U.S. Department of Energy
Office of River Protection
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

JAN 0 8 2007

06-WTP-205

Mr. C. M. Albert, Project Manager
Bechtel National, Inc.
2435 Stevens Center Place
Richland, Washington 99354

Dear Mr. Albert:

CONTRACT NO. DE-AC27-01RV14136 – TRANSMITTAL OF U.S. DEPARTMENT OF ENERGY (DOE), OFFICE OF RIVER PROTECTION (ORP) ASSESSMENT REPORT D-06-DESIGN-030, "BECHTEL NATIONAL, INC. (BNI) SAFETY REQUIREMENTS DOCUMENT (SRD) DESIGN STANDARDS IMPLEMENTATION"

The purpose of this letter is to transmit to BNI the ORP Assessment Report D-06-DESIGN-030, "BNI SRD Design Standards Implementation." This assessment report documents the review performed by ORP and contractor personnel of BNI's implementation SRD design standards in the design and procurement of important-to-safety mechanical, electrical, and ventilation systems and components.

The assessment team concluded that BNI is adequately implementing SRD design standards, including daughter standards, mechanical, electrical, and ventilation design areas. In addition, there were no identified instances of BNI deviating from SRD implementing codes and standards in a manner inconsistent with the requirements of RL/REG-97-13 and applicable BNI procedures. However, four assessment follow-up items (AFI) were identified which reflect BNI activities that were not sufficiently complete to allow for a complete assessment and the need for BNI engineering specifications to include design criteria for a natural phenomena hazard event involving volcanic ashfall. Future ORP assessments will confirm that actions taken by BNI, including advancement of the project's design, procurement, and installation, are adequate to close these AFI's. No response to this letter is necessary unless BNI takes exception to these AFI's.

This letter is not considered to constitute a change to the Contract. If the event the Contractor disagrees with this interpretation, it must immediately notify the Contracting Officer orally, and in writing within five working days in accordance with the Contract (Section H, Clause H.1 "Technical Direction").

JAN 0 8 2007

Mr. C. M. Albert
06-WTP-205

If you have any questions, please contact me, or your staff may call Bob Griffith, WTP Safety Authorization Basis Acting Team Lead, (509) 372-2821.

Sincerely,

John R. Eschenberg, Project Manager
Waste Treatment and Immobilization Plant Project

WTP:RWG

Attachment

cc w/attach:
B. Linzau, DNFSB
B. Quirk, DNFSB
BNI Correspondence

U.S. Department of Energy, Office of River Protection

BNI SRD Design Standards Implementation

Assessment Report

D-06-DESIGN-030

October 2006

Prepared by:

Robert W. Griffith 12/20/06

Robert W. Griffith, Team Lead

Approved by:

1-8-07

Lewis F. Miller, Jr., Acting Director
WTP Engineering Division

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LIST OF ACRONYMS

ABMA	American Bearing Manufacturers Association
AFI	Assessment Follow-up Items
AISC	American Institute for Steel Construction
AMCA	Air Movement and Control Association International, Inc.
ASME	American Society of Mechanical Engineers
ASNT	American Society for Nondestructive Testing
ASTM	American Society for Testing and Materials
B&PVC	Boiler & Pressure Vessel Code
BNI	Bechtel National, Inc.
BOF	Balance of Facilities
CFR	*Code of Federal Regulations*
DC	Direct Current
DOE	U.S. Department of Energy
EDG	Emergency Diesel Generator
HEPA	High-Efficiency Particulate Air
HLW	High-Level Waste
HVAC	Heating, Ventilation, and Air Conditioning
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IMS	Integrated Safety Management
ISA	Instrument Society of American
LAW	Low-Activity Waste
MAP	Material Acceptance Plan
MR	Material Requisition
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NPH	Natural Phenomena Hazard
NQA	Nuclear Quality Assurance
NRC	U.S. Nuclear Regulatory Commission
ORP	Office of River Protection
PSAR	Preliminary Safety Analysis Report
PT	Pretreatment
QA	Quality Assurance
QL	Quality Level
SC	Safety Class
SCN	Specification Change Notices
SDDR	Supplier Deviation Disposition Requests
SE	Safety Evaluation
SQ	Supplier Qualification
SRD	Safety Requirements Document
SS	Safety Significant
SSC	Structures, Systems and Components
TEMA	Tank Equipment Manufacturers Association
WAC	*Washington Administrative Code*
WED	WTP Engineering Division
WTP	Waste Treatment and Immobilization Plant

1.0 INTRODUCTION

The U.S. Department of Energy (DOE), Office of River Protection (ORP) will design, construct, commission, and operate a Waste Treatment and Immobilization Plant (WTP) to treat and immobilize waste contained in 149 single-shell tanks and 28 double-shell tanks at the Hanford Site. These tanks contain approximately 54 Mgal waste with 190 MCi radioactivity. The WTP will receive waste in batches from the double-shell tanks through transfer pipelines. This waste will be concentrated in an evaporator; strontium and transuranic will be precipitated from select waste streams; solids will be water washed, caustic leached, oxidative leached, and separated from the soluble fraction in an ultrafilter system; and cesium will be removed from the soluble fraction with an ion exchange system. The radionuclide rich solids and cesium ion exchange eluant will be combined and immobilized in High-Level Waste (HLW) glass. The Low-Activity Waste (LAW) supernatant will be further concentrated and immobilized in LAW glass or immobilized in an alternative waste form currently being studied.

As required by the Contract (DE-AC27-01RV14136, Section C.6, Standard 7, item (d)), Bechtel National, Inc. (BNI) will assess and control the hazards associated with the design, construction, operation (normal and abnormal), and deactivation and decommissioning of the WTP using a formal, approved integrated standards-based safety management program. As described in the Safety Requirements Document (SRD), Appendix A, necessary elements of the BNI ISM program are the establishment of the radiological, nuclear, and process safety requirements and standards for WTP design, construction, and operation. Establishment of these safety standards and requirements is an iterative process that takes place throughout the life of the project. The ISM process repeatedly evaluates these standards and requirements based on the evolving facility design.

This assessment report documents the ORP WTP Engineering Division (WED) evaluation of BNI's implementation of SRD design standards implementation in the mechanical, electrical, and ventilation systems and components design functional areas. ORP's Assessment Plan for the BNI SRD Design Standards Implementation assessment is provided in Appendix A.

2.0 BACKGROUND

DOE ORP performs periodic assessments of contractor activities in accordance with the requirements set forth in ORP Manual M 220.1, Revision 4, *Integrated Assessment Program*. In addition to ORP M 220.1, WED performs design oversight of the Contractor in accordance with Desk Instruction DI 220.1, Revision 1, *Conduct of Design Oversight*. In support of the assessment/design oversight program, ORP issues an annual assessment plan for assessments of contractor activities intended to: 1) monitor the contractors' performance to ascertain program status in facilities; 2) effect continuous improvement in contractors' operations; 3) determine the effectiveness of implementation of DOE Orders, state and federal regulations, national codes and standards, and other requirements for ORP as a whole; and 4) evaluate the quality of contractors' self-assessment programs.

ORP's assessment of the Contractor's SRD design standards implementation was performed in accordance with the annual assessment plan and the supporting manual and desk instruction.

3.0 OBJECTIVES, SCOPE AND APPROACH

3.1 OBJECTIVES

The objectives of this assessment were to:

1. Determine if the design of WTP Important-To-Safety (ITS) systems and components incorporate the design requirements of SRD implementing codes and standards, including daughter standards.
2. Confirm that any deviations in the implementation of SRD design codes and standards are processed in accordance with BNI procedures and the requirements of RL/REG-97-13, *Office of River Protection Position on Contractor-Initiated Changes to the Authorization Basis.*

3.2 SCOPE

The assessment of BNI's implementation of SRD design standards was limited to standards used to support the design, construction, installation, and testing of ITS systems and components in the mechanical, electrical, and ventilation design functional areas.

3.3 APPROACH

This assessment was conducted within the guidelines of ORP PD 220.1-12, Revision 1, *Conduct of Design Oversight.* Information was collected from various BNI documents, ORP documents, industry consensus codes and standards, and interviews with BNI personnel. A listing of documents reviewed is provided in Section 6.0.

The review team consisted of Bob Griffith (Team Lead and assessor in the ventilation functional area), Mark Ramsay (assessor in the electrical functional area), and Bill Sherbin (contractor assessor in the mechanical functional area). The approved assessment plan is provided in Appendix A.

The assessment approach followed was to identify a sample of ITS mechanical, electrical, and ventilation systems and/or components and to perform, to the extent possible, a vertical slice review of the implementation of SRD implementing design codes and standards for these systems and components. The objective was to assess the adequacy of Contractor engineering and procurement documentation, as well as vendor documentation that should reflect a consistent and complete flowdown of SRD requirements.

4.0 RESULTS

4.1 SRD MECHANICAL DESIGN STANDARDS IMPLEMENTATION

The assessors reviewed documents, and interviewed Contractor personnel to verify if the Contractor was implementing mechanical design codes and standards for ITS piping and components, including discussing the status of areas that were still under development by the Contractor (e.g., the equipment qualification program and internal flooding issues).

The scope of the SRD mechanical design standards implementation assessment included the following items:

- Determine if ITS Structures, Systems and Components (SSC) are designed to withstand the effects of Natural Phenomena Hazards (NPH), excluding seismic events.
- Determine if Safety Class (SC) and Safety Significant (SS) SSC are appropriately protected against dynamic effects (e.g., the effects of missiles, pipe whipping, and discharging fluids) that may result from failures of moderate- and high-energy systems or other accident conditions.
- Determine if designated piping materials for process safety piping comply with American Society of Mechanical Engineers (ASME) B31.3-96, Chapter VIII, Part 7 requirements for Category M piping. Also, to, verify that the specified corrosion/erosion allowance for process safety piping is in accordance with SRD, Volume II, Appendix H requirements.
- Determine if ITS valve operators are environmentally qualified to the requirements of Institute of Electrical and Electronics Engineers, Inc.(IEEE) 323-1983, *Qualifying Class 1E Equipment for Nuclear Power Generating Stations*.
- Determine if the minimum shell thickness of ITS heat exchangers meet the requirements of Tank Equipment Manufacturers Association (TEMA)-B, C or R heat exchanger mechanical standards.

The assessors found the Contractor's program implemented the SRD mechanical design standards. No deviations to the requirements within the codes and standards were found in the sample of documents that were reviewed. No Open Issues were identified. Two Assessment Follow-up Items (AFI) were identified related to the ashfall NPH.

4.1.1 Design of ITS Mechanical Systems for Natural Phenomena Hazards

The assessors performed a review of Contractor engineering specifications, safety documentation, procedures, and internal memoranda (References 1 through 10) to assess the design of ITS mechanical systems for NPHs. The assessors selected the ashfall event as the NPH to be reviewed against the design of the ITS Emergency Diesel Generators (EDG), air compressors, High-Efficiency Particulate Air (HEPA) filters, and package and split-system Heating, Ventilation, and Air Conditioning (HVAC) units. The review was limited to the assessment of hazards from suspended ash in the air.

For suspended ashfall loading that may affect the operability of the HVAC, ITS air compressors, and EDGs, a design criteria load rate of 0.174 gm/m^3 over a 20-hour duration is stated in the Preliminary Safety Analysis Report (PSAR), General Information volume, and is based on the studies undertaken by Energy Northwest, (formerly, the Washington Public Power Supply System). The ashfall would be the result of an eruption in the Cascade Range; therefore, there will be at least a 2-hour warning, which will allow some preparation at the site for this event.

Contractor personnel informed the assessors that the specifications for EDGs and ITS air compressors have not been issued. The ITS air compressors and EDGs will be procured as package units from an offsite vendor. The Contractor further stated that the procurement specification will include provisions for suspended ash using the design criteria ash load rate discussed above.

The assessors reviewed the engineering specification for package and split system air conditioning units (Reference 1). Although ashfall is listed in the engineering specification as a structural load requirement, there is no mention of suspended ash in the air. Because of this lack of an environmental requirement for suspended ash in the air during emergency conditions, the following AFI was identified:

D-06-DESIGN-030-AFI-01 Confirm Contractor engineering specification 24590-WTP-3PS-MEHX-T0001, Revision 0, *Engineering Specification for Package and Split System Air Conditioning Units* includes appropiate criteria for ash particle size and density for operation during an NPH ashfall event.

For the Pretreatment (PT) Facility HEPA filters, Contractor personnel informed the assessors that the primary line of filters will be impacted by the increased level of dust loading from an ashfall event. The PT PSAR discusses that filters will be changed out as required during the ashfall event. Based on discussions with Contractor personnel, the assessors were informed that the plan is to ensure that sufficient spares are available to support continued HVAC operability. For the HLW Facility HEPA filters, as discussed in the PSAR, a similar strategy to the PT Facility will be used. For the LAW Facility, there is no concern over suspended ash. There are no hazard or accident analysis requirements for the LAW C2V or C5V system to remain operational during or after an NPH event. The LAW C5V system has a safety classification of Additional Protection Class.

Because the HEPA filter specification does not identify environmental conditions for suspended ash in the air during emergency conditions, the assessors identified the following AFI:

D-06-DESIGN-030-AFI-02 Confirm Contractor engineering specification 24590-WTP-3PS-MKH0-T0002, *Engineering Specification for Nuclear Grade High Efficiency Particulate Air (HEPA) Filters (ASME AG-1 Section FK Filters)*, includes appropriate criteria for ash particle size and density to support the required operation of these filters during an NPH ashfall event.

4.1.2 Protection of Safety Class and Safety Significant Structures, Systems and Components Against Dynamic Effects

The assessors reviewed Contractor calculations, integrated safety management (ISM) meeting minutes, engineering specifications, design guides, system descriptions and safety documentation (References 11 through 17) to assess the approach being used to protect ITS Structures, Systems, and Components (SSC) against dynamic effects. Based on discussions with Contractor personnel, the assessors determined the WTP Project is currently developing the requirements for determining when high energy line breaks are assumed to occur, identifying the high energy lines subject to breaks, and identifying mechanical components that need to remain functional during high energy line breaks. The Contractor has not yet determined the room environmental temperatures resulting from high energy line breaks. The Contractor has completed a calculation for an array of high energy pipe size breaks and room volumes, but it is generic in nature

(Reference 17). Pipe whip, jet impingement, and missile loads due to pipe break as a result of high energy line break have not yet been calculated. This was discussed in a meeting with Contractor personnel on October 18, 2006. The assessors reviewed design guide 24590-WTP-GPG-ENG-081, *Protection from Effects of Pipe Break* (Reference 14) and found it to provide acceptable guidance for the performance of the high energy line break-related analysis.

For moderate energy pipe breaks, the flooding evaluation of WTP buildings is still a work-in-progress, with the Authorization Basis Change Requests proposing the changes identified to implement the necessary controls for these flooding events expected to be submitted for ORP review and approval before the end of the year.

Since the evaluations for failures of high energy and moderate piping are still under development, the assessors could not further evaluate the implementation of controls to protect the facilities and ITS systems and components from the dynamic effects of high and moderate energy line breaks. However, the assessors acknowledge that this lack of completed evaluations does not apply to the incorporation of control strategies related to steam releases in the LAW facility, as documented in the BNI Part 1 Safety Evaluation 24590-WTP-SE-ENS-06-0027, Revision 0 (Reference 13).

4.1.3 Compliance of Process Safety Piping Materials with the Requirements of ASME B31.3-96

The assessors reviewed Contractor safety documentation and calculations to determine if materials used for process safety piping comply with ASME B31.3-96, Chapter VIII, Part 7 requirements for Category M piping (References 18 through 21). In addition, the assessors evaluated the adequacy of the specified corrosion/erosion allowance against the requirements of SRD, Volume II, Appendix H.

The assessors determined the Contractor had established that the ASME B31.3-96, Chapter VIII, Part 7 requirements for Category M piping are not applicable to WTP piping. This determination was documented in safety evaluation (SE) 24590-WTP-SE-ENS-03-322, Revision 1 (Reference 19). WTP piping is classified as Normal Fluid Service. The assessors noted that SRD Safety Criterion 4.4-3 includes ASME B31.3 as an implemented code, as tailored in the SRD, Appendix C, Section 26. While the SRD does not specify a specific ASME B31.1-96 piping category for process safety piping, the assessors found both the Normal Fluid Service pipe classification and SRD requirements appropriate and acceptable.

The assessors reviewed two piping calculations (References 20 and 21) and verified that corrosion/erosion allowances are accounted for as design inputs. The specified corrosion/erosion allowance for this process safety piping was in accordance with the SRD, Volume II, Appendix H requirements. In addition, ASME B31.3-96 was specified as an implementing code for ITS liquid and gaseous systems in SRD Safety Criteria 4.2-2 and 4.2-3; Safety Criteria 4.2-3 included SRD Appendix H as an implementing standard for corrosion/erosion.

4.1.4 Environmental Qualification of ITS Valve Operators

The assessors performed a review of Contractor engineering specifications to determine if ITS valve operators were being environmentally qualified to the requirements of IEEE 323-1983 (References 12, 15, and 22 through 24). The assessors reviewed Engineering Specification 24590-WTP-3PS-JV15-T0001, *Engineering Specification for Actuators for On/Off Valves* (Reference 22) and determined the specification invoked the environmental qualification requirements of IEEE-323-1983.

At this point in the project, the Contractor has not produced a list of ITS valve operators. During a meeting with Contractor personnel, the assessors were informed that BNI intends to develop their Equipment Qualification program for the project along the lines of the U.S. Nuclear Regulatory Commission's (NRC) requirements as specified in Title 10 *Code of Federal Regulations* (CFR) 50.49,"Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants." The assessors were informed that the equipment will be qualified to operate in conditions reflected by the radiation and contamination areas as shown on project general arrangement drawings (References 25 through 28).

The assessors concluded that, if the Contractor properly implements requirements in line with 10 CFR 50.49, then ongoing design work and Equipment Qualification program development should result in ITS valve operators meeting appropriate Equipment Qualification requirements and specifications. Because the environmental qualification of ITS valve operators could not be verified, the assessors identified the following AFI:

D-06-DESIGN-030-AFI-03 Perform an assessment of the design and specifications for a sample of ITS valve operators to confirm the environmental qualification requirements specified in the Contractor's Environmental Qualification program, which are expected to be similar to the requirements of 10 CFR 50.49, have been properly implemented.

4.1.5 Compliance of ITS Heat Exchangers with TEMA Minimum Thickness Requirements

The assessors performed a review to determine if the minimum shell thickness of ITS heat exchangers meets the requirements of TEMA standards for Class B equipment (Reference 29). The assessors reviewed a sample of heat exchanger Mechanical Data Sheets for the treated LAW evaporator reboiler, cesium evaporator concentrate reboiler, and cesium evaporator after-condenser heat exchangers (References 30, 31, and 32). The datasheets indicated the reboilers and heat exchangers are intended to meet the requirements for TEMA Type B equipment. Because this equipment has not yet been procured, the TEMA-required minimum shell thickness calculations have not been performed. As discussed with BNI Engineering personnel, these calculations will be performed by the reboiler and heat exchanger vendors.

The assessors concluded that the Contractor properly specified the requirements for TEMA Class B equipment in the heat exchanger/reboiler Mechanical Data Sheets. TEMA Class B requires the equipment vendor to perform a minimum wall thickness

calculation. Based on discussions with Contractor personnel, the assessors determined these calculations have not yet been performed. The assessors found no basis upon which to conclude the calculations would not be performed in accordance with TEMA Class B equipment requirements.

4.2 SRD ELECTRICAL DESIGN STANDARDS IMPLEMENTATION

4.2.1 Incorporation of SRD Implementing Codes and Standards Electrical Design Requirements into the Design of ITS Systems and Components

The assessment of the implementation of SRD electrical design codes and standards focused on determining if the design of WTP ITS electrical systems and components incorporate the design requirements of the following SRD implementing codes and standards, including daughter standards (References 33 through 38):

- IEEE 384-1992, *Standard Criteria for Independence of Class 1E Equipment and Circuits;*
- IEEE 387-1995, *Standard Criteria for Diesel-Generator Units Applied as Standby Power4Generating Stations;*
- IEEE 485-1997, *Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations;*
- IEEE 946-1992, *Design of Safety-Related DC Auxiliary Power Systems for Nuclear Power Generating Stations*;
- IEEE 1187-2002, *Recommended Practice for Installation Design and Installation of Valve-Regulated Lead-Acid Storage Batteries for Stationary Applications; and*
- IEEE 1188-1996, *Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid Batteries for Stationary Applications.*

Specific lines of inquiry pursued by the assessors were as follows:

- What Contractor procedures and specifications and vendor documents exist which implement the standards identified above?
- Are ITS electrical supply systems (including standby/EDGs, direct current power, alternating current instrumentation and control power, including electrical circuits) adequately independent in accordance with the requirements of IEEE 384-1992?
- What Quality Assurance (QA) procedures, desk instructions, or business practices are followed to ensure that BNI and its subcontractors or vendors adequately implement the IEEE requirements in order to satisfy SRD safety criteria?
- In cases where standard compliance is required "as applicable," how does BNI determine the extent of applicability (what is or what is not applicable) and how is it measured?

In addition to the lines of inquiry above, the assessors endeavored to confirm that any deviations in the implementation of SRD electrical design codes and standards were processed in accordance with BNI procedures and the requirements of RL/REG-97-13.

4.2.1.1 Review of Contractor Procedures and Specifications and Vendor Documents

Based on review of system design media, procedure reviews and personnel interviews, electrical SRD safety implementing standards appear to be adequately incorporated into the design and appropriately conveyed (via purchase orders) to equipment suppliers. The assessment was limited to project documentation since the ITS (i.e., Safety Class) electrical equipment has not yet been procured. The Quality Level (QL) electrical purchase orders have been suspended pending resolution of various design issues such as revised ground motion seismic studies, hydrogen control issues (hydrogen in piping and ancillary vessels [HPAV]), and the proposed revision of the emergency power system, which includes the EDGs and 4.16kV switchgear. There were no findings or follow-up issues identified in this portion of the assessment.

Future ORP assessments regarding implementation of SRD standards should focus on the supplier QA.

The assessors reviewed industry consensus standards specified in SRD safety criteria and Contractor-identified engineering specifications and single-line diagrams associated with ITS electrical equipment (References 33 through 68) to assess the flowdown of SRD requirements into implementing Contractor documents. The list of codes and standards reviewed was expanded by the assessors beyond those listed in Section 4.2.1 in order to be comprehensive with respect to the SRD safety criteria.

The Contractor's engineering specifications were reviewed for specific instances where standards requirements were called out. Table 1 identifies the results of the assessors' review. As can be seen from the table, the Contractor's engineering specifications adequately called out and referenced the SRD implementing standards. It should be noted that Table 1 does not list IEEE Standards 603 or 628, because IEEE 603-1998 provides general criteria that is more directly implemented though other standards and IEEE 628-1987 is applicable to safety-class raceway systems, which have not yet been designed or installed. This is further explained below.

Table 1. Standard Requirements Reviewed

System or Equipment	Standards												
	308	323	338	344	379	384	387	485	741	946	1187	1188	NFPA70
4.16KV Switchgear	x	x	x	x	x	x			x				x
480V Sec Unit SubStn	x	x	x	x	x	x			x				x
480V MCCs	x	x	x	x	x	x			x				x
4.16kV-480V Dry Xfmrs	x	x	x	x	x	x			x				x
Power,Cont., Inst. Cabl		x											x
UPS System	x	x	x	x	x	x			x		x	x	x
4.16 EDGs	x	x	x	x	x	x	x		x				x
125V DC System	x	x		x	x	x		x	x	x	x	x	x

In nearly all of the Contractor's ITS equipment specifications, it is required that the vendor satisfy the Class 1E qualification requirements in IEEE 323-1983, the seismic requirements in IEEE 344-1987, and the Class 1E equipment protection requirements in IEEE 741-1997. (Note: IEEE 741-1997 is very general in nature and refers to other

IEEE standards for implementation of its equipment protection requirements.) Thus, these IEEE standards are typically programmatic in nature and the BNI QA organization, in coordination with BNI Engineering, maintains and applies processes to certify that qualified vendors have QA programs that meet the requirements of these standards. This is discussed in greater detail later in this report.

Many of the industry consensus standards are considered by BNI to be system-oriented standards and are implemented in the overall plant system configuration, rather than at a component level. For example, power system configuration (IEEE 308-1991), periodic safety system testing (IEEE 338-1987), single point failure criteria (IEEE 379-1994), and independence of Class 1E equipment (IEEE 384-1992) are typically system level standards and are implemented accordingly. IEEE 603-1998 is used to establish minimum general functional and design requirements for ITS electrical power systems and equipment. However, IEEE 603-1998 is intended to be used in conjunction with, and supplemented by, the system-oriented standards mentioned above, which provide more specific criteria for the electrical safety systems. For example, IEEE 379-1994 is used to establish more specific conformance with the general requirements of IEEE 603-1998 with respect to single-failure criteria.

The assessors determined the general requirements of these standards (i.e., system configuration, redundancy, equipment separation and isolation, etc.) were adequately implemented in the design based on review of applicable electrical system design documents (References 47 through 68). In the Emergency Generator engineering specification (Reference 53), key requirements specific to IEEE 387-1995 are cited as follows (bolding added for emphasis):

- "Furnish an engine of the manufacturer's standard design for stationary service in accordance with **IEEE 387**...."
- "... demonstrate the capability of the EDGs to carry the loads at rated power factor ...for the period of time required and to successfully reject the rated load without exceeding speeds or voltages causing tripping, mechanical damage or harmful overstresses per **IEEE 387**-1995, section 6.2.1."
- "The start and load tests shall be conducted in accordance with **IEEE 387**-1995, section 6.2.2."

In the 125V Direct Current (DC) System engineering specification (Reference 54), key requirements specific to IEEE 485-1997, IEEE 946-1992, IEEE 1187-2002, and IEEE 1188-1996 are cited:

- "The type, duration and timing of the loads shall be considered by Supplier in sizing the battery bank in accordance with **IEEE 485, IEEE 1187**, and IEEE 1189 for the load profile included in the material requisition."
- "The supplier is required to perform all standard tests [re: shop tests] for batteries in accordance with **IEEE 1188**."

National Fire Protection Association (NFPA) 70-1999, *National Electric Code* (Reference 46), is the BNI standard of acceptability for all the ITS electrical equipment. This is stated in the specifications as follows:

- "All electrical equipment and material including fittings, devices, apparatus, utilization equipment, cabinet, control panel and component wiring shall be suitable for installation and use in conformity with the **NFPA 70-1999**."
- "Suitability of equipment shall be evidenced by listing or labeling by nationally recognized testing laboratories (NRTL) as recognized by OSHA. Listing of individual components installed in cabinets and control panels shall not be construed as listing or approval of the assembled cabinet or control panel."

4.2.1.2 Review of Contractor's Implementation of Applicable Independence Requirements

The assessors performed a review of ITS electrical supply systems (including standby/ EDGs, direct current power, alternating current instrumentation and control power), including electrical circuits, to verify the designs included adequate independence in accordance with the requirements of IEEE 384-1992. None of the ITS electrical equipment has yet been installed. However, based on review of the drawings discussed above (References 55 through 68), redundant (independent) systems, when constructed, will be adequately separated according to the provisions of IEEE 384-1992.
For example, train A and train B (redundant) unit substations for HLW and PT Facilities will be located on different levels in the HLW building and in separate fire-rated rooms within the PT Facility. ITS train A and train B 4.16kV underground ductbanks, as installed, are independent and separate as required by the standard. Also, the concrete foundations currently installed for the ITS switchgear building are clearly independent and physically separate from each other in compliance with the standard.

Isolation devices are also provided where ITS equipment interface with the normal (preferred) power system. In the case of the normal 4.16kV distribution to the ITS switchgear buildings (train A and train B), normal power is isolated via (Class 1E) 4.16kV vacuum circuit breakers (isolation devices). These breakers isolate the 4.16kV bus from the normal power system, which is then fed via interlocked circuit breakers by the EDGs.

BNI's *Electrical Design Criteria and Guide* (Reference 69) was also reviewed. Section 12 of the guide, "Separation Criteria for Non-ITS and ITS Circuits," specifically implements the separation criteria in IEEE 384-1992, particularly with respect to SC/SS cable, conduit, and raceway routings.

Within the 125V DC system and uninterruptible power supply specifications, requirements are imposed with respect to alarm circuits that are non-ITS to identify and label these circuits and provide wire terminations that are separate from ITS circuit terminations in accordance with IEEE 384-1992.

4.2.1.3 Review of Contractor QA Procedures, Desk Instructions, and Business Practices

The assessors reviewed BNI QA procedures, desk instructions, and business practices (References 70 through 76) to determine if BNI and its subcontractors and vendors are adequately implementing the IEEE requirements in order to satisfy the SRD safety criteria.

Based on the BNI procedures and interviews with personnel from BNI's Supplier Quality Group and ORP personnel with QA responsibilities, the assessors determined the following process steps occur regarding quality assurance with respect to SRD standards implementation:

- An engineering specification of ITS equipment is prepared that includes applicable SRD implementing codes and standards.
- Supplier Qualification Request per BNI procedure 24590-WTP-GPP-PSQ-020 (Reference 72) is made by the BNI Acquisition Representative or Multi-Facility Acquisition Team. Within the request, a listing of associated Material Requisitions (MR) is provided. The MRs include the engineering specifications and, as such, the SRD implementing codes and standards. (This was verified by the assessors for the 4.16kV ITS Switchgear Material Requisition, 24590-QL-MRA-ES00-00001.)
- The Supplier Qualification (SQ) process is performed per BNI procedure 24590-WTP-GPP-PSQ-021 (Reference 71), in part to ensure the supplier understands the implementing codes and standards identified in the MRs that must be complied with by the furnished equipment. With respect to this, the following question was posed to BNI: "During this process, does the SQ department formally evaluate the suppliers' understanding of the standards identified in MR engineering specification?" The response was as follows:
  - In an initial request, when the prospective supplier is only being evaluated to ensure they have an overall QA program that meets requirements, not a full evaluation of all specific implementing standards is reviewed, since at that time no contracts have yet been established. The focus of the initial review is on the overall program and capability of the supplier based on the supplier's previous work and QA documentation. (Here is where the environmental, seismic, and class 1E program qualification requirements of IEEE 323-1983 and 344-1987 become a considering factor.) Once a contract has been established with the Nuclear Quality Assurance (NQA)-1 qualified vendor, the BNI SQ group performs implementing audits that involve selective sampling of standards. These audits include check sheets that indicate the standards evaluated for implementation. Also source verification activities in accordance with BNI procedure 24590-WTP-GPP-PSQ-042 (Reference 74) provide for a more thorough review of standards and, where deficiencies occur in standards implementation, quality deficiency reports are written in accordance with BNI procedure 24590-WTP-GPP-PSQ-047 (Reference 75). Based on discussion with ORP QA personnel, as of two years ago (when ORP last assessed their Supplier Quality Program), BNI had a sound Supplier Quality Assurance Program that was effectively being implemented.
- The Engineering organization remains involved throughout the procurement process in two main ways: 1) Engineering determines the level of source verification and establishes hold points and witness points, as well as the material assessment schedule; and 2) Engineering is the responsible organization for the Material Acceptance Plan (MAP).

The assessors concluded that the rigor in the Supplier Quality Assurance Program procedures and the link with the engineering organization were evidence of appropriate BNI oversight of suppliers to ensure SRD codes and standards are implemented.

4.2.1.4 Review of Contractor's "Extent of Applicability" Determination

The assessors performed a review to determine, in cases where standard compliance is required "as applicable," how BNI determines the extent of applicability (i.e., what is or is not applicable) and how BNI measures supplier compliance. In most of BNI's engineering specifications, the following words are used with respect to codes and standards implementation: "... [system, system assembly, assemblies, etc.] shall be designed, manufactured and tested in accordance with the applicable sections of the latest edition at time of contract award ...of the following standards." The question posed to BNI by the assessors on this subject was as follows: "How does the supplier know what sections are "applicable" and how does BNI ensure that the supplier is following the "applicable" sections of the implementing codes and standards?

BNI explained that the words "applicable sections" of a standard are understood by BNI to mean applicable with respect to the particular aspect of supplier fabrication (i.e., those sections that address testing are the "applicable sections" for testing and those sections that address the design are the "applicable sections" for the design, and so on). Moreover, an ASME NQA-1 qualified supplier (as determined by the BNI Supplier Quality organization) is expected by BNI Engineering to understand what sections of the standards apply to their product. There was no intent on the part of BNI to use this procurement language (i.e., "applicable sections") as a means to tailor SRD implementing codes and standards beyond that allowed by Appendix C of the SRD.

In addition to the previous discussion relative to supplier QA, BNI ensures the supplier is following applicable sections of the implementing codes and standards by review and approval of vendor design drawings, such as three line diagrams, schematic/wiring diagrams, equipment outline/layout drawings, test procedures/reports, and operating and maintenance manuals. However, documentation of this type was not available for review by the assessment team due to suspended purchase orders for the ITS electrical systems and equipment.

4.2.2 Processing of Deviations in the Implementation of SRD Electrical Design Standards

Section 4.4 of the assessment report addresses the Contractor's procedures for processing deviations in the implementation of SRD design standards, including those standards applicable to the design of mechanical, electrical, and ventilation systems and components. The purpose of Section 4.4 is to provide additional details for the assessment of the Contractor's processing of deviations in the implementation of SRD electrical design standards.

BNI has procedures in place (References 77 through 82) applicable to the processing of case-by-case deviations to the SRD implementing standards. The assessors determined the process and procedures were consistent with the requirements of RL/REG-97-13 (Reference 83). Only one deviation to the SRD electrical design standards has been processed to date (Reference 85) and the assessors concluded the deviation was processed

according to the BNI procedures. The deviation to the SRD electrical design standards was specifically associated with IEEE 628-1987. The deviation involved non-compliance to sloping requirements identified in the standard. The deviation was processed according to BNI procedures and underwent a safety evaluation (Part 1).

BNI utilizes their authorization basis maintenance procedure (Reference 77) to process deviations from SRD implementing codes and standards on a strictly case-by-case basis. The process is communicated in Section 3.12 of the authorization basis maintenance procedure, *Case-by-Case Deviations from SRD Implementing Codes and Standards*, and requires a Part 1 Safety Evaluation. Determination of case-by-case deviations from SRD codes and standards is also governed by the BNI design criteria procedure (Reference 78), specifically Section 3.3.2. These procedures state:

- "Limited facility case-by-case deviations from SRD-implementing codes and standards may be made without an SRD change, provided a safety evaluation is completed and notification made to DOE within 30 days of issuance. These are permanent deviations that are not intended to result in modification of the safety envelope. Case-by-case deviations can involve work not yet initiated that would impact cost or schedule if not done on a timely basis, or work already completed if re-work would impact cost or schedule."

The key features of the process are as follows:

- A Part 1 Safety Evaluation is performed to ensure that a revision to the Authorization Basis will not result.
- Deviations from the SRD are documented, tracked, and maintained; and reference the supporting safety evaluations.
- Documentation is auditable and readily accessible to DOE.
- DOE receives the safety evaluation within 30 days of the decision to deviate from the implementing code or standard and has 60 days to respond, if justification for the deviation is insufficient.

The BNI procedures discussed above indicate that a process is in place for deviations to SRD implementing codes and standards, which is consistent with the requirements of RL/REG 97-13. No deficiencies were identified by the assessors for the Contractor's processing of case-by-case deviations from SRD electrical design standards.

4.3 SRD VENTILATION DESIGN STANDARDS IMPLEMENTATION

The assessors selected the LAW offgas system as the ventilation system against which to evaluate the Contractor's implementation of SRD ventilation design codes and standards. This ITS system was selected on the basis that the system design, procurement, fabrication, and construction progress should be among the furthest along for the project, and, as such should allow for the most complete vertical slice review of the Contractor's implementation of SRD codes and standards. However, during the course of the assessment it became apparent to the assessors that even this system had not advanced to the point where a complete vertical assessment could be completed. Only three offgas system components had proceeded to the point of procurement, the offgas exhaust blowers, safe change HEPA filter housings, and the offgas piping. Yet, even for these components, the procurements had not advanced to the point that documentation from the

suppliers was available in the Contractor's Project Document Control records to include in this assessment. Since a future assessment will be necessary to allow a complete vertical slice review to be performed, the assessors identified the following AFI:

D-06-DESIGN-030-AFI-04 Perform a complete vertical slice assessment of a representative sample of ITS WTP systems to confirm that SRD design standards are properly implemented through design, procurement, fabrication, and installation (e.g., including such pertinent documentation as applicable Supplier Deviation Disposition Requests [SDDR]).

The assessors reviewed applicable SRD safety criteria (4.2, Confinement Design, 4.3, Engineered Safety Systems, and 4.4, Electrical and Mechanical Systems) to identify the implementing codes and standards for the design and construction of project ventilation systems. From this review, the assessors identified and performed a cursory review of the industry consensus codes and standards required by these safety criteria (References 18; 84 through 87). Having completed these preparatory reviews, the assessors interfaced with Contractor personnel to identify engineering and procurement documentation available for the LAW offgas system and components, against which the assessment of SRD design standards implementation could be performed. Based on this interaction, the assessors identified engineering specifications and materials requisitions for the LAW offgas system exhaust blowers and HEPA filter housings (References 88 through 93). These documents were reviewed in detail.

4.3.1 LAW Offgas System Implementation of SRD Design Codes and Standards

The assessors reviewed Contractor design and procurement documentation for the LAW offgas system exhaust blowers and HEPA filter housings to assess the flowdown of SRD implementing codes and standards requirements in the following areas:

- Allowable stresses;
- Duct and duct support materials selection;
- Exhaust blower construction;
- HEPA filter housing design and construction; and
- Separation, redundancy, and single-failure criteria.

The assessors reviewed Contractor records for these LAW offgas components to confirm applicable consensus codes and standards (References 18; 84 through 87) were consistently required and applied in Contractor specifications and procurement documents and, to the extent possible, in vendor-supplied documentation.

LAW Offgas Exhaust Blowers

The engineering specification (24590-WTP-3PS-MACS-T0004; Reference 88) for the LAW offgas blowers was reviewed. The assessors determined the specification invoked the following codes and standards for the design and fabrication of these blowers:

- ASME AG-1-1997 with ASME AG-1a Addenda 2000 (Reference 84);
- ASME NQA-1-1989, *Quality Assurance Program Requirements for Nuclear Facilities;*
- ASME NQA-2-1989, *Quality Assurance Program Requirements for Nuclear Facility*

Applications;

- ASME Boiler & Pressure Vessel Code (B&PVC), Section IX, *Quality Standard for Welding and Brazing;*
- American Welding Society (AWS) Standard D1.1-2000, *Structural Welding Code, Steel*
- AWS D1.3-98, *Structural Welding Code, Sheet Steel;*
- AWS D1.6-99, *Structural Welding Code, Stainless Steel;*
- AWS D9.1-2000, *Structural Welding Code, Sheet Steel Welding Code;*
- AWS D14.6-96, Structural Welding Code, *Welding of Rotating Elements of Equipment;*
- ASME PTC-10-1997, *Performance Test Code on Compressors and Exhausters; and*
- NFPA 70-1999, *National Electric Code* (Reference 46).

In addition to these industry consensus codes and standards, the specification invoked applicable standards from the American Bearing Manufacturers Association (ABMA), Air Movement and Control Association International, Inc. (AMCA), American Society for Nondestructive Testing (ASNT), and the National Electrical Manufacturers Association (NEMA).

The assessors found these industry codes and standards consistent with the implementing codes and standards invoked by applicable SRD safety criteria; in particular SRD Safety Criterion 4.4-3. The SRD safety criterion invokes ASME AG-1-1997 with ASME AG-1a-2000 Addenda, as tailored in SRD Appendix C, as the primary design and fabrication code for project offgas systems. The other SRD Safety Criterion 4.4-3 implementing codes and standards are applicable to project ventilation and offgas systems and components, other than the offgas exhaust blowers. As identified in Section 1.2 of ASME N510-1989, ASME N510 is intended for the post-delivery testing of installed air treatment systems, while ASME N509 is intended for the pre-delivery testing of individual components of air treatment systems. As discussed in Sections 5.7 and 5.8 of ASME N509-2002, fans and fan drive shall meet the requirements of ASME AG-1, Section BA. The assessors further determined that ASME AG-1 invokes, as daughter standards, the requirements of ASME NQA-1 and NQA-2, the ASME B&PVC, AWS standards, and pertinent ABMA, AMCA, ASNT, and NEMA standards. No discrepancies were identified in the flowdown of SRD implementing codes and standards into the requirements of BNI engineering specification 24590-WTP-3PS-MACS-T0004.

In addition to the proper flowdown of SRD implementing codes and standards requirements, the assessors identified the following SRD-compliant statements/ requirements in BNI engineering specification 24590-WTP-3PS-MACS-T0004:

- The design of the blowers was required to conform to ASME AG-1, Section BA.
- Seismic qualification of the design of blowers shall be in accordance with the methods and procedures described in BNI specifications 24590-WTP-3PS-SS90-T0001, *Seismic Qualification of Seismic Category I/II Equipment and Tanks*, or 24590-WTP-3PS-FB01-T0001, *Engineering Specification for Structural Design Loads for Seismic Category III & IV Equipment and Tanks.*
- Blower adjustable speed drives shall be provided/designed in accordance with BNI specification 24590-WTP-3PS-EVV1-T0001, *Low Voltage Adjustable Speed Drives.*

- Materials of construction shall conform to ASME AG-1, Section BA, Article BA-3000, Table BA-3100 and the Blower Data Sheets, as applicable.
- Welds shall be inspected in accordance with ASME AG-1, Article AA-6330.
- Inspection and testing of blowers shall conform to ASME AG-1, Section BA, Article BA-5000 with exception to the ASME AG-1 vibration requirements for the multi-stage blowers.
- Appendix B of the specification provides implementing standards for IEEE-323. Appendix B of the specification is verbatim to Section 23 of Appendix C of the SRD and, thus, is acceptable.
- Appendix C of the specification provides implementing standards for IEEE-344. Appendix B of the specification is verbatim to Section 22 of Appendix C of the SRD and, thus, is acceptable.

Based on the requirements of BNI engineering specification 24590-WTP-3PS-MACS-T0004 discussed above, the assessors concluded that the design of the LAW offgas exhaust blowers was consistent with the intent of the applicable implementing codes and standards for SRD Safety Criterion 4.4-3.

The assessors also reviewed the purchase order (24590-QL-POA-MACS-00002, Revision 4 and material requisition (24590-QL-MRA-MACS-00002, Rev. 4) applicable to the procurement of high integrity centrifugal blowers for the WTP Project. The purchase order and material requisition covered the following LAW offgas components:

- HOP-FAN-00001A, 1B, 1C, 9A, 9B, and 9C
- HOP-ASD-00001A, 1B, 1C, 3A, 3B, and3C
- HOP-MTR-00005A, 5B, 5C, 6A, 6B, and 6C
- LVP-EXHR-00001A, 1B, and 1C
- LVP-ASD-00001A, 1B, and 1C
- LVP-MTR-00001A, 1B, and 1C

The assessors also reviewed a supplement to the material requisition (24590-QL-MRA-MACS-00002-S0003, *Update Issue Date for Codes & Standards*, that revised the material requisition to include the results of BNI-approved engineering equivalency evaluations. The material requisition included BNI engineering specification 24590-WTP-3PS-MACS-T0004, Revision 2 and neither added to or deleted from the requirements of the engineering specification. As such, the assessors concluded that the appropriate SRD implementing codes and standards, including daughter standards, requirements properly flowed down to the LAW offgas exhaust blower procurement documents.

As discussed above, the status of this procurement was such that for this assessment documents from the LAW offgas system exhaust blowers vendor were not yet available for review. Specifically, this procurement was suspended pending the resolution of commercial issues with the vendor (Ellis-Watts). See AFI D-06-DESIGN-030-AFI-03 above for more information.

LAW HEPA Filter Housings

The engineering specification (24590-WTP-3PS-MKH0-T0001) for the LAW offgas HEPA filter safe change housings (Reference 89) was reviewed. The assessors determined the specification invoked the following codes and standards for the design and fabrication of these housings:

- ASME AG-1-1997 with ASME AG-1a Addenda 2000 (Reference 84);
- ASME N509-1989, Reaffirmed 1996, *Nuclear Power Plant Air-Cleaning Units and Components;*
- ASME N510-1989, Reaffirmed 1995 (Reference 86);
- ASME NQA-1-1989, *Quality Assurance Program Requirements for Nuclear Facilities;*
- ASME B&PVC, Section IX, *Quality Standard for Welding and Brazing;*
- AWS D1.1-2000, *Structural Welding Code, Steel;*
- AWS D1.1-00, *Structural Steel Welding Code;*
- AWS D1.3-98, *Structural Welding Code, Sheet Steel;*
- AWS D1.6-99, *Structural Welding Code, Stainless Steel;*
- AWS D9.1-00, *Structural Welding Code, Sheet Steel Welding Code;*
- American National Standards Institute (ANSI)/ASME B18.2.1-1996 with 1999 Addenda, *Square and Hex Bolts and Screws (Inch Series)*;
- ASME B30.20-2003, *Below the Hook Lifting Devices; and*
- ASNT Standard SNT-TC-1A-1980, June 1980 edition through 2001 edition with Supplements, *ASNT Recommended Practices.*

The assessors found these industry codes and standards consistent with the implementing codes and standards invoked by applicable SRD safety criteria; in particular SRD Safety Criterion 4.4-3. The SRD safety criterion invokes ASME AG-1-1997 with ASME AG-1a-2000 Addenda, as tailored in SRD Appendix C, as the primary design and fabrication code for project offgas systems. Other SRD Safety Criterion 4.4-3 implementing codes and standards include ASME N509-89 and ASME N510-1989. The other SRD Safety Criterion 4.4-3 implementing codes and standards are applicable to project ventilation and offgas systems and components, other than the offgas HEPA filters safe change housings.

In addition to the proper flowdown of SRD implementing codes and standards requirements, the assessors identified the following SRD-compliant statements/ requirements in BNI engineering specification 24590-WTP-3PS-MKH0-T0001:

- Design of the Safe Change HEPA Filter Housings shall conform to ASME AG-1 Sections HA, IA, and DA and applicable portions of the documents listed in Section 2 of the Engineering Specification.
- Safe Change HEPA Filter Housing design shall conform to ASME AG-1, Article HA-4000.

Based on the requirements of BNI engineering specification 24590-WTP-3PS-MKH0-T0001, including the requirements discussed above, the assessors concluded that the design of the LAW offgas HEPA filters safe change housings was consistent with the

intent of the applicable implementing codes and standards for SRD Safety Criterion 4.4-3.

The assessors also reviewed the material requisition (24590-QL-MRA-MKH0-00001, Revision 5) applicable to the procurement of safe change HEPA filter housings for the WTP project, including datasheet 24590-LAW-MKD-LVP-00013, Revision 2, *LVP Secondary Offgas @ 48'*. The material requisition covered LAW melter offgas system safe change HEPA filter housing numbers LVP-HEPA-00001A, 1B, 2A, 2B, and 3A. As an observed good practice, the assessors noted that all safe change HEPA filter housings (LVP, C5V, and C3V), regardless of their respective safety functions, were required to meet the requirements of ASME NQA-1-1989.

The material requisition included BNI engineering specification 24590-WTP-3PS-MKH0-T0001, Revision 3 and neither added to or deleted from the requirements of the engineering specification. As such, the assessors concluded that the appropriate SRD implementing codes and standards, including daughter standards, requirements properly flowed down to the LAW offgas system safe change HEPA filter housings procurement documents.

As discussed above, the status of this procurement was such that for this assessment documents from the LAW offgas system safe change HEPA filter housings vendor were not yet available for review. See AFI D-06-DESIGN-030-AFI-04 above for more information. A minor discrepancy was identified during the review of datasheet 24590-LAW-MKD-LVP-00013, Revision 2. The datasheet made reference to the "LAB building" height of 68 feet. This was pointed out to cognizant BNI Engineering personnel, who acknowledged the error in the datasheet and indicated that a revision to the datasheet was currently in progress. The incorrect reference to the LAB building will be corrected in this revision. This was acceptable to the assessors.

LAW Offgas System Piping

The assessors reviewed the material requisitions (24590-QL-MRA-PS02-00002, Revision 4, *Pipe, Spool Fabrication, 316/316L SS, (≤ 4"ϕ NPS)* and 24590-QL-MRA-PS02-00009, Revision 3, *Pipe, Spool Fabrication, SS (≥ 6" 304L/316L)* applicable to LAW offgas system piping, including the engineering specifications for the applicable pipe classes (References 93 through 97). The pipe class specifications invoked ASME B31.3, "Normal Fluid Service," as the applicable design code. Specified corrosion allowances ran from 0.0040 inches (which, per Appendix H of the SRD, is the minimum standard corrosion allowance when the corrosion rates are indeterminate, but are expected to be low) to 0.125 inches. The assessors identified no deficiencies based on the review of the pipe class specifications.

In addition to the pipe class specifications, the material requisitions included engineering specification 24590-WTP-3PS-PS02-T0001, Revision 7, *Shop Fabrication of Piping*. This specification included specification change notices (SCN) 24590-WTP-3PN-PS02-00044 and -00047; both SCNs were also reviewed by the assessors. SCN 24590-WTP-3PN-PS02-00044 provided the vendor with the results of the engineering equivalency evaluations performed by BNI for the SRD implementing codes and standards applicable to the piping covered by engineering specification 24590-WTP-3PS-PS02-T0001. The assessors reviewed the SCN and determined the daughter standards identified for

ASME B31.3-96, the ASME B&PVC, and American Society for Testing and Materials (ASTM) material standards were consistent with the SRD and acceptable, with one minor exception. The assessors noted that both the specification and SCN 24590-WTP-3PN-PS02-00044 made reference to ASME B&PVC Section VII for the construction of pressure vessels. The proper callout should be to Section VIII. BNI acknowledged this error in the specification and indicated their intention to correct it with an SCN. This was acceptable to the assessors. No other deficiencies were identified.

4.3.2 Implementation of SRD Design Codes and Standards for the Balance of Facilities (BOF) Ammonia Storage Vessels

The assessors reviewed the engineering specification (24590-WTP-3PS-AMR-T0002, Revision 0, *Anhydrous Ammonia Storage/Supply Package*) and material requisition (24590-QL-MRA-MS00-00008, Rev. 1, *Anhydrous Ammonia Storage/Supply Package*) for the Balance of Facilities (BOF) anhydrous ammonia storage/supply system. The purpose of this review was to confirm implementation of codes and standards associated with SRD Safety Criterion 4.2-2 in the design, fabrication, and construction of this system. SRD Safety Criterion 4.2-2 deals with safety requirements for ITS liquid and gaseous systems and components. The specific industry consensus standard of interest in this review was ANSI Standard K61.1-1999, *Safety Requirements for the Storage and Handling of Anhydrous Ammonia*, (Reference 98). Although the focus of the review was on the engineering specification and material requisition for the anhydrous ammonia storage/supply system, the assessment also included review of the following engineering specifications and procurement documents related to this system:

- Engineering specification 24590-3PS-JQ07-T00001, Revision 1, *Engineering Specification for Instrumentation for Packages Systems;*
- Engineering specification 24590-3PS-EKP0-T0001, Revision 3, *Engineering Specification for Electrical Requirements for Packaged Systems;*
- Engineering specification 24590-3PS-MV00-T0001, Revision 2, *Engineering Specification for Pressure Vessel Design and Fabrication;*
- Engineering specification 24590-3PS-MVB2-T0001, Revision 2, *Engineering Specification for Welding of Pressure Vessels, Heat Exchangers and Boilers;*
- Engineering specification 24590-3PS-SS00-T0001, Revision 5, *Engineering Specification for Welding of Carbon Structural Steel;*
- Engineering specification 24590-3PS-P000-TC12H, Revision 2, *Piping Material Classification – Pipe Class C12H;*
- Engineering specification 24590-3PS-P000-TC31J, Revision 2, *Piping Material Classification – Pipe Class C31J; and*
- Material acceptance plan 24590-WTP-MAP-04-00156, Revision 1, *Anhydrous Ammonia Storage/Supply Package.*

The assessors determined the material requisition addressed two ammonia reagent storage vessels (AMR-VSL-00001 and 00002), one ammonia reagent vaporizer (AMR-VPR-00001), and the associated anhydrous ammonia system controls and interconnecting

piping. The engineering and procurement documents identified above were found to appropriately and consistently invoke the requirements of SRD implementing and/or daughter codes and standards, including the ASME B&PVC, Section VIII (construction of pressure vessels); ASME B&PVC, Section IX (welder qualifications); ANSI/ASME B31.3 (process piping); ASNT Recommended Practice SNT-TC-1A (certification of nondestructive examination personnel); AWS welding standards; the American Institute for Steel Construction (AISC) (manual of steel construction); the Uniform Building Code, 1997 Edition; NFPA Standard 70-1999 (*National Electric Code*); ASTM (material standards); IEEE standards (human factors, instrument grounding, periodic surveillance and testing, and independence of equipment and circuits); and Instrument Society of American (ISA) Standard S84.01-1996. In addition to these codes and standards, the assessors confirmed the engineering and procurement documentation for this system properly invoked the requirements from ANSI Standard K61.1, 29 CFR 1910.111, "Storage and Handling of Anhydrous Ammonia, and applicable *Washington Administrative Code* (WAC) requirements (WAC 296-24-510, -750, and -5100).

Only one minor discrepancy was identified. MAP 24590-WTP-MAP-04-00156, Item 26 required that, for identified structural steel members, the supplier was to verify the width, depth, and thickness *have a 1/16 inch from* that specified in the AISC Manual of Steel Construction. The text is italicized to highlight the MAP text of concern. This text was discussed with cognizant BNI Acquisition Services personnel who informed the assessors that the MAP was in the process of being updated; one of the changes being made was to correct this text to read "...have a tolerance of -1/16 of an inch from that specified in the AISC Manual of Steel Construction." This was acceptable to the assessors since, based on review of the Commercial Grade Item Evaluation Form included in the material requisition, this thickness requirement was properly specified.

4.4 DEVIATIONS FOR THE IMPLEMENTATION OF SRD DESIGN STANDARDS

The assessors reviewed the requirements of RL/REG-97-13 (Reference 83) and applicable sections of Contractor procedures associated with the processing of deviations from SRD implementing codes and standards (References 77 through 82) (e.g., Section 3.12, *Case-by-Case Deviations from SRD Implementing Codes and Standards*, of BNI procedure 24590-WTP-GPP-SREG-002 and Section 3.3.2 of BNI procedure 24590-WTP-3DP-G04B-00001 [References 78 and 79]). In addition, the assessors interviewed Contractor personnel to identify deviations from SRD implementing codes and standards processed by the Contractor up to the time of the assessment.

The assessors determined the Contractor had processed 18 case-by-case deviations to the WTP Authorization Basis (References 99 through 116). Copies of these deviations were obtained and reviewed against the requirements of the Contractor's procedures and RL/REG-97-13. The assessors concluded that BNI was processing and documenting these case-by-case deviations in accordance with their procedures and the requirements of RL/REG-97-13. Specifically:

- The Contractor performed and documented an evaluation for each deviation that determined the deviation conformed to applicable laws and regulations, top level standards and principles, and SRD safety criteria. This determination was documented in

a Part 1 Safety Evaluation for each case-by-case deviation, signed by appropriate, responsible Contractor management.

- The Contractor's Part 1 Safety Evaluation documented the basis for concluding the case-by-case deviations did not cause or threaten imminent danger to the workers, the public, or the environment from radiological, nuclear, or chemical hazards.
- Delay of implementation of the changes could affect project cost and/or schedule.
- No discrepancies with the documentation and administrative control requirements of RL/REG-97-13, Position 3.8 were identified by the assessors. Since these are one-time (e.g., case-by-case) deviations from SRD implementing codes and standards requirements, notification of ORP is by way of the Contractor's formal monthly submittal of Part 1 Safety Evaluations to ORP. These deviations do not require a follow-up Authorization Basis Change Request to resolve the deviation. As such, the monthly notification and ORP review is appropriate.
- Deviations from the SRD are documented, tracked, and maintained in accordance with Contractor procedures and QA processes; including reference to the supporting safety evaluations.
- Documentation supporting the Contractor's implementation of deviations to SRD implementing codes and standards is auditable and readily accessible by ORP.

No Findings, Open Items, AFIs, or Observations were noted relative to the Contractor's processing of deviations to SRD implementing codes and standards.

5.0 OPEN ITEMS

The following AFIs have been identified by the SRD Design Standards Implementation Assessment Team. Following the completion of Contractor actions and/or the advancement of project design activities, these AFIs will be included in future ORP assessments to confirm the adequacy these actions or to complete the intended scope of this assessment.

D-06-DESIGN-030-AFI-01 Confirm Contractor engineering specification 24590-WTP-3PS-MEHX-T0001, Revision 0, *Engineering Specification for Package and Split System Air Conditioning Units*, includes appropriate criteria for ash particle size and density for operation during an NPH ashfall event.

D-06-DESIGN-030-AFI-02 Confirm Contractor engineering specification 24590-WTP-3PS-MKH0-T00002, *Engineering Specification for Nuclear Grade High Efficiency Particulate Air (HEPA) Filters (ASME AG-1 Section FK Filters)*, includes appropriate criteria for ash particle size and density to support the required operation of these filters during an NPH ashfall event.

D-06-DESIGN-030-AFI-03 Perform an assessment of the design and specifications for a sample of ITS valve operators to confirm the environmental qualification requirements specified in the Contractor's Environmental Qualification program, which are expected to be

	similar to the requirements of 10 CFR 50.49, have been properly implemented.
D-06-DESIGN-030-AFI-04	Perform a complete vertical slice assessment of a representative sample of ITS WTP systems to confirm that SRD design standards are properly implemented through design, procurement, fabrication, and installation (e.g., including such pertinent documentation as applicable Supplier Deviation Disposition Requests [SDDR]).

6.0 REFERENCES

1. 24590-WTP-3PS-MEHX-T0001, Revision 0, *Engineering Specification for Package and Split System Air Conditioning Units.*
2. 24590-WTP-3PS-MKH0-T00002, Revision 2, *Engineering Specification for Nuclear Grade High Efficiency Particulate Air (HEPA) Filters (ASME AG-1 Section FK Filters)*, March 8, 2006.
3. Safety Implementation Note 24590-PTF-SIN-06-0002, D*esign Basis Ashfall Criteria*, Dated April 6, 2006.
4. CCN: 052546, *ISM Review of Ashfall Impacts to LAW Offgas and Ventilation Systems.*
5. CCN: 053734, *Volcanic Ashfall.*
6. CCN: 057712, *Volcanic Ashfall.*
7. CCN: 137969, *Design Basis Ashfall.*
8. 24590-WTP-SED-ENS-03-002-03, Section 3.3.3.9 (LAW), Revision 0.
9. 24590-WTP-GPP-SANA-002, Revision 19, *Hazard Analysis, Development Of Hazard Control Strategies, And Identification Of Standards.*
10. 24590-PTF-SIN-ENS-06-0002, Revision 0, *Design Basis Ashfall Criteria.*
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