAW Melter 2 lid cooling system. Melter 2 produces low activity glass from the LAW melters, and the cooling system provides cooling water to the Melter 2 lid. The WTP site work process for conducting leak testing is specified in Construction Procedure 24590-WTP-GPP-CON-3504, *Pressure Testing of Piping, Tubing and Components*. The requirements for pneumatic pressure testing are specified in ASME Code B31.3, Paragraph 345.4, Hydrostatic 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 piping within the test boundary. Pre-job briefings were well conducted and addressed safety guidelines, the emergency plan, 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 requirements for the hydrostatic pressure tests of the LAW Melter 2 lid cooling system observed by Independent Oversight were specified in System Pressure Test Package Numbers 24590-LAW-PPTR-CON-13-0341 and -0342, LAW Melter Process System. This test package included the test data sheets, test information, test requirements, valve lineup sheets, and marked-up piping and instrumentation diagrams (P&IDs) for the pressure test performed on instrument lines (tubing). The pressure test and inspection boundaries were shown on the marked-up P&IDs, and the attached valve lineup sheets listed the test valve position and referenced test plug or blind flange locations. The piping within the pressure test boundaries is classified as CM. Before the pressure tests, Independent Oversight walked down the piping systems and examined the valve lineup and pressure test tags attached to the valves. The tags are placed on components to caution that a pressure test is in progress, to indicate the test position of the component (open, closed, or N/A), and to state that operation of the component is restricted to authorized test personnel. No discrepancies were identified.

The minimum test pressures were 75 pounds per square inch (psi) for one system and 76.7 psi for the other. The reason for the differences in test pressures was the adjustment for four feet of elevation difference between the test gauges for the portion of the system tested under package 24590-LAW-PPTR-CON-13-0341. The construction procedure specifies a minimum hold time of 10 minutes for the test pressure. 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 80 psi and held for 11 minutes, slightly in excess of the pressure test requirements. Walkdowns and inspections of the piping, valves, and other components were performed by BNI Field Engineering personnel. Independent Oversight witnessed the walkdowns and inspections. No leaks were identified, and the pressure tests were declared successful. The pressure testing program was found to be satisfactory for the sample reviewed.

WCD Welding Inspection Program

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)

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

Independent Oversight observed visual inspections of two in-process elbow to elbow piping welds in the LAW. Acceptance criteria for visual examination of structural welds are specified in the ASME Code. These welds were randomly selected by a WCD site inspector during a walkdown in the LAW. The WCD site inspector also reviewed the field welding checklists, weld wire draw slips, and drawings associated with the welds. The WCD welding inspection program was found to be satisfactory for the sample reviewed by Independent Oversight.

Concrete Batch Plant Uniformity Testing

Criteria: Tests required to demonstrate satisfactory performance of an item for service, for example the concrete batch plant, shall be planned and executed. Characteristics to be tested and test methods to be employed shall be specified. Test results shall be demonstrated and their conformance with test requirements and acceptance criteria shall be evaluated. (NQA-1, Requirement 11; Policy Q-11.1 of the WTP QAM; and DOE Order 414.1C)

A new mixing drum was installed during maintenance on the central concrete mix plant in February and March 2014. BNI Specification 24590-WTP-3PS-DB01-T0001, *Engineering Specification for Furnishing and Delivering Ready-Mix Concrete*, requires performance of a concrete uniformity test in accordance with ASTM International (ASTM) C94 prior to production of concrete to demonstrate that the concrete plant produced uniform concrete. Since the mixer drum was replaced, a new uniformity test was required. The requirements for this test, designated as a concrete uniformity test, are specified in Annex A of ASTM C94, *Standard Specification for Ready-Mixed Concrete*. There are six different parameters required to be tested to demonstrate that the concrete mixer is producing uniform concrete, including unit weight, slump, air content, coarse aggregate content, unit weight of air-free mortar, and average compressive strength at seven days. The uniformity test is performed by mixing a batch of concrete and obtaining samples from two different locations in the drum, one near the front and the other near the back. The sampling method used was Alternate Procedure 2 specified in Section 11.3.3 of ASTM C94, which requires that samples be obtained after discharge of approximately 15 percent and 85 percent of the concrete drum. The six tests listed above are performed on each sample, and the differences between the test results are compared. The maximum permissible differences in the test results between the two samples are listed in Table A1.1 in ASTM C94. The test results are required to conform to the limits specified in Table A1.1 for five of the six tests.

Independent Oversight observed the uniformity test performed on the concrete central mix plant on March 6, 2014. The testing was performed by QC personnel from the subcontractor, Central Mix, and witnessed by a BNI QC inspector. Independent Oversight observed sampling of the concrete and performance of the slump, air content, and unit weight testing on the concrete samples. The results of these three tests were within the limits specified in Table A1.1. Independent Oversight also observed molding of the two

sets of three cylinders for the compressive strength tests. The cylinders were cured at the batch plant for 24 hours and then transported to an offsite laboratory for testing. Samples for determining the coarse aggregate content and mass per unit weight per volume of air-free mortar were also sent to an offsite laboratory for these tests.

The BNI QC inspector documented his inspection on WTP QA/QC Surveillance Report number 24590-WTP-SV-QC-14-034. The data sheet from Central Mix showing the results of the uniformity testing is attached to the surveillance report. One minor discrepancy noted by Independent Oversight was that the data recorded in the results summary on page 1 of the QA/QC surveillance report for the unit weight of air-free mortar was incorrect. The correct values are shown on the Central Mix data sheet. The concrete batch plant uniformity test was performed in accordance with the requirements specified in ASTM C94. All six tests were within the limits specified in Table A1.1. The results were satisfactory and demonstrated that the concrete batch plant continues to produce uniform concrete.

Concrete Placement Records

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).

Independent Oversight reviewed the results of QC tests performed on concrete samples from the two Q concrete pours that were placed in the HLW facility in January 2014. These tests included slump, temperature, and unit weight testing performed on the freshly mixed concrete and unconfined compression tests performed on concrete cylinders cured in the concrete laboratory for 7 to 28 days. The concrete design strength is based on the unconfined compression strength of concrete cylinders, which are either 4 inches in diameter and 8 inches high or 6 inches in diameter and 12 inches high. The concrete strength is determined by casting samples of concrete in cylindrical molds, moist curing them in a field laboratory for a specified period, and then subjecting them to an unconfined compression test. The results of the unconfined compression tests are used to verify the concrete quality and demonstrate that the concrete meets the design strength requirements. The methods for sampling the concrete, casting and curing the cylinders, and performing the unconfined compression tests are specified in ASTM standards. Typically, the design strength at WTP is based on concrete test cylinders cured in the laboratory for 28 days, and the unconfined compression strength of the concrete at 28 days generally exceeds the specified design strength by 1000 psi or more for all classes of structural concrete. The unconfined compression tests performed on concrete cylinders from the two concrete wall placements reviewed showed that the concrete strength at an age of 28 days in these placements ranged between 5900 and 6800 psi. The average strength for the test cylinders was 6350 psi. The required (design) strength for the concrete is 5000 psi. Therefore, the quality of concrete at the WTP plant is satisfactory.

Independent Oversight also reviewed the results of unconfined compression tests performed on three samples of grout placed in January 2014. The grout is either a combination of sand, cement, and water mixed in the concrete batch plant, or from a pre-packaged proprietary grout mix. The grout mixture is a highly viscous fluid that is poured in place. The purpose of the grout is to provide a uniform bearing surface under equipment bases, pipe supports, or other structural supports. The design strength of the grout is typically 5000 psi, as determined in unconfined compression tests performed on samples of the grout molded in uniform two-inch cubes. The results of tests performed on samples of the grout placed in

January 2014 showed that the grout obtained unconfined compression strength in the range of 9000 to 10,000 psi at an age of seven days, well in excess of design requirements.

Installation of Electrical Equipment

Criteria: *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)*

Independent Oversight toured several of the WTP buildings, including the LAB, LAW, and several BOF buildings, inspecting newly installed electrical switchgear, panels, cables, and instrumentation to verify that as-built configurations were consistent with the design documents (i.e., specifications and drawings). Independent Oversight's observations are discussed in more detail below.

Pre-Job Briefings and Electrical Safety Training

Independent Oversight attended a pre-job briefing for changing out a temporary power supply in the HLW and safety training presented by the BNI medium voltage electrical (MVE) lead engineer for temporary power. The BNI responsible superintendent (RS) led the discussion during the pre-job briefing with the electricians and supervisors who were to be involved in changing out a temporary power feed to a permanent feed the following day. Lockout/tagout procedures were covered, and all attendees indicated understanding of the procedures. The RS also covered proper personal protective equipment and other safety precautions. This pre-job brief also included a walkdown to inspect all of the affected components and to allow the craft to ask questions. The brief was efficient and thorough. The MVE safety training was a regular monthly meeting to maintain the electricians' qualifications to work on electrical systems greater than 1000 volts. The meeting covered the dangers of arc-flash and the importance of communications and complete procedural compliance. An industry accident was discussed where a worker was severely injured by shortcutting safety requirements. Each person was reminded of the inherent dangers of electrical work.

Control Panel Labeling Consistency – Water Treatment Building

Specification 24590-WTP-3PS-JQ07-T0001, *Engineering Specification for Instrumentation for Packaged Systems*, details the requirements for instrumentation for packaged systems. This specification is applicable to the process service water system (PSW) chlorination panel and the adjacent domestic (potable) water system (DOW) chlorination panel in the Water Treatment Building (WTP Building 86) because these panels were purchased as skid-mounted equipment. The specification designates the color of the indicator lights related to operating status of the equipment. The indicator lights on the adjacent panels are not consistent with the above specification, nor are they consistent with each other. The table below compares the existing conditions with the specification and design drawings.

Color of Indicator Light	Existing PSW Chlorination Panel	Existing DOW Chlorination Panel	Specification 24590-WTP-3PS-JQ07-T0001, Rev. 3	PSW Schematic Drawing 2D718-0408-D, Rev 12	DOW Schematic Drawing D719-0408-D, Rev 12
Red	Run	Trip	Stop	Run	Run

Green	Stop	Stop	Run	Stop	Stop
Yellow or Amber	Trip	Run	Transition, Indeterminate	Trip	Trip

The pictures (below) of the two panels show that the positions of the yellow and red indicator lights are reversed between the two panels.

Although there is considerable discussion and differences of opinion throughout the industry regarding the coloring of lights and their associated meanings, the BNI specification requirements for labeling indicator lights is the controlling document that specifies colors of indicator lights on control panels at WTP. The SETROUTE card for this cabinet has been signed off as being complete and labeling verified. CDR number 24590-WTP-CDR-CON-14-0123 was initiated to document and disposition this issue. WCD will follow up on this issue.

Control Panel Labeling Consistency – LAW

Independent Oversight, in conjunction with WCD, also identified several labeling inconsistencies regarding the color of the indicator lights related to operating status of the equipment on the 10 Ton Electric Wire Rope Hoist cabinet, panel LPH-PNL-00028, located on the Elevation -21' level in the LAW. Specification 24590-WTP-3PS-JQ07-T0001 is also applicable to this panel. The panel contains 25 lights and switches, some of which were labeled, colored, and/or located incorrectly:

- Main Contactor Energized - Label should be "Contactor" not "Contractor".
- Hoist Stopped - Design Drawing D-20596-860 indicates blue light; as built is red light.
- Hoist Overweight - Design Drawing D-20596-860 indicates red light; as built is blue light.
- Cable Cutter Power Switch - location is wrong, switched with Slack Cable Tripped light.
- Slack Cable Tripped - location is wrong, switched with Cable Cutter Power switch.
- RSD Limit Switch - Location is different than shown on panel layout drawing.

The SETROUTE card for this cabinet has been signed off as being complete and labeling verified. CDR number 24590-WTP-CDR-CON-14-0218 was initiated to document and disposition this issue. WCD will follow up on this issue.

Another example of labeling inconsistencies regarding the color of the indicator lights related to operating status of the equipment was identified by Independent Oversight on the LAW Container Transport Bogie

South Control Panel (24590-LAW-JC-LPH-PNL-00027), also located on the Elevation -21' level in the LAW. There are three lights on the panel, labeled as follows:

Color	As-Built Label	Specification 24590-WTP-3PS-JQ07-T0001, Rev. 3, Section 3.3.6	Schematic Drawing 0739269211-01001H1, Rev. 3
Red	Fault	Stop	Run
Green	Run	Run	Stop
Yellow or Amber	Stop	Transition, Indeterminate	Fault

The indicator light colors and labeling on the control panel are inconsistent with the specification. The design drawing is inconsistent with the labeling on the control panel and the specification. The SETROUTE card for this cabinet has been signed off as being complete and labeling verified. This issue was also documented on CDR number 24590-WTP-CDR-CON-14-0218. WCD will also follow up on this issue. **(See OFI-WTP-2.)**

Other Electrical Installation Issues

Independent Oversight, in conjunction with WCD, identified the following issues during walkdowns in the Water Treatment Building and LAW:

- In the Water Treatment Building, an electrical pull-box was identified that was unmarked. Paragraph 5.1.4 of Specification 24590-WTP-3PS-E00X-T0005, *Engineering Specification for Electrical Raceway and Cable Identification*, requires that pull-boxes be identified. Review of the SETROUTE database showed this unlabeled junction box was a 12"x12"x6" pull-box that should have been labeled 86PBFX1009. SETROUTE Record number 24590-BOF-SRC-E-08-0035, Rev. 1, was signed on January 19, 2010, indicating that this pull-box was properly labeled and identified as required by Specification 24590-WTP-3PS-E00X-T0005. WCD will follow up on this issue.
- Installation of cable trays and cables is ongoing in the LAW. On the Elevation -21' level, electricians were installing cables into existing trays. Independent Oversight identified one cable tray in the overhead, just north of column 4/E, that had several tightly bundled cables that were transitioning from one cable tray to another. These cables are required to be separated or their ampacity properly de-rated, and to be documented to comply with National Fire Protection Association (NFPA)-70-1999 (National Electrical Code, or NEC) Section 310. The WCD site electrical inspector will follow up on this concern and will discuss it with the BNI field engineer.
- When cables transition from one cable tray to another, NFPA-70-1999 (NEC) Section 318-6 requires bonding the cable trays together with a grounding conductor. While bonding of cable trays is being done properly most of the time, several examples were identified by Independent Oversight where the ground connections were not completed. Discussions with BNI field engineers disclosed that the intent is to examine all cable trays to ensure that they are bonded after cable pulling is completed. Currently, cable trays are not always bonded at the time when the cables are being pulled, increasing the likelihood that bonding jumpers will be missed, considering the large number of cables and trays. **(See OFI-WTP-3.)**

Overall, installation of electrical equipment was satisfactory. However, errors were identified on SETROUTE records, and configuration of some installed control panels did not comply with design specification and drawing requirements.

Maintenance, Preservation, and Protection of Stored and Installed Equipment

Criteria: 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)

Independent Oversight examined the preservation of electrical and mechanical equipment in the LAW. BNI procedures 24590-WTP-GPP-MGT-031, *Asset Preservation and Maintenance Process*, and 24590-WTP-GPP-CMNT-004, *Periodic Maintenance and Surveillance Process*, establish a preventive maintenance program to prevent damage and degradation to equipment during storage or after installation prior to commissioning.

Independent Oversight toured various areas of the LAW to observe ongoing construction activities and measures used for the protection of stored or installed electrical and mechanical equipment. Openings in pipes, pumps, tanks/vessels, and instrument lines were closed with caps or tape to maintain cleanliness and prevent internal contamination. Most of the mechanical equipment, such as pumps, was protected from construction activities with wooden boxes. Drive shafts on pumps that couple the pumps to the drive motors were covered with metal shields. However, several examples were identified in the LAW where electric motors were exposed to dust and debris caused by construction activities, such as dust resulting from drilling in concrete, metal grinding, and exposure to moisture, paint, or chemicals. Several electric motors were observed to be covered with dust, and grindings of welds were observed in close proximity to two motors. Although the motors are the totally enclosed fan cooled type, it would be a good practice during construction to cover the motors with tarps or plastic sheets. **(See OFI-WTP-4.)**

Instrumentation and spur blocks are currently being installed in the LAW. Independent Oversight identified several instrument panels in the LAW with installed instruments and spur blocks that were not protected from construction activities, although no work was currently in progress on these panels. The **s**pur blocks are used to provide an interface between field instrumentation (typically transmitters) and the main control network. These spur blocks have 4, 6, or 8 input sockets and a single output socket to the control network. These input and output sockets require a plug to be installed on the connecting cables. Paragraph 3.4.3 of BNI Specification 24590-WTP-3PS-JQ08-T0001, *Engineering Specification for Construction and Installation of Controls and Instrumentation*, states that when an input socket is not used, a cap is required to be installed on the socket to prevent dust and debris from getting into the connection ports. Independent Oversight identified several examples in the LAW where, although there may be a significant time lapse between spur block installation and connection of wiring to the spur blocks, spur blocks have been installed, but open sockets were not covered with caps. Several instrument panels with installed instruments and spur blocks were observed that were not protected by any type of covers. Discussions with the BNI lead electrical field engineer (LEFE) for LAW about this issue revealed that he is aware of the problem. Caps have been ordered, but the BNI LEFE was unsure of the expected delivery time and no interim measures are in place (e.g., covering the exposed sockets, even with electrical tape, to protect the instruments from possible debris contamination). In the Water Treatment Building, spur block PSW-SPBLK-5032 was noted to be missing a dust cap, although the rest of the installation appeared complete. **(See OFI-WTP-4.)**

Self-Assessment Program

Criteria: *Line and support organizations shall perform self-assessments of their performance and the adequacy of their processes. Self-assessments shall be used to evaluate performance at all levels periodically and to determine the effectiveness of policies, requirements, and standards and implementation status. Self-assessment results must be documented in sufficient detail to identify the activity covered, identify the individuals performing the surveillance, and document results and any necessary corrective actions. (Policy Q-02.2 of the WTP QAM; DOE Order 226.1A; DOE Order 226.1B; and DOE Order 414.1C) Note: DOE Order 226.1A was superseded by DOE Order 2261B by Contract Modification 310, dated January 28, 2014.*

In the construction quality quarterly report issued on May 22, 2013, Independent Oversight identified an OFI specifying that the self-assessment process within the BNI Construction Field Engineering organization could rely more on performance-based assessments and/or complete a higher percentage of performance-based self-assessments. When the OFI was identified, BNI Procedure 24590-WTP-GPP-MGT-036, *WTP Self-assessment*, Rev. 2A, was the current implementing procedure for WTP personnel to use to perform the self-assessments necessary to comply with the BNI QA program and DOE QA requirements. This procedure described a process for managers and employees to perform either compliance-based or performance-based self-assessments. Self-assessments are self-critical evaluations of work processes and activities to ensure that work is performed as expected, to monitor work results to ensure that completed work meets project requirements, and to evaluate performance at all levels to identify problems with work processes and completed work activities. A compliance-based assessment was 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 included a review of documentation to measure whether those performing the task are following the prescribed method or rule, with only minimal observations of work. A performance-based assessment was 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 Overview section in Revision 2A of Construction Procedure 24590-WTP-GPP-MGT-036 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.

BNI initiated PIER 24590-WTP-PIER-MGT-13-0743-D to address this OFI in June 2013. Independent Oversight reviewed the PIER, which was closed on July 31, 2013. The closure statement for the PIER states that discussion of the OFI with the WTP BNI field engineering manager determined that reviews of work in progress are part of the normal work process for BNI Field Engineering, and although they are not formally documented as assessments, these work process assessments accomplish the same purpose. However, Paragraph 2.2.2.2.3 of BNI QAM Policy Q-02.2 states that self-assessment results are to be documented commensurate with the significance of risks associated with the activities being evaluated.

Between January 1 and August 1, 2013, the BNI Field Engineering organization performed 21 compliance-based self-assessments that were limited to reviewing completed construction records to determine whether the records were complete and accurate. No additional self-assessments were completed by BNI Field Engineering between August 1 and November 15, 2013, the date of the most recent Independent Oversight Construction Quality Review. Between November 15, 2013, and March 6, 2014, no self-assessments were completed by BNI Field Engineering. Only two self-assessments were

completed by the BNI Construction organization since November 15, 2013; one addressed control of construction site badges, while the other addressed administrative control of contractors. BNI Field Engineering did not complete any performance-based self-assessments in 2013 to observe ongoing work activities and to evaluate performance in construction activities, such as piping and pipe support installation, instrument tubing and support installation, and electrical cable and component installation.

Subsequent to November 15, 2013, BNI Procedure 24590-WTP-GPP-MGT-036 was re-issued as Revision 3 to add instructions for conducting line surveillances and re-titled *WTP Self-Assessment and Line Surveillance*. The definition of a line surveillance is a methodology for observing and evaluating ongoing or routine activities, behaviors, processes, etc., for the purpose of verifying, monitoring, or validating (e.g., periodic inspection of fire extinguisher placement, or routine check of inspection records for accuracy). The instructions for conducting self-assessments were not changed.

The BNI Construction Field Engineering organization has not fully implemented a self-assessment program that includes both performance- and compliance-based assessments to evaluate work processes and work in progress as required by DOE Order 226.1B and Criterion 9 of DOE Order 414.1C. BNI provided Independent Oversight with its self-assessment schedule for 2014. The schedule indicates that eight performance-based self-assessments are planned for 2014; covering several work activities including cable installation and terminations, structural steel erection, pressure testing, alignment of pumps, and nondestructive examination of welding.

Quality Assurance Surveillance Activities

Criteria: *Quality Assurance surveillances shall be performed by knowledgeable personnel and shall be scheduled in a manner to provide coverage, consistency and co-ordination of ongoing work. Surveillance results shall be documented in sufficient detail to identify the activity covered, identify the individuals performing the surveillance, and document results and any necessary corrective actions. (NQA-1 Criterion 18; Policy Q-02.3 of the WTP QAM; and DOE Order 414.1C)*

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. The QA surveillances supplement QA audits that are conducted by the offsite QA staff. Independent Oversight reviewed 15 QA surveillances completed in January and February 2014. These audits covered observations of a cross section of ongoing work activities in progress at the WTP site. A few minor deficiencies were identified which were documented in the BNI corrective action program.

QA surveillances are performed to observe the full range of ongoing work activities. The BNI QA surveillance program was found to be satisfactory for the sample reviewed by Independent Oversight.

6.0 CONCLUSIONS

Independent Oversight determined that construction quality at WTP is adequate in the areas that were reviewed (design and procurement programs were not included in the scope of this quarterly construction quality review). BNI Engineering has developed appropriate corrective actions to resolve specific deficiencies for construction quality NCRs and CDRs reviewed by Independent Oversight, and BNI continues to implement corrective actions necessary to address errors in installation of PICAs. BNI's approach to determining the extent of condition was adequate. However, corrective actions have not been timely to resolve the PICA installation errors; more than 30 months have elapsed since the problems were

identified, and corrective actions had yet to be completed as of March 6, 2014. Overall, installation of electrical equipment was satisfactory. However, errors were identified on SETROUTE records, and configuration of some installed control panels did not comply with design specification and drawing requirements.

The self-assessment program in the BNI Construction Field Engineering organization still consists of mostly compliance-based assessments, and does not regularly include performance-based assessments. Almost all self-assessments conducted by this organization since 2011 have focused on determining the completeness and accuracy of completed construction records. BNI Field Engineering conducted no performance-based self-assessments of work in progress during 2013, and only three performance-based self-assessments in 2011 and 2012. The self-assessment program implemented in the BNI Field Engineering organization still needs improvement, as identified in the May 2013 Independent Oversight review of WTP construction quality.

7.0 OPPORTUNITIES FOR IMPROVEMENT

This Independent Oversight review identified three OFIs. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are suggestions offered by the Independent Oversight review team that may assist site management in implementing best practices, or provide potential solutions to minor issues identified during the conduct of the review. In some cases, OFIs address areas where program or process improvements can be achieved through minimal effort. It is anticipated that these OFIs will be evaluated by the responsible line management organizations and either accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

OFI-WTP-1: WTP should assure that subcontractors working on site maintain their procedures current with WTP specifications and other work control documents.

OFI-WTP-2: WTP should consider revising the SETROUTE to include verification that the labeling of controls and indicators on control panels comply with the design documents. Crane hoist panels and similar bogie control panels should be checked for consistency with design documents. There needs to be more diligence to ensure that equipment delivered to the WTP site and installed complies with BNI specifications. The SETROUTE Equipment Installation Card has a sign-off block to "Verify nameplate data against drawings and specifications. Verify the nameplate is permanently attached to the equipment." This statement should be expanded to include the labeling of controls and indicators, or another sign-off block is needed to address these items. It appears that this is a recurring issue of not verifying that the supplied equipment does in fact meet the design documents. The lack of consistency between the as-built panels, design drawings, and design specifications could also affect WTP equipment operating procedures.

OFI-WTP-3: WTP should consider adding a sign-off on the SETROUTE card to ensure that the trays are bonded when cables jump from one tray to another.

OFI-WTP-4: WTP should consider strengthening the program for protecting equipment installed at the WTP site.

8.0 ITEMS FOR FOLLOW-UP

Independent Oversight will continue to follow up on inspection of welding activities, piping and pipe supports, pressure testing of piping, cable pulling, cable terminations, and installation of electrical

equipment. 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 BNI Field Engineering. In addition, Independent Oversight will perform further evaluation of preservation and maintenance of installed equipment.

Appendix A
Supplemental Information

Review Dates

March 3-6, 2014

Office of Health, Safety and Security Management

Glenn S. Podonsky, Director, Office of Independent Enterprise Assessments
William A. Eckroade, Deputy Director, Office of Independent Enterprise Assessments
Thomas R. Staker, Director, Office of Environment, Safety and Health Assessments
William E. Miller, Director, Office of Nuclear Safety and Environmental Assessments

Quality Review Board

William A. Eckroade
Thomas R. Staker
William E. Miller
Michael A. Kilpatrick

Independent Oversight Site Lead for Hanford Site

Robert Farrell

Independent Oversight Team Composition

Joseph Lenahan
James Boyd

Appendix B
Documents Reviewed

- Construction Procedure 24590-WTP-GPP-CON-3504, Rev. 9C, Pressure Testing of Piping, Tubing and Components, February 27, 2014
- Construction Procedure 24590-WTP-GPP-CON-3205, Rev. 4A, Post Installed Concrete Anchors, January 6, 2014
- Specification 24590-WTP-3PS-DB01-T0001, Rev. 8, Engineering Specification for Furnishing and Delivering Ready-Mix Concrete, March 26, 2007
- Specification No. 24590-WTP-3PS-FA02-T0004, Rev. 6, Engineering Specification for Installation and Testing of Post Installed Concrete Anchors and Drilling/Coring of Concrete, October 7, 2013
- Construction Procedure 24590-WTP-GPP-MGT-043, Rev. 5B, Corrective Action Management, February 12, 2014
- Construction Procedure 24590-WTP-GPP-MGT-044, Rev. 2, Nonconformance Reporting and Control, December 4, 2013
- Construction Procedure 24590-WTP-GPP-MGT-036, Rev. 3A, WTP Self Assessment and Line Surveillance, February 26, 2014
- Construction Procedure 24590-WTP-GPP-QA-601, Rev. 6C, Quality Assurance Surveillance, May 1, 2013
- Construction Procedure 24590-WTP-GPP-MGT-031, Rev. 3, Asset Preservation Management Process, April 30, 2012
- Construction Procedure 24590-WTP-GPP-GCB-00100, Rev. 19B, Field Material Management, June 30, 2013
- Construction Procedure 24590-WTP-GPP-CMNT-004, Rev. 7A, Periodic Maintenance and Surveillance Process, September 9, 2013
- Document No. 24590-WTP-QAM-QA-06-001, Rev. 13, Quality Assurance Manual, September 20, 2013
- Intermech Procedure W/IP WTP 9.70, Rev. 0, Post Installed Expansion Anchor Installation Procedure, November 11, 2011
- Patriot Fire Protection, Inc. Work Procedure P046, Rev. 5, Post Installed Concrete Anchors, May 22, 2013
- Nonconformance Report numbers 24590-WTP-NCR-CON-13-0184 through -0217 and 24590-WTP-NCR-CON-14-001 through -041
- QA/QC Surveillance Report Number 24590-WTP-SV -QC-14-034, Uniformity Testing of CPM Concrete after Replacing the Mixer Drum for Plant #1, March 11, 2014
- QA/QC Surveillance Report Number 24590-WTP-SV -QA-14-017, Hydrostatic Pressure Test of BOF Dimineralized Water System (DIW) Piping, February 19, 2014
- System Pressure Test Document Numbers 24590-LAW-PPTR-CON-13-0341 and -0342, LAW Melter 2 Cover Lid Cooling System
- Drawing Number 24590-LAW-M6-LMP-00043002, Rev. 0, LAW Melter Process System Melter 2 Melter Lid Cooling Loop
- Specification No. 24590-WTP-3PS-E00X-T0003 Rev. 7, Engineering Specification for Cable Terminations, October 27, 2011
- Specification No. 24590-WTP-3PS-E00X-T0004 Rev. 8, Engineering Specification for Installation of Cables, September 17, 2013
- Specification No. 24590-WTP-3PS-E00X-T0005 Rev. 5, Engineering Specification for Electrical Raceway and Cable Identification, October 27, 2011

- Specification No. 24590-WTP-3PS-EW00-T0001 Rev. 3, Engineering Specification for Power, Control, and Instrumentation Cable, Medium Voltage Power Cable and Fiber Optic Cable (Safety), July 1, 2011
- 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-JXF0-T0002 Rev. 1, Engineering Specification for Instrument Piping Material Classes - Q, October 17, 2013
- Specification No. 24590-WTP-3PS-JXF0-T0003 Rev. 0, Engineering Specification for Instrument Tubing Supports - QL, July 29, 2004
- Specification No. 24590-WTP-3PS-JQ08-T0001 Rev. 3, Engineering Specification for Instrumentation for Packaged Systems, December 15, 2010
- Construction Procedure 24950-WTP-GPP-CON-3304 Rev. 2D, Electrical Cable Installation, September 23, 2013
- Construction Procedure 24950-WTP-GPP-CON-3305 Rev. 2D, Electrical Cable Terminations, August 22, 2013
- Construction Procedure 24950-WTP-GPP-CON-3401 Rev. 3D, Controls and Instrumentation Installation, October 31, 2013
- Guide 24590-WTP-GPG-E-001, Rev. 14 SETROUTE Work Process, June 13, 2013
- Drawing Number 2D719-0408-D, Sheet 1, Rev. 12, DOW Chlorination Skid Panel Schematic
- Drawing Number 2D718-0408-D, Sheet 1, Rev. 12, PSW Chlorination Skid Panel Schematic
- Drawing Number 2D701-0408-E, Sheet 5, Rev. 5, Classic I/O Conduit Plan
- Drawing Number D-20596-860, Rev. 2, 10 Ton Monorail Electric Wire Rope Hoist Control Panel Layout
- Drawing Number D-20596-802, Rev. 2, 10 Ton Monorail Electric Wire Rope Hoist Electrical Schematic – Electrical Distribution
- Drawing Number D-20596-803, Rev. 1, 10 Ton Monorail Electric Wire Rope Hoist Electrical Schematic – Electrical Control
- Drawing Number D-20596-804, Rev. 1, 10 Ton Monorail Electric Wire Rope Hoist Electrical Schematic – Interior Lights
- Drawing Number 0739269211-010010H1, Rev. 3, LAW Vitrification System LPH LAW Container Transport Bogie South Control Panel Schematic
- Field Sketch for Arc Flash Analysis Temporary Power Field Sketch Substation 12, Ckt 15, Sheet 1, Rev. 7
- Field Sketch for Arc Flash Analysis Temporary Power Field Sketch Substation 12 SWBD, Sheet 1, Rev. 8
- SETROUTE Cable Installation Card, Record Number 24590-BOF-SCC-E-09-0222, Rev. 0
- SETROUTE Raceway Card, Record Number 24590-BOF-SRC-E-08-0035, Rev. 1

Interviews:
- Field Engineering Manager
- Field Engineers
- QC Manager
- QC Inspectors
- Subcontract Technical Representatives

Observations:
- Hydrostatic pressure tests
- Concrete batch plant mixer uniformity test
- In-process welding inspections

- Preservation of installed equipment
- Installed electrical equipment and control panels