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

02-OSR-0507

Mr. R. F. Naventi, Project Manager
Bechtel National, Inc.
2435 Stevens Center
Richland, Washington 99352

Dear Mr. Naventi:

CONTRACT NO. DE-AC-01RV14136 – SAFETY REQUIREMENTS DOCUMENT (SRD) DESIGN STANDARDS IMPLEMENTATION INSPECTION REPORT, IR-02-012

Reference: ORP letter from R. J. Schepens to R. F. Naventi, BNI, "Notification of Construction Authorization Readiness Assessment and Associated Concerns," 02-OSR-0480, dated October 4, 2002.

This letter forwards the subject inspection report. The inspection, which was conducted from September 16 through 20, 2002, assessed Bechtel National, Inc.'s (BNI) implementation of design safety standards. Three Findings were identified and are documented in the Notice of Findings (Enclosure 1).

Inspection details, including Findings, are documented in the enclosed inspection report (Enclosure 2). Two Findings resulted from the BNI staff's failure to implement SRD standards. One Finding resulted from the failure to follow procedures, as required by the Contractor's Quality Assurance Manual. The Findings are as follows: (1) BNI was implementing an unapproved American Society of Mechanical Engineers code used to design piping, pipe support and vessels; (2) BNI had not established a process to incorporate Human Factors Engineering in the facility design, and (3) BNI used stresses in a calculation that exceeded the allowable stresses specified in the standard cited in the SRD.

In summary, this inspection found inconsistencies in the implementation of design safety standards. As a result, the U.S. Department of Energy, Office of River Protection (ORP) has concluded BNI should take immediate actions to assure its staff is sufficiently knowledgeable of Contract design requirements, the SRD standards, and the process for revising authorization basis standards. To attain a timely response to these and other design engineering process issues from recent inspections, the Reference requested BNI to show, at a minimum, plans and actions to comprehensively address issues associated with design process implementation.

You are requested to provide a written response to the Findings described above within 30 days, in accordance with the instructions provided in the Notice of Finding. The ORP will combine your responses to the Reference letter and the specifics to the above Findings to determine acceptability of your corrective actions. If you have any questions, please contact me, or your staff may call Robert C. Barr, Safety Regulation Division, (509) 376-7851.

Sincerely,

Roy J. Schepens
Manager

OSR: JLP

Enclosures (2)

cc w/encls:
W. R. Spezialetti, BNI

NOTICE OF FINDINGS

Section C, "Statement of Work," Standard 7, "Environment, Safety, Quality, and Health," of the Contract,[1] defined Bechtel National, Inc.'s (the Contractor) responsibilities under the Contract as they related to conventional non-radiological worker safety and health; radiological, nuclear, and process safety; environmental protection; and quality assurance.

Standard 7, Section (d) of the Contract required the Contractor to develop and implement an integrated, standards-based, safety management program to ensure that radiological, nuclear, and process safety requirements are defined, implemented, and maintained. The Contractor was required to conduct work in accordance with the Contractor-developed and U.S. Department of Energy (DOE)-approved Safety Requirements Document (SRD). The Contractor's SRD was defined in 24590-WTP-SRD-ESH-01-001-02, Rev. 0, dated October 14, 2001.

During the performance of an inspection of the Standards Implementation Process conducted September 16-20, 2002, at the Contractor's offices, the following items were identified that did not meet the above cited requirements:

1.a The SRD Safety Criterion 4.2-2 required the Contractor adhere to the requirements of the American Society of Mechanical Engineers (ASME) Section VIII, *Boiler and Pressure Vessel Codes, Rules for Construction of Pressure Vessels* for the design of vessels and tanks. ASME Section VIII contained provisions for the design and analysis of vessels and tanks including seismic considerations. The SC made no reference to ASME Section III.

Contrary to the above, Contractor Engineering Specification 24590-WTP-3PS-MV00-T0002, Rev. 0, *Seismic Qualification Criteria for Pressure Vessels*, used ASME Section III allowable stresses in the seismic design and analysis of vessels and vessel supports instead of Section VIII allowable stresses.

This is a Finding for failure to meet Contractual requirements to implement the DOE-approved SRD. (See IR-02-012, Section 1.2.2, IR-02-012-01a-FIN)

1.b The SRD Safety Criterion 4.2-2 required the Contractor adhere to the requirements of the ASME standard B31.3-96, *Process Piping,* for the design and analysis of piping. ASME B31.3 contained provisions for the design and analysis of piping including seismic considerations. The SC made no reference to ASME Section III.

[1] Contract No. DE-AC27-01RV14136, between U.S. Department of Energy and Bechtel National, Inc., dated December 11, 2000.

Contrary to the above, Contractor Engineering Specifications 24590-WTP-DC-PS-01-001, Rev. 1, *Pipe Stress Design Criteria*, and 24590-WTP-DC-01-PS-002, Rev. 1, *Pipe Support Design Criteria*, used ASME Section III allowable stresses in the seismic design and analysis of piping instead of ASME B31.3-96 allowable stresses.

This is a Finding for failure to meet Contractual requirements to implement the DOE-approved SRD. (See IR-02-012, Section 1.2.2, IR-02-012-01b-FIN)

2. The SRD Safety Criterion 4.3-6 required the Contractor adhere to the requirements of the IEEE 1023-88, *IEEE Guide for the Application of Human Factors Engineering to Systems, Equipment and Facilities of Nuclear Power Stations.* IEEE 1023-88 contained provisions for the application of human factors engineering (HFE) in the design, operation, testing and maintenance of the facility.

   Contrary to the above, there was no documented evidence the Contractor had established a process that incorporated HFE in the facility design.

   This is a Finding for failure to meet Contractual requirements to implement the DOE-approved SRD. (See IR-02-012, Section 1.4.2, IR-02-012-03-FIN.)

3. Standard 7, Section (e)(3), "Quality Assurance," of the Contract required the Contractor to develop a Quality Assurance (QA) Program, supported by documentation that described overall implementation of QA requirements. Documentation must identify the procedures, instructions, and manuals used to implement the Contractor's QA program within the Contractor's scope of work.

   The Contractor's *Quality Assurance Manual* (QAM), 24590-WTP-QAM-QA-01-001, Rev. 0, dated August 31, 2001, contained the policies that established the QA requirements for the project. QAM Policy Q-05.1, "Instructions, Procedures, and Drawings," Section 3.1.1 required activities affecting quality to be prescribed by and performed in accordance with documented instructions, procedures, and drawing of the type appropriate to the circumstances.

   Contractor Procedure 24590-WTP-3DP-G04B-00037C, Rev. 0, *Engineering Calculations*, provided requirements for preparing, checking, and approving calculations. Section 3.2.3 of the procedure required calculations to include design inputs, and section 3.4 required checkers to verify the calculations complied with design criteria. Section 3.5 required the cognizant Discipline Manager to review the design calculation to ensure their completeness and conformance with design requirements. Contractor drawings 24590-HLW-P3-P33T-00001, Rev. 2, *HLW Vitrification Building, Canister Handling Embedded C5* Duct; dated July17, 2002; 24590-HLW-P3-P33T-00002, Rev. 3, *HLW Vitrification Building Melter Cave #1, Embedded C5 Duct,* dated July 17, 2002; and 24590-HLW-P3-P33T-00003, Rev. 2, *HLW Vitrification Building, Melter*

Cave #2, Embedded C5 Duct, required the duct material to be ASTM A240 Grade 304L stainless steel.

Contrary to the above, Calculation 24590-HLW-P6C-P40T-00001, Rev. B, *Stress Analysis Report of HLW C5 Embedded Steel Duct,* approved May 1, 2002, and marked "committed preliminary," provided the stress report for the HLW C5 ducting but incorrectly used ASTM A312 Grade TP304 as the material for construction instead of the correct ASTM A240 Grade 304L.

This is a Finding for failure to follow procedures as required by QAM Policy Q-05.1. (See IR-02-012, Section 1.5.2, IR-02-012-04-FIN)

The ORP requires the Contractor to provide, within 30 days of the date of the cover letter that transmitted this Notice, a reply to these Findings. The reply should include (1) admission or denial of the alleged Finding, (2) the reason for the Finding, if admitted, and if denied, the reason why, (3) the corrective steps that have been taken and the results achieved, (4) the corrective steps that will be taken to avoid further Findings, and (5) the date when full compliance with the applicable commitments will be achieved. When good cause is shown, consideration will be given to extending the requested response time.

Enclosure 2
02-OSR-0507

U. S. DEPARTMENT OF ENERGY
Office of River Protection

INSPECTION:	SAFETY REQUIREMENTS DOCUMENT DESIGN STANDARDS IMPLEMENTATION
REPORT NO.:	IR-02-012
FACILITY:	Bechtel National, Inc.
LOCATION:	3000 George Washington Way Richland, Washington 99352
DATES:	September 16 – 20, 2002
INSPECTORS:	J. Polehn (Lead), Senior Regulatory Technical Advisor W. Ang, Team Member R. DeFayette, Team Member V. Ferrarini, Team Member T. Quinn, Team Member
APPROVED BY:	P. Carier, Verification and Confirmation Official Office of Safety Regulation

EXECUTIVE SUMMARY
SRD Design Standards Implementation

INTRODUCTION

This inspection of the Bechtel National, Inc. (the Contractor) Safety Requirements Document (SRD) design standards implementation process covered the following areas:

- Implementation of SRD Civil-Structural Design Standards (Section 1.2)
- Implementation of SRD Mechanical Design Standards (Section 1.3)
- Implementation of SRD Control, Electrical, Instrumentation, and Human Factors Design Standards (Section 1.4)
- Implementation of SRD Mechanical (Ventilation) Design Standards (Section 1.5)
- Implementation of SRD Fire Protection Design Standards (Section 1.6)
- Deviations from the Implementation of SRD Design Standards (Section 1.7).

SIGNIFICANT OBSERVATIONS AND CONCLUSIONS

- In the Civil-Structural building design and analysis area, the contractor incorporated the safety standards stipulated in the SRD. However, for piping, pipe support and vessel design the contractor used a design code, American Society of Mechanical Engineers (ASME) Section III, that was not contained in the SRD. This resulted in two Findings for failure to meet Contractual requirements to implement the U.S. Department of Energy (DOE) approved SRD (IR-02-012-01a-FIN and IR-02-012-01b-FIN) (Section 1.2).
- In the Mechanical Design area for pipes and vessels, the Contractor issued five Material Requisitions (MRs) (four Quality Level-1 and one for commercial grade) for purchase of equipment and components. For those MRs, the Contractor implemented safety criteria design codes and standards for important to safety process safety piping and components as required by the SRD (Section 1.3).
- For the Electrical, controls and instrumentation, and Human Factors work activities, the Contractor implemented the requirements of the SRD electrical standards for the systems selected for review. However, there was no documented evidence the Contractor had established a process incorporating Human Factors Engineering in the facility design, nor was there documented evidence the engineering specification for the Programmable Protection System, which was an important-to-safety system with protective functions, complied with the single failure criteria for software common mode failures. This resulted in an Inspection Follow-up Item and a Finding for failure to meet Contractual requirements to implement the DOE approved SRD (IR-02-012-02-IFI) and (IR-02-012-03-FIN) (Section 1.4.2).

- While a limited number of final documents were available for review for the High-Efficiency Particulate Air (HEPA) filters, interim documentation demonstrated the Contractor was implementing the relevant standards specified in the SRD. Except for one calculation, the Contractor incorporated the SRD required design standards into the design of High Level Waste (HLW) ventilation ducting and HEPA filters. The calculation used stresses that exceeded the allowable stress required by the Safety Criteria in ASME B31.3-96. This resulted in a Finding for failure to follow procedures as required by the Contractor's Quality Assurance Manual (QAM) (IR-02-012-04-FIN) (Section 1.5.2).

- Contractor personnel were adequately knowledgeable of SRD safety criteria and implementing codes and standards requirements for the design and construction of the River Protection Project Waste Treatment and Immobilization Plant fire protection structures, systems, and components (SSC). At the time of this inspection, the design of fire protection SSCs was partially complete (i.e., specifications had been issued but purchase orders had not). The fire protection design and construction codes and standards implemented by the Contractor in the limited and preliminary design documents reviewed were consistent with the SRD, Section 4.5, Implementing Codes and Standards.

- The inspectors identified inconsistent implementation of design standards. On one hand, Contractor personnel who were interviewed appeared knowledgeable of Contract design requirements and SRD standards, and the process required to change them. Contrary to this, the inspectors identified examples where work being performed was not in accordance with existing standards and the authorization basis (AB) change process was not followed. The inspectors, therefore, concluded Contractor personnel were not sufficiently knowledgeable of Contract design requirements, the SRD standards, and the process for revising AB standards (Section 1.7).

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SRD DESIGN STANDARDS IMPLEMENTATION INSPECTION REPORT

1.0 REPORT DETAILS

1.1 Introduction

Standard 7, "Environment, Safety, Quality, and Health," Table S7-1, "Radiological, Nuclear, and Process Safety Deliverables," of the Contract, DE-AC27-01RV14136, dated December 11, 2000, between Bechtel National, Inc. (the Contractor) and the U.S. Department of Energy (DOE), required the Contractor to submit a Safety Requirements Document (SRD) as part of the River Protection Project Waste Treatment and Immobilization Plant (WTP) design and supporting documentation. As described in Standard 7, Section d, the SRD is the set of environment, safety, quality, and health (ESQ&H) tailored requirements as referenced in Section I Clause entitled, "Laws, Regulations, and DOE Directives." These requirements include both the safety criteria (SC) and Implementing Codes and Standards specified in Volume II of the SRD. The objectives of this inspection were to assess the adequacy of the Contractor's implementation of the SRD Implementing Codes and Standards into the WTP design and the Contractor's process for dispositioning deviations from these codes and standards.

1.2 Implementation of SRD Civil-Structural Standards (Inspection Technical Procedure (ITP) I-110)

1.2.1 Inspection Scope

This part of the inspection was to verify, by interviewing Contractor personnel and reviewing selected design documents, the Contractor was implementing SC design codes and standards for important-to-safety (ITS) civil-structural design engineering of buildings and structures including tanks, pressure vessels, and piping as specified in SC 4.1-2, 4.1-3, and 4.1-4 of the SRD. The verification was to ensure the following:

- For building designs, applicable nominal loads (dead, live, soil, wind, snow, flood, and earthquake) were specified and accounted for in accordance with American Society of Civil Engineers (ASCE) 7-95. (SC 4.1-2, 3 and 4)

- The damping factor used for seismic analysis was in accordance with ASCE 4-98, Section 3.1. (SC 4.1-2)

- Rebar materials were specified in accordance with American Concrete Institute (ACI) 349-01 for structures. (SC 4.1-2)

- Seismic analysis for structures was performed in accordance with ASCE 4-98. (SC 4.1-2)

- Stresses in steel structures were specified in accordance with American Institute of Steel Construction (AISC) N690-94. (SC 4.1-2)

- Pressure vessels were designed in accordance with American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Section VIII. (SC 4.2-2)

- Piping systems met the requirements of ASME B31.3-96. (SC4.2-2)

1.2.2 Observations and Assessments

The inspectors reviewed calculations, Material Requisitions (MRs) and procedures as discussed below to assess if the Contractor implemented the proper SRD design standards.

- Calculations 24590-HLW-DGC-S13T-00008, Rev. 1, *Interior Wall Rebar from Elev. –21 ft to grade* and 24590-HLW-SOC-S15T-00023, Rev. 1, *Concrete Structure Analysis Elev. –21 to Grade.* These calculations were in accordance with 24590-WTP-DC-ST-001, Rev. 0, *Structural Design Criteria* that identified required loadings including dead, live, snow, wind, and earthquake loads. The inspectors verified the calculations properly included required loadings in accordance with ASCE 7-95. In addition, the inspectors verified the damping factor and seismic analysis was in accordance with ASCE 4-98.

- MR 24590-QL-MRA-DG00-00001, Rev. 2, *Rebar Mill Order,* and specification 24590-WTP-3PS-DG00-T0001 MVB2-T0001, Rev. 2, *Furnishing of Reinforcing Steel*. The specification required the Quality Classification Level to be indicated on the Purchase Order. The purchase order indicated the material to be American Society for Testing Materials (ASTM) A 706-00, *Specification for Low Alloy Steel Deformed Bars for Concrete Reinforcement,* and Quality Class QL-1. ASTM A 706-00 was the referenced deformed reinforcement material for rebar identified in ACI 349-01. Therefore, the rebar material ordered was as specified in ACI 349-01.

- Calculation 24590-HLW-DVR-ST-02-051, Rev. 0, *Secondary Steel at El. 0 ft*, and 24590-WTP-DC-ST-01-001 Rev. 0, *Structural Design Criteria*. Both documents identified AISC N690-94, as the design code for use in determining the allowable stress for the design of steel structures. The calculation properly applied the correct allowable stress for steel design.

- MR 24590-MRA-MVAO-00002, Rev. 1, for Submerged Bed Scrubbers (SBS) Condensate Vessel Plant Item Number 24590-HLW-MV-HOP-VSL-00903. The MR clearly identified the design code as ASME Section VIII as required by SC 4.2-2. It also referenced Engineering Specification 24590-WTP-3PS-MV00-T0002, Rev. 0, *Seismic Qualification Criteria for Pressure Vessels*. The specification invoked requirements from ASME Section III, Subsections NC, NF and Appendix F for analysis and allowable stresses for seismic design of vessels and vessel supports even though the SC did not make any reference to the ASME Section III. ASME Section III allowable stress was generally higher than that allowed by ASME Section VIII for seismic loadings for vessels, thus potentially resulting in a less robust design. Therefore, in order to use the higher allowable stresses, and to ensure the resulting design met the governing codes and SC requirements, the contractor must evaluate them and justify their use via the

Authorization Basis Change Notice (ABCN) process. The Contractor failed to prepare and submit an ABCN documenting and justifying use of a different implementing code. Therefore, the use of ASME Section III for the analysis and acceptance was not in accordance with SC 4.2-2, which required the use of ASME Section VIII. This was considered a Finding for failing to meet Contractual requirements to implement the DOE-approved SRD (IR-02-012-F01a).

- 24590-WTP-GPG-ENG-004, Rev. 0, *Engineering Design Guide for Pipe Stress, Pipe Layout and Pipe Spacing*, 24590-WTP-DC-PS-01-001, Rev. 1, *Pipe Stress Design Criteria*, 24590-WTP-DC-01-PS-002, Rev. 1, *Pipe Support Design Criteria*, and 24590-WTP-GPG-ENG-005, Rev. 0, *Engineering Design Guide for Pipe Supports*. These design documents invoked the requirements from ASME Section III, Subsections NC, NF and Appendix F for analysis and allowable stresses for seismic design for piping even though the SC required the use of ASME B31.3-96 and made no reference to ASME Section III. ASME B31.3-96 had requirements for seismic design that could have been applied to WTP piping and pipe supports. However, ASME Section III allowable stresses, which were generally higher than allowed by ASME B31.3-96 for seismic loadings, were used. As was the case for the vessels described above, using those stresses also could result in a less robust design. Therefore, in order to use the higher allowable stresses, and to ensure the resulting design met the governing codes and SC requirements, the contractor must evaluate them and justify their use via the ABCN process. The Contractor failed to prepare and submit an ABCN justifying the use of a different implementing code. Therefore, the use of ASME Section III, for the analysis and acceptance was not in accordance with SC 4.2-2, which required the use ASME B31.3-96. This was a considered a Finding for failing to meet Contractual requirements to implement the DOE-approved SRD (IR-02-012-01b-FIN).

1.2.3 Conclusions

The inspectors determined, in the Civil-Structural building design and analysis area, the Contractor incorporated the safety standards stipulated in the SRD. However, for piping, pipe support and vessel design the Contractor used a design code, ASME Section III, that was not contained in the SRD. This resulted in two examples of a Finding for failure to meet Contractual requirements to implement the DOE-approved SRD (IR-02-012-01a-FIN and IR-02-012-01b-FIN).

1.3 Implementation of SRD Mechanical Design Standards (ITP I-110)

1.3.1 Inspection Scope

This part of the inspection was to verify, by interviewing Contractor personnel and reviewing selected design documents, the Contractor was implementing SC design codes and standards for ITS process safety piping and components, such as tanks, valves, pumps, and heat exchangers, as specified in SC 4.1-3, 4.2-2, 4.4-2, and 4.4-20 of the SRD. The verification was to ensure the following:

- Designated piping materials complied with Chapter VIII, Part 7, of ASME B31.3-96, *Process Piping Code*, Category M. (SC 4.2-2)

- Stipulated welding requirements complied with Chapter VIII, Part 9, Paragraph M328, of ASME B31.3-96. (SC 4.2-2)

- Stipulated piping component material complied with Chapter VIII, Part 8, Paragraph M326, of ASME B31.3-96. (SC4.2-2)

- Seismic design criteria stipulated for piping systems addressed criteria for earthquakes and other loading factors as required by DOE-STD-1020-94. (SC 4.1-3)

- Pressure vessels, heat exchangers, and the pressure-retaining parts of pumps and valves were designed in accordance with the ASME Boiler and Pressure Vessel (B&PV) Section VIII. (SC 4.2-2)

- Valve operators were environmentally qualified in accordance with Institute of Electrical and Electronics Engineers, Inc. (IEEE) 323-83. (SC 4.4-2)

- Heat Exchanger shell minimum thickness was in accordance with Tubular Exchanger Manufacturer's Association (TEMA). (SC 4.4-20).

1.3.2 Observations and Assessments

Although the Contractor had not yet received any ITS materials or components, several items had been ordered. The inspectors reviewed procedure 24590-WTP-3DP-G06B-00001, Rev. 1, *Material Requisitions* (MRs), which defined Engineering responsibilities associated with preparation, review, approval, and control of MRs. The procedure required MRs to identify material or equipment for purchase, and to contain engineering specifications that defined the technical and quality assurance program requirements to permit the Contractor to verify applicable codes and standards were met.

The inspectors reviewed several engineering specifications and discussed them with responsible personnel:

- 24590-WTP-3PS-MV00-T0001, Rev. 0, *Pressure Vessel Design and Fabrication.* Section 2 of the specification listed required codes and standards. ASME Section VIII was included in the list as required by SC 4.2-2. Section 3.2.1 of the specification required seismic analyses performed in accordance with the requirements of 24590-WTP-3PS-MV00-T0002, *Seismic Qualification Criteria for Pressure Vessels*.

- 24590-WTP-3PS-MV00-T0002, Rev. 0, *Seismic Qualification Criteria for Pressure Vessels.* Section 2 of the specification listed required codes and standards. DOE-STD-1020-94 was included in the list as required by SC 4.1-3.

- 24590-WTP-3PS-MVB2-T0001, Rev. 0, *Welding of Pressure Vessels, Heat Exchangers and Boilers*. Section 2 of the specification listed required codes and standards. Although Section 2 did not directly reference ASME B31.3-96 as required by SC 4.2-2, it did contain it by reference because Section 2 included ASME Section IX, *Welding and Brazing Qualifications,* and ASME B31.3-96, in Paragraph 328.2.1, also required qualification of welding procedures and of the performance of welders to conform to the requirements of Section IX. The inspectors determined this was satisfactory.

- 24590-WTP-3PS-P000-T0001, Rev. 0, *Piping Material Classes*. Section 5 of the specification required the piping to meet the applicable design codes in attached piping class sheets, and those sheets included ASME B31.3-96 as required by SC 4.2-2.

- 24590-WTP-3PS-PB01-T0001, Rev. 0, *Technical Supply Conditions for Pipe, Fittings, and Flanges*. The scope stated the specification applied to all material requisitions for pipe, fittings, and flanges purchased per the requirements of the referenced codes as listed in Section 2 of the specification. Section 2 included ASME B31.3-96 as required by SC 4.2-2.

- 24590-WTP-3PS-PS02-T0001, Rev. 1, *Shop Fabrication of Piping*. Section 2, listed required codes and standards. ASME B31.3-96 was included in the list as required by SC 4.2-2.

The inspectors reviewed five MRs:

- 24590-QL-MRA-MVA0-00001, Rev. 1, Pressure Vessels, High Alloy, Shop Fab, >168" (14') Diameter QL-1. The MR was issued for purchase of a Quality Level 1 (QL-1), HLW effluent transfer vessel and a QL-1, plant overflow vessel on August 22, 2002. The attached mechanical systems data sheet contained a section on design data requiring the vessel to be designed in accordance with ASME Section VIII, as required by SC 4.2-2. It also contained Engineering Specifications 24590-WTP-3PS-MV00-T0001, Rev. 0, for pressure vessel design and fabrication; 24590-WTP-3PS-MVB2-T0001, Rev. 0, for welding requirements; and 24590-WTP-3PS-MV00-T0001, Rev. 0, for seismic qualification. This was in compliance with the SC 4.2-2.

- 24590-QL-MRA-MVA0-00002, Rev. 10, Pressure Vessels, High Alloy, Shop Fabricated, Medium, 5-14 ft Diameter QL-1. The MR was issued for purchase of the QL-1, submerged bed scrubber (SBS) condensate vessel (24590-HLW-MV-HOP-VSL-00903) on April 24, 2002. The attached mechanical systems data sheet contained a section on design data requiring the SBS condensate vessel to be designed in accordance with ASME Section VIII, as required by SC 4.2-2. It also contained Engineering Specifications 24590-WTP-3PS-MV00-T0001, Rev. 0, for pressure vessel design and fabrication; 24590-WTP-3PS-MVB2-T0001, Rev. 0, for welding requirements; and 24590-WTP-3PS-MV00-T0002, Rev. 0, for seismic qualification. This was in compliance with SC 4.2-2. However, the specifications also invoked allowable stresses from ASME Section III, which were not part of the SC. This led to a Finding described in more detail in Section 1.2.2 of this inspection report.

- 24590-QL-MRA-PP02-00009, Rev. 0, Pipe, Spool Fabrication, Pulse Vent Fabrication, QL-1. The MR was issued for purchase of QL-1 pipe spools on July 10, 2002. Section 2 of the MR

listed a number of specifications that applied to the purchase. Among those were 24590-WTP-3PS-P000-T0001, Rev. 0, on piping material classes; 24590-WTP-3PS-PB01-T0001, Rev. 0, on technical supply conditions for piping and fittings; and 24590-WTP-3PS-PS-02-T0001, Rev. 1, on shop fabrication of piping. Furthermore, Section 2.4.1 required the fabrication of pipe spools to meet the specification for shop fabrication of piping (which included requirements for ASME B31.3-96). Section 2.4.2 also directed the seller to fabricate pipe spools in strict compliance with ASME B31.3-96. The inspectors determined the listed requirements were in accordance with the SC 4.2-2.

- 24590-QL-MRA-MKAS-00001, Rev. 2, Submerged Bed Scrubbers, Flue Or Off-Gas LAW QL-1. The MR was issued for purchase of three QL-1, submerged bed scrubber vessels (24590-LAW-LOP-SCB-00001, 2, 3) on August 15, 2002. The attached Mechanical Data Sheet required the design code to meet ASME Section VIII criteria. It also listed as requirements specifications 24590-WTP-3PS-MV00-T0001, Rev. 0, for pressure vessel design and fabrication; 24590-WTP-3PS-MVB2-T0001, Rev. 0, for welding of pressure vessels; and 24590-WTP-3PS-MV00-T0002, Rev. 0, for seismic qualification criteria for pressure vessels. The inspectors determined the requirements were in compliance with SC 4.2-2.

- 24590-CM-MRA-PS02-00005, Rev. 1, Pipe, Spool Fabrication (Services) PTF Embedded Drain Pipe. This MR was for the purchase of commercial grade piping. Although the SC were required only for QL piping and not for commercial piping, Section 2 required the seller to meet the requirements of ASME B31.3-96, which is a requirement of SC 4.2-2.

SC 4.4-20 required heat exchanger shell minimum thickness in accordance with the Tubular Exchanger Manufacturers Association (TEMA) standards. However, because the Contractor had not ordered any shell and tube heat exchangers, the inspectors reviewed the engineering specification that would be attached to a purchase order for them (24590-WTP-3PS-MES0-T0001, Rev. B). The specification, together with the purchase order, data sheets, and drawings, covered the requirements for the design, fabrication, and testing of shell and tube heat exchangers. Section 2.2 listed the required codes as ASME Section VIII, Division I, "*Rules for Construction of Pressure Vessels*", and ASME NQA-1-89. Section 2.3 listed the Industry Standard as the TEMA Standard, Eighth Edition, 1999. The specification discussed the use of TEMA standards throughout the document. The inspectors determined this was consistent with SC 4.4-20.

Section 3.7.1 of the engineering specification discussed minimum shell thickness and stated the minimum shell thickness, exclusive of corrosion allowance, must be the greater of ¼ inch or TEMA minimums. Section 3.9 discussed expansion joints and noted, in Section 3.9.3, the minimum thickness must satisfy both TEMA and ASME Section VIII, Division 1, requirements. Section 3.9.1 also stated it was the seller's responsibility to determine the need for shell expansion for the conditions specified by the buyer using TEMA rules. Therefore, even though this was not a numeric revision of the specification, and as long as the referenced standards were not removed from the specification when it becomes a numeric revision, it met the requirements of SC 4.4-20.

1.3.3 Conclusions

The inspectors reviewed five MRs (four QL-1, and one for commercial grade) for purchase of equipment and components. The inspectors also reviewed six engineering specifications containing listings of codes and standards that must be met by sellers and discussed them. Based on the interviews and the documents reviewed above, the inspectors concluded the Contractor implemented SC design codes and standards for ITS process safety piping and components as required by the SRD.

1.4 Implementation of SRD Control, Electrical, Instrumentation, and Human Factors Design Standards (ITP I-110)

1.4.1 Inspection Scope

This part of the inspection was to verify, by interviewing responsible personnel and reviewing selected design documents, the Contractor was implementing SC design codes and standards for ITS control and instrumentation, electrical and human factors design engineering of systems and components as specified in SC 4.1-3, 4.3, and 4.4 of the SRD. The SC documented specific IEEE and Instrument Society of America (ISA) standards as implementing standards as follows:

- Single failure criteria for instrumentation and controls and electrical designs were in accordance with IEEE 379-94**,** *Application of the Single Failure Criterion to Nuclear Power Generating Station Safety Systems*. (SC 4.3-3)

- Equipment qualification requirements were in accordance with IEEE 323-83**,** *IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations*. (SC 4.4-2)

- Seismic qualification requirements were in accordance with IEEE 344-87**,** *IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations*. (SC 4.1-3 and 4.3-2)

- Instrumentation design standards were in accordance with ISA S84.01-1996**,** *Application of Safety Instrumented Systems for the Process Industries,* supplemented with requirements for digital systems control, protection for the effects of EMI/RFI and conformance with setpoint requirements. (SC 4.3-1)

- Electrical separation requirements were in accordance with IEEE 384-92**,** *IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits*. (SC 4.3-2)

- Human factors engineering was incorporated per IEEE 1023-88**,** *IEEE Guide for the Application of Human Factors Engineering to Systems, Equipment and Facilities of Nuclear Power Stations.* (SC 4.3-6)

1.4.2 Observations and Assessments

The inspectors reviewed calculations, MRs and procedures as discussed below to assess if the Contractor implemented the proper SRD design standards.

- SC 4.3-3 required ITS engineering safety systems to be designed for high functional reliability and in-service testability commensurate with the safety functions to be performed. Design provisions should be included to limit the loss of safety functions due to damage to several structures, systems or components important to safety resulting from a common-cause or common-mode failure. It also required the Contractor to meet IEEE 379-94, *Application of the Single Failure Criterion to Nuclear Power Generating Station Safety Systems*. The IEEE standard required safety systems having protective functions for defense against design basis accidents designed to assure a protected event did not result in loss of a protective function.

  The inspectors reviewed 24590-WTP-GPG-I-014, Rev. B, *Control System Design Process Guide*, and 24590-WTP-PL-J-01-004, Rev. A, *Software Project Plan for the Programmable Protection System*. The inspectors determined there were no requirements in the documents to consider or protect against software common-mode failures for protection of the most critical safety functions as required in the SC. Furthermore, the inspectors determined 24590-WTP-3PS-JD03-T0002, Rev. A, *Engineering Specification for Programmable Protection System*, did not address common mode failures. The inspectors discussed this with Contractor personnel who acknowledged there was no documented evidence that the Contractor had considered protection against software common mode failures. In an interview on September 17, 2002, the Contractor Controls and Instrumentation (C&I) Engineering Manager noted to the inspectors that their design procedure was not far enough along in development to identify methods for protection against software common mode failure. In an interview with the C&I Engineering supervisors responsible for development of the design guides, it was clear to the inspectors that the Contractor understands this issue but, as yet, had not identified the methods of protection against software common mode failure that would be utilized in design. This is considered an Inspection Follow-up Item (IR-02-012-02-IFI).

- SC 4.3-2 required when single failure protection was required, ITS engineered safety systems must be designed to ensure the effects of natural phenomena (including lightning) and of normal operating, maintenance, testing, and postulated accident conditions on redundant channels will not result in loss of the protective function, or it must be demonstrated to be acceptable on some other defined basis. The SC required the Contractor to meet IEEE 323-83, *Qualifying Class 1E Equipment for Nuclear Power Generating Stations*, to satisfy the SC.

  The inspectors reviewed engineering specification 24590-WTP-3PS-JD03-T0002, Rev. A, *Engineering Specification for Programmable Protection System*, and material requisitions including MR 24590-QL-MRA-JD03-00001, Rev. 0, *Programmable Protection System – ITS*, and determined they did not require IEEE 323-83 qualification.

The Contractor stated environmental qualification was only required in a harsh environment as defined in a tailored version of IEEE 323-83 submitted in ABCN 24590-WTP-ABCN-ESH-02-003, Rev. 0. The Office of River Protection (ORP) approved the ABCN on September 5, 2002 (DOE letter 02-OSR-0377). The Contractor further stated that because no harsh environment currently existed, as noted in the hazards analysis for WTP, no environmental qualification for harsh environment was required. The inspectors concurred in this assessment.

The SC also required the Contractor to meet IEEE 384-92, *Standard Criteria for Independence of Class 1E Equipment and Circuits*, for electrical separation requirements. The inspectors discussed this with the electrical and controls and instrumentation (C&I) design groups and determined that no design criteria had been issued as yet for implementing this standard. The design criteria were scheduled for issuance in the fall of 2002.

- SC 4.1-3 addressed natural phenomena hazards (NPH) design for structures, systems, and components (SSCs) that were ITS and had NPH safety functions. IEEE 344-87 was the standard invoked by SC 4.1-3 to provide requirements to satisfy the SC.

  The inspectors reviewed engineering specifications and design guides for instrumentation and control for the Programmable Protection System (PPJ) (which was a system designed to provide primary protective function response to design basis hazards) and HLW Melter System including the following:

  - 24590-WTP-DB-ENG-01-001, Rev. 0, *Basis of Design*
  - HLW PSAR Section 4, Rev. E
  - 24590-WTP-GPG-I-014, Rev. B, *Control System Design Process Guide*
  - 24590-WTP-PL-J-01-004, Rev. A, *Software Project Plan for the Programmable Protection System*
  - 24590-WTP-3PS-JD03-T0002, Rev. A*, Engineering Specification for Programmable Protection System*.

  Although the last three items above were “alpha” revisions, the inspectors noted no deviations to the requirements to comply with IEEE 344-87 for NPH protection.

- SC 4.3-1 required engineered safety systems to be designed to initiate the operation of appropriate systems automatically to ensure that specified acceptable design limits were not exceeded as a result of anticipated operational occurrences. The SC listed ISA S84.01-96 as the primary standard to meet those requirements. However, the SC did not specify any guidance or an acceptable methodology for determination of setpoints that would be required to ensure acceptable design limits were not exceeded. Furthermore, the inspectors determined, by reviewing 24590-WTP-GPG-J-014, Rev. B, *Control*

System Design Process Guide, that no instrumentation methodology (such as ISA S67.04-94 or other design guides) existed for the application of instrument uncertainty in the design process. The inspectors discussed this with the Instrument and Controls Department Manager who acknowledged no instrumentation methodology currently existed for determination of setpoints in the design of the WTP. However, he also told the inspectors the Contractor was reviewing possible methodologies for determining setpoints but due to the stage of the design had not yet identified specific setpoints.

- SC 4.3-6 required the Contractor to meet IEEE 1023-88, *IEEE Guide for the Application of Human Factors Engineering (HFE)*. Among other things, the standard required a task analysis be performed as part of the design engineering function, particularly with regard to control room design.

  Section 7 of 24590-WTP-DB-ENG-01-001, Rev. 0, *Basis of Design,* provided overall guidance on control philosophy but did not provide requirements for HFE in the design process. Section 9 provided the basis of design for control and instrumentation but also did not provide input on HFE requirements to the design process. 24590-WTP-3DP-G04B-00001A, Rev. 0, *Design Criteria,* provided overall requirements to be considered in the design process but did not include specific HFE requirements as required by IEEE 1023-88. The inspectors also reviewed 24590-WTP-3PS-JD03-T0002, Rev. A, *Engineering Specification for Programmable Protection System*. It also did not address IEEE 1023-88 or require the vendor to provide any system or components to meet the HFE design principles of IEEE 1023-88.

  At the time of the inspection new documents were being developed to address more specific guidance on control system design. This included 24590-WTP-GPG-J-014, Rev. B, *Control System Design Process Guide,* and 24590-WTP-3PS-JQ00-T00001, Rev. B, *Engineering Specification for WTP Control Room Requirements.* Although both of those documents were preliminary documents neither of them identified any commitment or requirements to implement IEEE 1023-88. In fact, the inspectors determined only a single control document, 24590-WTP-GPG-J-002, Rev. A, *Design Guide for the Human Machine Interface (HMI),* had been developed by the Contractor for HMI applicable to visual display units that invoked IEEE 1023-88 for this portion of the design.

  Therefore, there was no documented evidence the Contractor was implementing the Human Factors requirement of SC 4.3-6 in the design despite being 2 years into the design process. Based on the review of the above listed documents and interviews with the Contractor personnel described below, no written implementation documentation or verbal commitment to IEEE 1023 Section 6.1 Task Analysis was found. During an interview with the Contractor Human Factors Specialist on September 11, 2002, it was determined that draft documentation implementing IEEE 1023 in the LAW PSAR was written, but not included in the PSAR by Contractor management. In an interview with the Contractor C&I Design Manager on September 17, 2002, the manager noted that Human Factors is a weak area and that a formal plan does not exist for the Task Analysis portion of IEEE 1023. Finally, in a formal meeting between the inspector and the Contractor staff, including the Regulatory and Safety Manager, Human Factors Specialist

C&I Design Manager, and Engineering Technology staff on September 18, 2002, in response to a direct question by the inspectors, the Contractor made no verbal commitment to perform the IEEE required Task Analysis steps. Based on the above, BNI did not provide documented evidence for the implementation of SC 4.3-6, which required human error be taken into account in the design; this is a Finding for failure to meet Contractual requirements to implement the DOE approved SRD (IR-02-012-03-FIN).

1.4.3 Conclusions

The inspectors determined for the documents and standards selected and reviewed during the inspection, implementation of electrical standards for Electrical, Instrumentation and Control (I&C), and Human Factors work activities was mixed. There was evidence work was being performed in accordance with appropriate SRD implementing codes and standards. But, there were other cases where the Contractor was not properly implementing required codes and standards. This was evidenced by the inspectors' identification of an Inspection Follow-up Item and a Finding for failure to meet Contractual requirements to implement the Department of Energy approved SRD (IR-02-012-02-IFI) and (IR-02-012-03-FIN) in section 1.4.2.

1.5 Implementation of SRD Mechanical (Ventilation) Design Standards (ITP-110)

1.5.1 Inspection Scope

This part of the inspection was to assess, by interviewing personnel and reviewing selected design documents, the implementation of SRD required codes and standards in the design of HLW mechanical (ventilation) SSCs. The inspectors selected the HLW C5 ventilation duct, high efficiency particulate air (HEPA) filters, and exhaust fans for this inspection.

1.5.2 Observations and Assessments

SC 4.4-6 required each air treatment system designated as Safety Design Class (SDC) to be designed to ensure its operability under normal and accident conditions. It required ASME N509-89, *Nuclear Power Plant Air-Cleaning Units and Components,* ASME AG-1-97, *Code on Nuclear Air and Gas Treatment,* and ASME N510-89, *Testing of Nuclear Air Treatment Systems*, as the Implementing Codes and Standards for the design of SDC air treatment systems. The Implementing Codes and Standards provided requirements for determining the allowable stresses, materials selection, and construction.

The inspectors determined Engineering Specifications 24590-WTP-3PS-MDRM-T0001, Rev. 0, *Heating, Ventilation and Air Conditioning System Seismic Category I and II Ductwork;* 24590-WTP-3PS-MDH0-T0001, Rev. 0, *Heating, Ventilation and Air Conditioning System Category III and IV Ductwork;* and 24590-WTP-3PS-MD00-T0001, Rev. 0, *Heating, Ventilation and Air Conditioning System Installation*, provided the requirements for design, construction, testing, and installation of the HLW C5 ventilation ductwork and met the requirements of ASME AG-1-97,

Section SA. However, the Contractor determined that piping material would be more suitable for ductwork embedded in concrete rather than the ducting material required by ASME AG-1-97. Therefore, the Contractor notified the ORP, via the Decision to Deviate (DTD) process, it planned to change the AB to require the use of piping material for embedded ductwork that met the requirements of ASME B31.3-96 instead of ducting material.

The Contractor developed drawings 24590-HLW-P3-P33T-00001, Rev. 2, *HLW Vitrification Building, Canister Handling Embedded C5* Duct, dated July 17, 2002; 24590-HLW-P3-P33T-00002, Rev. 3, *HLW Vitrification Building Melter Cave #1, Embedded C5 Duct,* dated July 17, 2002; and 24590-HLW-P3-P33T-00003, Rev. 2, *HLW Vitrification Building, Melter Cave #2, Embedded C5 Duct,* dated July 17, 2002, for the installation and installed the ductwork. The drawings required the use of material that complied with ASME B31.3-96. The standard for C5 ventilation ductwork that was not embedded in concrete continued to be ASME AG-1-97. At the time of the inspection, however, the Contractor had not revised the Engineering Specifications to reflect the new material. The HVAC Engineering Supervisor stated the Specifications would be changed. This will be verified during closeout of Finding IR-02-012-04-FIN discussed below.

Contractor engineers had performed a stress analysis of the HLW C5 ventilation embedded duct to qualify the duct for the thermal effect of a melter pour spill. Calculation 24590-HLW-P6C-P40T-00001, Rev. B, *Stress Analysis Report of HLW C5 Embedded Steel Duct,* approved May 1, 2002, and marked "committed preliminary," provided the stress report for the ducting. The calculation used ASTM A312 Grade TP304 as the duct material. However, the HLW C5 ventilation embedded duct material was required, by the drawings referenced above, to be ASTM A240 Grade 304L. The inspectors considered the incorrect use of ASTM A312 Grade TP304 in the design calculation rather than the correct ASTM A240 Grade 304L as a Finding (IR-02-12-04-FIN) for failure to follow procedures as required by the Contractor's Quality Assurance Manual (QAM). QAM Policy Q-05.1 required activities affecting quality to be prescribed by, and performed in accordance with, documented procedures and drawings. Contractor Procedure 24590-WTP-3DP-G04B-00037C, Rev. 0, *Engineering Calculations*, provided requirements for preparing, checking, and approving calculations. Section 3.2.3 of the procedure required calculations to include design inputs, and section 3.4 required checkers to verify the calculations complied with design criteria. Section 3.5 required the cognizant Discipline Manager to review the design calculation to ensure their completeness and conformance with design requirements.

The calculation itself used 20,000 psi as the allowable stress for the ASTM A312 Grade TP304 material. But, the allowable stress for the correct material, ASTM 240 Grade 304L, was 16,700 psi. The calculation also determined the HLW C5 ventilation embedded duct would be subject to 19,560 psi due to sustained loads. Thus, the calculation showed that the installed HLW C5 ventilation embedded duct could be subject to sustained design loads that exceeded the code allowable stress for the material required by the installation drawings. The inspectors discussed this with the Contractor who subsequently provided the inspectors with a Certified Material Test Report (CMTR) that showed the actual strength of the embedded material was greater than the calculated stresses that would be encountered. The strength of the material, as shown on the CMTR, will be verified by ORP during closeout of the Finding.

SC 4.4-6 required the air treatment systems to be designed to operate under normal and accident conditions, and referenced ASME AG-1-97 as a required standard. Some of the important components of the air treatment system were the High Efficiency Particulate Air (HEPA) filters. Though the purchase orders for the filters were scheduled to be issued September 27, 2002, the Contractor had not issued them because on September 6, 2002, it identified the AB must be changed to add an addendum to ASME AG-1-97 (i.e., ASME AG-1a-00). The Contractor committed to submit to the ORP a Decision to Deviate (DTD) from the SRD and an ABCN to provide justification for the change in the standard before the purchase of the filters. This was evidence to the inspectors the Contractor personnel involved with the HEPA filters understood the standards implementation change process.

The inspectors interviewed Contractor staff and reviewed engineering specifications for the HEPA filters (24590-WTP-3PS-MKH0-T0003, Rev. A, *Engineering Specification for Remote Change HEPA Filter Housings, Rev. A* and 24590-WTP-3PS-MKH0-T0002, Rev. 0, *Engineering Specification for HEPA Filters*) to determine how the SC requirements were implemented. The Contractor staff was knowledgeable of the requirements, and the HEPA filter engineering specifications and associated DIMs referenced the requirements.

To further determine whether the SC requirements had been implemented, the inspectors interviewed Contractor Environmental, Safety and Health (ES&H) personnel to ascertain whether ashfall had been evaluated as one of the natural phenomena hazards (SC 3.1-4). The ES&H personnel informed the inspectors ashfall considerations had not been evaluated as a hazard for the HEPA filters because it was not considered a likely scenario. They also stated this lack of likely scenario had not been documented. The personnel stated they would evaluate and document that scenario in subsequent revisions of Volume 1 of the PSAR and FSAR. This explanation was provided to the ORP and is being dispositioned through the PSAR and FSAR review process.

The inspectors reviewed Engineering Specification 24590-WTP-3PS-MACS-T0001, Rev. 1, *High Integrity Centrifugal Fans,* that was issued to specify the requirements for the design, materials of construction, fabrication and testing of the HLW C5 ventilation exhaust fans. They confirmed the specification met the requirements of ASME AG-1-97, Section BA. The inspectors determined the Contractor had issued MR 24590-QL-MRA-MACS-00001, *High Integrity Centrifugal Fans QL-1 (U6L1),* Rev. 1, and purchase order 24590-QL-POA-MACS-00001, *High Integrity Centrifugal Fans QL-1 (U6L1),* Rev. 0, for the purchase of Low Activity Waste (LAW) C5 ventilation exhaust fans, and used the engineering specification for HLW fans as the design basis. The Contractor informed the inspectors that the purchase order for the HLW fans had not yet been issued pending receipt of engineering data sheets. However, the Contractor stated the LAW requisition and purchase order would be used for the HLW fans. The inspectors reviewed the purchase order for the LAW fans and determined it required the LAW fans to be manufactured and tested in accordance with specification 24590-WTP-3PS-MACS-T0001, Rev. 1. The inspectors determined that the purchase of the HLW C5 ventilation exhaust fans tested in accordance with specification 24590-WTP-3PS-MACS-T0001 would meet the requirements of the SRD.

1.5.3 Conclusions

Except for one calculation, the inspectors concluded the Contractor incorporated the SRD required design standards into the design of HLW ventilation ducting. The calculation resulted in the inspectors identifying a Finding (IR-02-012-04-FIN) related to the use of an allowable stress that exceeded the ASME B31.3-96 allowable stress for the embedded duct piping. The inspectors also determined that while few final documents (i.e., Rev. 0) were available for review for the HEPA filters, two interim engineering specifications related to the filters demonstrated the Contractor was implementing the HEPA standards specified in the SRD, and the responsible personnel were knowledgeable of the requirements (Section 1.5.2).

1.6 Implementation of SRD Fire Protection Design Standards (ITP-110)

1.6.1 Inspection Scope

The inspectors reviewed specifications, calculations, and drawings for fire protection SSCs and interviewed Contractor engineering personnel to assess the implementation of the Implementing Codes and Standards required by the SRD in the design of HLW fire protection SSCs. The inspectors assessed implementation of required standards in the design of HLW building fire barriers, fire barrier penetration seals, fire detection and alarm system, fire suppression sprinkler system, and building floor drainage system.

1.6.2 Observations and Assessments

During this inspection period, the Contractor was still in an early phase of the HLW Fire Protection design. Design documentation was either preliminary or had not yet been initiated for many aspects of the Fire Protection program.

SC 4.5-20 required the Contractor to perform a Fire Hazards Analysis (FHA) of the facility to confirm the facility could be placed in a safe state during and after all credible fire and explosion conditions. The Contractor prepared 24590-HLW-RPT-ESH01-001*, Preliminary Fire Hazards Analysis for the High-Level Waste Building,* Rev. 0*,* and submitted it to ORP for review and approval on February 19, 2002. At the time of this inspection, the Contractor was still resolving questions resulting from the ORP review. The inspectors reviewed the HLW Preliminary FHA to understand the HLW Fire Protection design and determined the design was based on the requirements for building materials of construction, definition of fire areas, fire barriers, fire detection and alarm features, and automatic and manual fire suppression. The analysis included a calculation for the response time for the Hanford Fire Department that was included in the manual fire suppression analysis. The calculation used fire engine speeds of 45 mph outside the WTP fence and 15 mph speed inside the fence to determine a response time of approximately 8 minutes and 18 seconds under ideal conditions. The inspectors determined that this response time calculation was reasonable.

SC 4.5-2 required buildings containing a significant quantity of radioactive and/or hazardous material to be constructed of noncombustible or fire-resistive material, where appropriate. National Fire Protection Association (NFPA) 801*, Standard for Facilities Handling Radioactive Materials, 1995 Edition*, was required as an implementing standard for this criterion. NFPA 801-95, Section 3-5, required buildings in which radioactive materials were to be used, handled, or stored to be fire resistive or noncombustible (Type I or Type II in accordance with NFPA-220*, Standard on Types of Building Construction*). However, DOE letter 02-OSR-0382 approved ABCN 24590-WTP-ABCN-ESH-02-012*, Types of Building Construction – Fire Resistance Rating,* to tailor NFPA 801-95, Section 3-5 and replace "Type I or Type II in accordance with NFPA-220, *Standard on Types of Building Construction"* with "Fire Resistive in accordance with the 1997 edition of the Uniform Building Code (UBC-97)."

The inspectors determined the HLW Preliminary FHA subdivided the HLW building into fire areas separated by 2-hour rated fire barriers and the UBC-97 construction type classification for the HLW building was Type I-FR (fire resistive). The barriers were of reinforced concrete and structural steel construction or other fire rated materials with rated fire doors, fire dampers, and penetration seals. Contractor architects informed the inspectors that the HLW building was being designed as a Type II Fire Resistive structure in accordance with UBC-97 but design documents at the time of the inspection were predominantly preliminary and/or draft documents.

SC 4.5-3 required confinement of the fire to its origin should be achieved by passive barriers and by activating systems such as fire and smoke dampers, exhaust fans, and drainage pumps to prevent migration of gases, hot combustion products, and flammable liquids outside the fire area. It required the use of NFPA 801-95 as an implementing standard. Section 3-6.1 and Appendix A, Section A-3-6.1 of NFPA 801-95 required penetration seals for electrical and mechanical openings to meet the requirements of ASTM E 814*, Fire Tests of Through-Penetration Fire Stops*, or Underwriter Laboratories (UL) 1479*, Fire Tests of Through-Penetration Fire Stops*. The inspectors interviewed the Engineering Fire Protection Supervisor and the Architect assigned responsibility for the design of fire barrier penetration seals. Contractor personnel were aware of the SRD and implementing code requirements for fire barrier penetration seals.

Section 3-10.2 of NFPA 801-95 required provisions for drainage design in areas handling radioactive materials and in any associated drainage facilities (e.g., pits, sumps, and sump pumps) to be sized to the criteria provided by Section 3-10.2. Fire protection and mechanical systems engineering personnel informed the inspectors that the HLW process drain facilities were being designed to accommodate the maximum flow from automatic suppression systems (i.e., sprinklers) or a 500 gpm hose stream for a period of 30 minutes. However, at the time of the inspection, there were no Rev. 0 calculations for the HLW drainage system design.

SC 4.5-7 required the facility to include a fire detection system to detect the presence of a fire and activate alarm systems so measures for confinement and suppression of the fire and personnel evacuation could start promptly. The detection system must include a means to summon the Hanford Site fire department and be capable of operation without offsite power. The SC required the use of NFPA 801-95 as an implementing standard. Section 4-8 of that standard specified design requirements for the "Fire Signaling System" and required the use of NFPA 72*, National Fire Alarm Code,* for the installation of the fixed fire suppression and alarm systems.

The Contractor informed the inspectors that a specification had been issued for the fire suppression and alarm systems but the sub-contracting process had not been completed. The inspectors reviewed specification 24590-3PS-JQ05-T0001*, Engineering Specification for Fire Detection System, Rev. 0.* It provided the requirements for a fire detection alarm system which met the requirements of NFPA Standard 72 and NFPA 801, Section 4-8.

1.6.3 Conclusions

Contractor personnel were adequately knowledgeable of SRD SC, and Implementing Codes and Standards requirements for the design and construction of WTP fire protection SSCs. At the time of this inspection, the design of fire protection SSCs was preliminary or partially complete (i.e., specifications had been issued but purchase orders had not). The fire protection design and construction codes and standards implemented by the Contractor in the limited and preliminary design documents reviewed were consistent with the SRD, Section 4.5 Implementing Codes and Standards.

1.7 Deviations From Implementation of the Design Standards

1.7.1 Inspection Scope

The inspectors interviewed Contractor personnel and reviewed documents to determine whether the Contractor staff was knowledgeable of Contract design requirements, the SRD standards, and the process for revising the authorization basis documents.

1.7.2 Observations and Assessments

The inspectors determined during interviews the Contractor staff was knowledgeable of the Contract and AB requirements. When questioned directly, several staff unhesitatingly volunteered the process which must be followed if a standard to be implemented appeared to be different than an existing AB requirement. There was direct evidence of this in at least three cases reviewed by the inspectors. In one case, the Contractor was preparing to issue a purchase order for HEPA filters when it identified the AB had to be changed to add an addendum to a required standard (Section 1.5.2 of this report). In another case, the Contractor requested a change for the environmental qualification of valve operators because it believed the existing requirements would not have been applicable to the WTP (Section 1.3.2). In a third case, a change to the AB was requested related to fire resistance ratings of WTP buildings (Section 1.6.2). There also have been numerous other ABCNs submitted to the ORP since the time of the last inspection.

Nevertheless, the inspectors also identified examples where the Contractor failed to implement the AB change process effectively. Three of these were the subjects of the Findings identified in this report. One of the Findings dealt with embedded ductwork for the HLW C5 ventilation system (Section 1.5.2). There were also two examples of a Finding that dealt with the use of

improper stress allowances for vessels and pipes (Section 1.2.2). None of the examples had any direct safety impact on construction or design of the WTP because the errors were on preliminary documents or were identified in time to correct them. Nonetheless, this was indicative that weaknesses existed in the implementation of design standards.

1.7.3 Conclusions

The inspectors identified mixed results in the implementation of design standards. On one hand, Contractor personnel who were interviewed appeared to be knowledgeable of Contract design requirements and SRD standards and the process required to change them. Contrary to this, the inspectors identified several examples where work being performed was not in accordance with existing standards and the AB change process was not followed. The inspectors therefore were not able to conclude Contractor personnel were sufficiently knowledgeable of Contract design requirements, the SRD standards, and the process for revising AB standards. This will be evaluated in more detail in an AB maintenance inspection scheduled for the near future.

2.0 EXIT MEETING SUMMARY

The inspectors presented the inspection results to members of Contractor management at an exit meeting on September 20, 2002. The Contractor acknowledged the findings and observations presented. The inspectors asked the Contractor whether any materials examined during the inspection should be considered limited rights data. The Contractor stated that no limited rights data was examined during the inspection.

For inspection Finding IR-02-012-04-FIN, which identified material embedded in concrete that potentially had an allowable stress less than that specified on the drawing, the Contractor stated they would check into this further and get back with the inspectors. On September 24, 2002, subsequent to the exit, the Contractor provided the inspectors with a CMTR that showed the actual strength of the embedded material was greater than the calculated stresses that would be encountered.

3.0 REPORT BACKGROUND INFORMATION

3.1 Partial List of Persons Contacted

S. Anderson, C&I Engineering Manager
T. Austin, Automation Engineering
D. Brooks, Senior Human Factors Specialist
C. Brown, Sub-lead, HLW Plant Design, Engineering
D. Cragin, Supervisor, HLW HVAC, Engineering
T. DeGarmo, Lead, Fire Safety, Environmental, Safety and Health
R. Dickey, Safety and Licensing Engineer
L. Donovan, LAW Melter Design Supervisor

P. Douglass, C&I Engineering Supervisor
D. Eadie, Lead, HLW Architecture, Civil Structural and Architecture
M. Erlinger, Quality Assurance
J. Fish, Automation Engineering
J. Forrest, SQA and ES&H Lead – C&I Engineering
D. Gott, Supervisor, HLW Plant Design, Engineering
B. Harchburger, Sr. Engineer, Electrical Engineering
J. Hinckley, LAW Hazards and Safety Analysis Lead
T. Ho, Engineering Department Supervisor
L. Kessie, Architect Supervisor, Civil Structural and Architecture
K. Lasko, Commissioning and Training
J. Lee, Engineering Technology
P. Lowry, HLW Hazards and Safety Analysis Lead
L. McAdams, ES&H Representative, C&I Engineering
C. McKnight, Supervisor, Fire Protection Engineering
D. Markman, Melter System, C&I Engineering
T. Meagher, Industrial Safety Manager, Environmental, Safety and Health
B. Mellony, Automation Engineering
J. Miller, Deputy Plant Design Manager, Engineering
M. Platt, Safety Program Lead
B. Rao, Discipline Manager for Mechanical Systems
M. Rees, Deputy Architect Supervisor, Civil Structural and Architecture
J. Shen, Plant Design Stress & Supports Supervisor
C. Slater, Mechanical Systems, Pressure Vessel & Tanks Lead
L. Solis, Senior Engineer, PT HVAC, Engineering
B. Spezialetti, Safety and Licensing Manager
T. Spicer, I&C Engineering
P. Talmage, QA Software Lead
A. Tan, Senior Mechanical Engineer, HLW HVAC, Engineering
S. Thomson, Engineering Technology Manager
A. Tiwari, Deputy Manager – Electrical Engineering
S. Vail, Engineering Compliance Supervisor
J. Weetch, Pipe and Valve Supervisor
M. Wright, Supervisor, HLW Mechanical Systems Engineering

3.2 List of Inspection Procedures Used

ITP I-110, "SRD Design Standards Implementation Assessment"

3.3 List of Items Opened, Closed, and Discussed

3.3.1 Opened

IR-012-02-01a-FIN	Finding	Contractor Engineering Specification 24590-WTP-3PS-MV00-T0002, Rev. 0, Seismic Qualification Criteria for Pressure Vessels, used ASME Section III allowable stresses instead of ASME Section VIII allowable stresses. (Section 1.2.2)
IR-012-02-01b-FIN	Finding	Contractor Engineering Specification 24590-WTP-DC-PS-01-001, Rev. 1, Pipe Stress Design Criteria, and 24590-WTP-DC-01-PS-002, Rev. 1, Pipe Support Design Criteria, used ASME Section III allowable stresses in the seismic design and analysis of piping instead of ASME B31.3-96 allowable stresses. (Section 1.2.2)
IR-012-02-02-IFI	Inspection Follow-up Item	There was no documented evidence the engineering specification for the PPJ, which was an ITS system with protective functions, complied with the single failure criteria for software common mode failures. (Section 1.4.2)
IR-012-02-03-FIN	Finding	There was no documented evidence the Contractor had established a process that incorporated human factors engineering in the facility design. (Section 1.4.2)
IR-012-02-04-FIN	Finding	Contractor calculation 24590-HLW-P6C-P40T-00001, Rev. B, Stress Analysis Report of HLW C5 Embedded Steel Duct, used 20,000 psi as the allowable stress for accepting installed HLW C5V embedded ducting instead of the allowable 16,700 psi. Furthermore, the 19,600 psi calculated stress for the installed ductwork exceeded the ASME B31.3-96, Table A-1, allowable stress. (Section 1.5.2)

3.3.2 Closed

None

3.3.3 Discussed

None

3.4 List of Acronyms

AB	authorization basis
ABCN	Authorization Basis Change Notice
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
B&PV	Boiler and Pressure Vessel Code
BNI	Bechtel National, Inc.
CMTR	Certified Material Test Report
C&I	controls and instrumentation
DTD	Decision to Deviate
DOE	U. S. Department of Energy
EMI	electromagnetic interference
ES&H	Environment, Safety and Health
ESQ&H	Environment, Safety, Quality and Health
FSAR	Final Safety Analysis Report
FHA	Fire Hazards Analysis
FR	Fire-Rated
HFE	Human Factors Engineering
HEPA	High-Efficiency Particulate Air
HLW	High Level Waste
HMI	Human Machine Interface
HVAC	Heating, Ventilation, and Air Conditioning
I&C	Instrumentation and Control
IEEE	Institute of Electrical and Electronic Engineers, Inc.
ISA	Instrument Society of America
ITP	Inspection Technical Procedure
ITS	important-to-safety
LAW	Low Activity Waste
MRs	Material Requisitions
NFPA	National Fire Protection Association
NPH	natural phenomena hazard
OBE	Operating Basis Earthquake
ORP	Office of River Protection

PPJ	Programmable Protection System
PSAR	Preliminary Safety Analysis Report
QA	quality assurance
QL	Quality Level
RFI	radiofrequency interference
SBS	submerged bed scrubber
SC	Safety Criteria
SDC	Safety Design Class
SDS	Safety Design Significant
SRD	Safety Requirements Document
SSCs	structures, systems, and components
TEMA	Tubular Exchangers Manufacturers Association
UBC	Uniform Building Code
UL	Underwriter Laboratories
WTP	Waste Treatment and Immobilization Plant