3.0 DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT, AND SYSTEMS

This chapter of the Final Safety Analysis Report (FSAR) discusses the principal architectural and engineering design of those structures, systems, components, (SSCs) and equipment that are important to safety. It also provides information regarding design, fabrication, erection, and testing to quality standards commensurate with the importance of their safety functions to be performed during the life of the plant. Recognized industry codes and standards are applied per the safety classifications to ensure meeting the required safety-related function.

3.1 Conformance with Criteria

3.1.1 Introduction

This section of the FSAR addresses the principal design criteria of the Advanced Boiling-Water Reactor (ABWR) Standard Plant measured against the U. S. Nuclear Regulatory Commission (NRC) General Design Criteria (GDC) for Nuclear Power Plants, Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50 Appendix A.

3.1.2 Summary of Application

Section 3.1 of the South Texas Project (STP) Units 3 and 4 Combined License (COL) FSAR incorporates by reference Section 3.1 of Revision 4 of the ABWR design control document (DCD). In addition, Section 3.1 of the COL FSAR includes the following departures:

Tier 1 Departure

- STD DEP T1 2.4-1 — Residual Heat Removal System and Spent Fuel Pool Cooling

This departure adds the capability to choose a third loop of residual heat removal (RHR) in the Augmented Fuel Pool Cooling and Fuel Pool Makeup Modes.

- STD DEP T1 2.15-1 — Re-Classification of Radwaste Building Substructure from Seismic Category I to Non-Seismic

This departure reclassifies the radwaste building substructure from Seismic Category 1 to non-seismic.

- STD DEP T1 3.4-1 — Safety-Related I&C Architecture

This departure proposes to change safety-related instrumentation and control (I&C) architecture, including the replacement of the essential multiplex system and the non-essential multiplex system in the ABWR design with a separate and independent system-level data communication.

- STP DEP T1 5.0-1 Site Parameters

This departure identifies site parameters specific to STP Units 3 and 4 that were considered in the design. Specific parameters include flood level and maximum probable precipitation.

Tier 2 Departures Not Requiring Prior NRC Approval

- STP DEP 8.2-1 Electrical Equipment Numbering

This departure addresses offsite electrical design that is unique to STP Units 3 and 4.

- STP DEP 1.1-2 Dual Units at STP 3 & 4

The ABWR DCD design is for one unit. This departure identifies the STP as dual units with some shared equipment and structures.

3.1.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is documented in Section 3.1 of NUREG-1503, "Final Safety Evaluation Report Related to Certification of the ABWR Standard Design," dated July 1994.

In accordance with Section VIII, "Processes for Changes and Departures," of "Appendix A to Part 52--Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies Tier 1 and Tier 2 departures. Tier 1 departures are subject to the requirements of 10 CFR Part 52 Appendix A, Section VIII.A.4. Tier 2 departures are subject to the requirements of 10 CFR Part 52 Appendix A Section VIII.B.5, which are similar to the requirements in 10 CFR 50.59.

The regulatory basis for the acceptance of Tier 1 departures is in NUREG–0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," or Standard Review Plan (SRP), Section 3.1 and in Appendix A to 10 CFR Part 50.

3.1.4 Technical Evaluation

As documented in NUREG–1503, NRC staff reviewed and approved Section 3.1 of the certified ABWR DCD. The staff reviewed Section 3.1 of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to the conformance with criteria.

The staff reviewed the information in the COL FSAR:

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3 for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

Tier 1 Departure

- STD DEP T1 2.4-1 — Residual Heat Removal System and Spent Fuel Pool Cooling

This departure adds the capability to choose a third loop of RHR in the Augmented Fuel Pool Cooling and Fuel Pool Makeup Modes. In FSAR Subsection 3.1.2.6.4.2, "Evaluation Against Criterion 63," an editorial change notes the third RHR loop in demonstrating compliance with GDC 63, "Monitoring Fuel and Waste Storage This departure is evaluated in Chapter 5 of this Safety Evaluation Report (SER).

- STD DEP T1 2.15-1 — Re-Classification of Radwaste Building Substructure from Seismic Category I to Non-Seismic

This departure reclassifies the radwaste building substructure from Seismic Category 1 to non-seismic. FSAR Subsection 3.1.2.6.2.2.1, "Fuel Storage and Handling System," refers to the reclassification of the radwaste building substructure to non-seismic in demonstrating compliance with GDC 61, "Fuel Storage and Handling and Radioactivity Control." This departure is evaluated in Chapter 14 and Sections 3.7 and 3.8 of this SER.

- STD DEP T1 3.4-1 — Safety-Related I&C Architecture

This departure proposes changes to safety -related I&C architecture. This departure is evaluated in Chapters 7 and 14 of this SER. FSAR Subsection 3.1.2.3.3.2, "Evaluation Against Criterion 22," clarifies the elimination of the multiplex system in demonstrating compliance with GDC 22, "Protection System Independence."

- STP DEP T1 5.0-1 — Site Parameters

This departure identifies site parameters specific to STP Units 3 and 4 that were considered in the design, such as flood level and maximum probable precipitation. The applicant provides additional information in FSAR Subsection 3.1.2.1.2.2, "Evaluation Against Criterion 2," in demonstrating compliance with GDC 2, "Design Bases for Protection Against Natural Phenomena.

Tier 2 Departures Not Requiring Prior NRC Approval

- STP DEP 8.2-1 — Electrical Equipment Numbering

This departure addresses the offsite electrical design that is unique to STP Units 3 and 4. FSAR Subsection 3.1.2.2.8.2.2, "Offsite Electric Power System," summarizes and describes the electrical system and refers to FSAR Sections 8.1.1, "Offsite Transmission Network"; 8.1.2, "Electrical Power Distribution System"; and 8.2, "Offsite Power System." This departure is evaluated in Chapter 8 of this SER.

- STP DEP 1.1-2 — Dual Units at STP 3 & 4

The ABWR DCD design is for one unit. Therefore, compliance with GDC 5, "Sharing of Structures, Systems, and Components," is not applicable. In this departure, the applicant proposes to construct two ABWR units at the STP site. FSAR Subsection 3.1.2.1.5.2,

"Evaluation Against Criterion 5," demonstrates compliance with GDC 5, specifically for the fire protection water supply. This departure is evaluated in various chapters of this SER.

In addition, FSAR Subsection 3.1.2.4.16.2, "Evaluation Against Criterion 45," clarifies the scope of components that comply with GDC 45, "Inspection of Cooling Water System."

Overall, revisions to Section 3.1 of STP COL FSAR are clarifications that are needed to ensure consistency with the detailed descriptions in other FSAR sections. Therefore, the staff found these changes acceptable.

3.1.5 Post Combined License Activities

There are no post-COL activities related to this section.

3.1.6 Conclusion

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. The staff's review confirmed that there is no outstanding issue related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52 Appendix A, Section VI.B.1, all nuclear safety issues relating to the conformance with NRC general design criteria that were incorporated by reference have been resolved.

The staff's review confirmed that the applicant has addressed the relevant information, and no outstanding information is expected to be addressed in the COL FSAR related to this section.

3.2 Classification of Structures, Components, and Systems

3.2.1 Seismic Classification

3.2.1.1 *Introduction*

This section of the FSAR addresses the requirement that nuclear power plant structures, systems, and components (SSCs) important to safety be designed to withstand the effects of earthquakes without losing the capability to perform their safety functions. Certain features that are safety-related are necessary to ensure (1) the integrity of the reactor coolant pressure boundary (RCPB), (2) the capability to shut down the reactor and maintain it in a safe-shutdown condition, and (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures. The earthquake for which these safety-related features of the plant are designed is defined as the safe-shutdown earthquake (SSE). The SSE is based on an evaluation of the maximum earthquake potential for the site and is the earthquake that produces the maximum vibratory ground motion for which SSCs are designed to remain functional. Those features of the plant that are designed to remain functional if an SSE occurs are designated Seismic Category I in RG 1.29, "Seismic Design Classification," Revision 4.

3.2.1.2 *Summary of Application*

Section 3.2.1 of the STP Units 3 and 4 COL FSAR incorporates by reference Section 3.2.1 of the certified ABWR DCD Revision 4 referenced in Appendix A to 10 CFR Part 52. In addition, in FSAR Section 3.2.1, the applicant provides the following:

Tier 1 Departures

- STD DEP T1 2.4-3 RCIC Turbine/Pump

This departure replaces the reactor core isolation cooling (RCIC) system pump and turbine design in the DCD with a monoblock turbine/pump design for improved reliability, performance, and simplicity. The departure identifies the RCIC turbine/pump and piping as Seismic Category 1 in Table 3.2-1 of the COL FSAR.

- STD DEP T1 2.14-1 Hydrogen Recombiner Requirements Elimination

This departure eliminates the requirement to maintain equipment needed to mitigate a design-basis, loss-of-coolant accident (LOCA) hydrogen release, consistent with the requirements of 10 CFR 50.44.

- STD DEP T1 2.15-1 Reclassification of Radwaste Building Substructure from Seismic Category 1 to Non-Seismic

This departure changes the seismic classification of the radwaste building substructure and commits to follow the guidance of RG 1.143.

- STD DEP T1 3.4-1 Safety Related Instrumentation and Control Architecture

This departure eliminates the multiplexing system, renames several instrumentation and control (I&C) systems, and adds the Seismic Category I engineered safety feature (ESF) logic and control system to COL FSAR Table 3.2-1.

Tier 2 Departure Requiring Prior NRC Approval

- STD DEP 8.3-1 Plant Medium Voltage Electrical System Design

This departure changes the voltage of the safety-related switchgears from 6,900 volts to 4,160 volts. The seismic classification is unchanged from that in the DCD. This departure affects the Technical Specifications (TS).

Tier 2 Departures Not Requiring Prior NRC Approval

- STD DEP 9.1-1 Update of Fuel Storage and Handling Equipment

This departure changes the safety classification of the fuel-serving equipment from Safety Class 2 to nonsafety. The seismic classification is unchanged from that in the DCD.

- STD DEP 9.3-2 Breathing Air System

This departure describes a new breathing air system (BAS) that is entirely separated from the existing service air system (SAS). The BAS identifies its containment isolation (including supports, valves, and piping) as Seismic Category 1 in Table 3.2-1 of the COL FSAR.

Supplemental Information

The applicant adds “Hot Machine Shop” under system U95 to Table 3.2-1 of the COL FSAR.

3.2.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is in NUREG–1503. In addition, the relevant requirements of the Commission regulations for the seismic qualification, and the associated acceptance criteria, are in Section 3.2.1 of NUREG–0800.

In accordance with Section VIII, “Processes and Changes and Departures,“ of, “Appendix A to Part 52--Design Certification Rule for the U.S. Advanced Boiling Water Reactor,” the applicant identifies Tier 1 and Tier 2 departures. Tier 1 departures require prior NRC approval and are subject to the requirements specified in 10 CFR Part 52 Appendix A, Section VIII.A.4. Tier 2 departures affecting the TS require prior NRC approval and are subject to the requirements of 10 Part CFR PART 52 Appendix A, Section VIII.C.4. Tier 2 departures not requiring prior NRC approval are subject to the requirements of 10 Part CFR PART 52 Appendix A, Section VIII.B.5, which are similar to the requirements in 10 CFR 50.59.

The relevant NRC requirements for reviewing the additional information in the application are in Section 3.2.1 of NUREG–0800. The specific regulations are as follows:

1. General Design Criterion (GDC) 2, as it relates to the requirements that SSCs important to safety shall be designed to withstand the effects of earthquakes without losing the capability to perform necessary safety functions.
2. GDC 61, as it relates to the design of radioactive waste systems—and other systems that may contain radioactivity—to assure adequate safety under normal and postulated accident conditions.
3. 10 CFR Part 100, Appendix A and 10 CFR Part 50, Appendix S as they relate to certain SSCs designed to withstand the SSE and to remain functional.

Acceptance criteria that adequately meet the above requirements include:

1. GDC 2, 10 CFR Part 100 Appendix A, and 10 CFR Part 50 Appendix S regarding seismic design classification are met by using the guidance in RG 1.29, "Seismic Design Classification." This regulatory guide describes an acceptable method for identifying and classifying those features of the plant that should be designed to withstand the effects of the SSE.
2. RG 1.151 provides guidance for establishing the seismic design requirements and the classification of safety-related instrumentation sensing lines.
3. RG 1.143 provides guidance for establishing the seismic design requirements of radioactive waste management SSCs to meet the requirements of GDC 2 and 61, as they relate to designing these SSCs to withstand earthquakes. This regulatory guide identifies several radioactive waste SSCs requiring some level of seismic design consideration.
4. RG 1.189 provides guidance for establishing the design requirements of fire protection to meet the requirements of GDC 2, as it relates to designing these SSCs to withstand earthquakes. This regulatory guide identifies portions of fire protection SSCs requiring some level of seismic design consideration.

3.2.1.4 *Technical Evaluation*

As documented in NUREG–1503, NRC staff reviewed and approved Section 3.2.1 of the certified ABWR DCD. The staff reviewed Section 3.2.1 of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this section.

The staff reviewed the information in the COL FSAR:

Compliance with Regulatory Guidance

NRC staff reviewed COL FSAR Tier 2 Table 1.9S-1 and found that the classification of site-specific SSCs conforms to RG 1.29 Revision 4, RG 1.143 Revision 2, and RG 1.189 Revision 1. The conformance to the latest regulatory guide revisions is acceptable because it is consistent with the guidance in Section C.I.1.9.1 of RG 1.206, which states that "COL applicants should provide an evaluation of conformance with the guidance in NRC regulatory guides in effect 6 months before the submittal date of the COL application."

In STP DEP 1.1-2, the applicant changes the fire protection pump house and storage tanks design to allow the dual units to share the fire water supply system, as permitted in RG 1.189. When the ABWR DCD was initially submitted for NRC review, RG 1.189 had not been issued. However, ABWR DCD Subsection 9.5.1.3.2 states that the sprinkler systems and the portions of the wet standpipe system within the control and reactor buildings and one train of the fire suppression water supply system are analyzed to remain functional following an SSE. The seismic design of the fire water supply system will meet Regulatory Positions 3.2.1.j and 3.2.2.a of the RG 1.189 issued later and is therefore acceptable.

Tier 1 Departures

- STD DEP T1 2.4-3 RCIC Turbine/Pump

The separate casing design of the RCIC system pump and turbine in the DCD has been changed in the COL FSAR to a single casing design. As a result, the separate entry for the RCIC turbine in the Section 3.2 table is deleted in the COL FSAR. The classification for the RCIC turbine/pump and associated piping remains Seismic Category I to ensure that they are functional during and after an SSE. The classification is considered acceptable. The detailed evaluation of this Tier 1 departure is in Section 5.4 of this Safety Evaluation Report (SER).

- STD DEP T1 2.14-1 Hydrogen Recombiner Requirements Elimination

10 CFR 50.44 was amended after the issuance of the design certification for the ABWR design. The amended 10 CFR 50.44 eliminates the requirements for hydrogen control systems to mitigate a design-basis LOCA hydrogen release. As a result of this change, the hydrogen recombiners (flammability control system) are eliminated from Table 3.2-1 of the COL FSAR.

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3 for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

The staff found this change acceptable. The detailed evaluation of this Tier 1 departure is in Section 6.2 of this SER.

- STD DEP T1 2.15-1 Reclassification of Radwaste Building Substructure from Seismic Category 1 to Non-Seismic

This departure changes the seismic classification of the radwaste building substructure from Seismic Category I to be consistent with the entire radwaste building. The departure references RG 1.143. COL application Table 1.9S-1 identifies conformance with RG 1.143, Revision 2. Although RG 1.143 is the standard regulatory position for the classification and design of structures that house radioactive waste management systems, the applicant has not included the technical justification for the departure from the design certification. NRC staff issued request for additional information (**RAI**) **03.02.01-1** (eRAI 2916) requesting the applicant to clarify why the seismic classification of the radwaste building substructure was revised from Seismic Category I, and why the classification according to RG 1.143 is appropriate and justified. The applicant's response to the RAI dated August 6, 2009, (ML092220162) states that the classification is based on the conclusion that the radwaste building does not contain any safety-related SSCs, and the design follows the guidance in RGs 1.29 and 1.143 for radioactive waste management systems. The staff's evaluation of the acceptability of this departure is in Section 3.8.4 of this SER. The applicant also points out that Section 3.8.4 of NUREG–1503 concludes that the radwaste building is not classified as Seismic Category I. The staff agreed with the conclusion in the ABWR Final Safety Evaluation Report that the radwaste building does not house any safety-related SSCs and hence, is not Seismic Category I. The commitment in the COL FSAR to use RG 1.143 for the design of the radioactive waste management system provides reasonable assurance that SSCs important to safety will withstand the effects of earthquakes without losing the capability to perform necessary safety functions. This RAI is therefore closed.

- STD DEP T1 3.4-1 Safety Related I&C Architecture

This departure eliminates the multiplexing system, renames several I&C systems, and adds the Seismic Category I ESF logic and control system to COL FSAR Table 3.2-1. The seismic classification of the safety-related ESF logic and control system will ensure that it maintains its function to shut down the reactor during and following an SSE and is therefore acceptable to NRC staff. The detailed evaluation of this Tier 1 departure is in Chapter 7 of this SER.

Tier 2 Departure Requiring Prior NRC Approval

- STD DEP 8.3-1 Plant Medium Voltage Electrical System Design

This departure changes the voltage of the switchgear from 6,900 volts to 4,160 volts. The classification of the safety-related switchgear remains Seismic Category I and is therefore acceptable. The detailed evaluation of this Tier 2 departure is in Chapter 8 of this SER.

Tier 2 Departures Not Requiring Prior NRC Approval

- STD DEP 9.1-1 Update of Fuel Storage and Handling Equipment

This departure changes the safety classification of the fuel-serving equipment from Safety Class 2 to nonsafety. The seismic classification is unchanged from that in the DCD. The supplemental requirement in the COL FSAR states that the cranes and fuel-servicing equipment

are designed to hold up their loads and to maintain their position over the units under conditions of an SSE. This supplemental requirement ensures that an SSE will not cause the failure of the cranes and fuel-serving equipment or reduce the function of the safety-related SSCs. This supplemental requirement meets Regulatory Position C.2 of RG 1.29 and is therefore acceptable.

- STD DEP 9.3-2 Breathing Air System

The applicant properly reclassifies the BAS containment isolation including supports, valves, and piping as Seismic Category I and safety-related because the containment isolation function mitigates the consequences of accidents that could result in potential offsite exposures. This departure meets the 10 CFR Part 50 Appendix S requirements and is therefore acceptable.

The applicant's evaluation in accordance with Item B.5(b) of Section VIII of Appendix A to 10 CFR Part 52 determined that the above departures do not require prior NRC approval. Within the review scope of this section, NRC staff found it reasonable that these departures do not require prior NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

Supplemental Information

The hot machine shop was added to Table 3.2-1 in the COL FSAR. The hot machine shop is a nonsafety-related structure. Footnote "f" under Table 3.2-1 of the DCD states that the SSCs that could damage Seismic Category I SSCs if structural integrity fails are checked analytically and are designed to assure structural integrity under seismic loading resulting from an SSE. This seismic design requirement meets Regulatory Position C.2 of RG 1.29 and is therefore acceptable.

Scope

The applicant is expected to identify site-specific SSCs that are not included in the DCD. The reactor service water (RSW) system outside the control building and the firewater pump house are outside the scope of the ABWR DCD. It appears that SSCs such as the RSW pumps, the RSW pump house, and the firewater pump house are not included in Table 3.2-1 of the COL FSAR or in Table 3.2-1 of the DCD. NRC staff issued **RAI 03.02.01-2** (eRAI 2916) requesting the applicant to review the COL application for completeness in order to identify any SSCs that have not been seismically classified and to clarify when this seismic classification information will be submitted. The applicant's response dated August 6, 2009, (ML092220162) provides a revised copy of COL FSAR Tier 2 Table 3.2-1 that includes the RSW pump, the ultimate heat sink (UHS) and associated structures (including the RSW pump house), and the firewater pump house. Verification that this change appears in the next revision of the COL FSAR is being tracked as **Confirmatory Item 03.02.01-2**.

Seismic Category I

Per STD DEP T1 2.15-1, the UHS and the RSW piping-tunnel are designed to the site-specific SSE. Because the Seismic Category I classification is the same as the seismic classification in the DCD, the design will ensure that the safety-related SSCs will remain functional during and after an SSE. This design classification is therefore acceptable.

Seismic Category II SSCs

Potential site-specific Seismic Category II SSCs can be identified per COL License Information Item 3.22 in COL FSAR Subsection 3.7.5.4. COL License Information Item 3.22 states that the COL applicant will describe the process for completing the design of balance-of-plant and nonsafety-related systems to minimize II/I interactions and will propose procedures for an inspection of the as-built plant for II/I interactions. Classifying nonsafety-related SSCs whose failure will reduce the function of safety-related SSCs as Seismic Category II SSCs will be performed as part of COL License Information Item 3.22. NRC staff issued **RAI 03.07.02-13** requesting the applicant to describe in the FSAR in detail the criteria to be used for determining whether the failure of nonsafety-related SSCs will impact the ability of the safety-related SSCs to perform their safety function. This is evaluated in Section 3.7.2 of this SER.

ITAAC

Under 10 CFR 52.80(a), a COL application is required to contain the proposed inspections, tests, and analyses that the licensee should perform and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that if the inspections, tests, and analyses are performed and the acceptance criteria are met, the facility was constructed and will operate in conformity with the COL, the provisions of the Atomic Energy Act, and the NRC regulations. In the COL application Part 9, Table 3.0-1 lists the ITAAC for the as-built UHS to be able to withstand structural design-basis loads, which include the SSE loads. This ITAAC will provide reasonable assurance that if the ITAAC is performed and the acceptance criteria are met, the UHS SSCs have been constructed and will operate in conformity with the COL and the NRC regulations.

STD DEP 9.3-2 classifies the BAS containment isolation (including the supports, valves, and piping) as Seismic Category I and safety-related. However, there are no ITAAC in the DCD or Part 9 of the COL application for the as-built breathing air containment isolation SSCs to ensure that they meet the seismic requirements. NRC staff issued **RAI 03.02.01-3** (eRAI 2916) requesting the applicant to add the ITAAC in Table 3.0-12 of Part 9 of the COL application to ensure that the as-built Seismic Category I SSCs will operate in conformity with the COL and the NRC regulations. Alternatively, the applicant can clarify in the introduction section of Part 9 of the COL application that ITAAC verification methodology for the basic configuration for SSCs outside the scope of the DCD will follow the verification methodology stated in DCD Tier 1 Section 1.2, which includes type tests, analyses, or a combination of type tests and analyses of the Seismic Category I mechanical and electrical equipment. The applicant's response to the RAI dated August 6, 2009, (ML092220162) revises the BAS ITAAC in COL application Part 9, Table 3.0-12 to include basic configuration verification. Also, the applicant has revised COL FSAR Part 9, Section 1.0 to state that the ITAAC verification methodology for the basic configuration for the site-specific SSCs will follow the verification methodology as stated in DCD Tier 1, Section 1.2. The staff found the applicant's response acceptable. Verification that this change appears in the next revision of the COL FSAR is being tracked as **Confirmatory Item 03.02.01-3**.

As discussed earlier, COL License Information Item 3.22 states that the COL applicant will describe the process for completing the design of the balance-of-plant and nonsafety-related systems to minimize seismic II/I interactions and to propose procedures for an inspection of the as-built plant for II/I interactions. However, there is no ITAAC in Part 9 of the application to ensure that COL License Information Item 3.22 will be performed. The staff issued **RAI 03.02.01-4** (eRAI 2916) requesting the applicant to add the ITAAC to ensure that the as-

built nonsafety-related SSCs meet Regulatory Position C.2 of RG 1.29, which states that the failure of nonsafety-related SSCs will not reduce the function of the safety-related SSCs. The applicant's response dated August 6, 2009, (ML092220162) states that the inspection of seismic II/I interactions is not included in the referenced ABWR DCD Tier 1, Section 1.2. Verifications for the basic configuration of the systems do not identify the inspection for II/I interactions in their scope. In NUREG–1503, page 14-39 states that the need was assessed for an ITAAC to verify that the failure of non-Seismic Category I SSCs will not impair the function of the safety-related SSCs, and COL License Information Item 3.22 was determined to be adequate for the design certification. The ABWR DCD was therefore certified without an ITAAC for the seismic II/I interaction. However, the need for an ITAAC for the seismic II/I interaction in the COL application depends on the acceptance of COL License Information Item 3.22. The review of COL License Information Item 3.22 is provided in Section 3.7 of this SER and is being evaluated in **RAI 03.07.02-13**. As a result, **RAI 03.02.01-4** is closed.

Also discussed earlier, the design of the RSW pumps is outside the scope of the DCD. There is no ITAAC listed in the DCD or in Part 9 of the COL application to ensure that the as-built, safety-related RSW pumps will remain functional during and after an SSE. The staff issued **RAI 03.02.01-5** (eRAI 2916) requesting the applicant to review the completeness of the ITAAC to include all Seismic Category I SSCs outside the scope of the DCD. Alternatively, the applicant can clarify in the introduction to Part 9 of the COL application that the ITAAC verification methodology for the basic configuration for SSCs outside the scope of the DCD will follow the verification methodology stated in DCD Tier 1 Section 1.2, which includes type tests, analyses, or a combination of type tests and analyses of the Seismic Category I mechanical and electrical equipment. The applicant's response dated August 6, 2009, (ML092220162) revises COL FSAR Part 9, Section 1.0 to state that the ITAAC verification methodology for the basic configuration of the site-specific SSCs will follow the verification methodology as stated in DCD Tier 1, Section 1.2. The staff found the applicant's response acceptable. Verification that this change appears in the next revision of the COL FSAR is being tracked as **Confirmatory Item 03.02.01-5**.

List of SSCs Needed for Continued Operation

In NUREG–0800, Section 3.2.1 states that "if the applicant has set the operating-basis earthquake (OBE) Ground Motion to the value one-third of the SSE Ground Motion, then the applicant should also provide a list of SSCs necessary for continued operation that must remain functional without undue risk of the health and safety of the public and within applicable stress, strain and deformation, during and following an OBE." The ABWR design eliminates the OBE design requirement and sets the OBE ground motion to one-third of the SSE ground motion, which eliminates this requirement from the design per 10 CFR Part 50 Appendix S, Section IV(a)(2)(i)(A).

Under 10 CFR Part 50 Appendix S, IV(a)(3) states that if vibratory ground motion exceeding that of the OBE ground motion occurs or if significant damage to the plant occurs, the licensee must shut down the nuclear power plant and before resuming operations, the licensee must demonstrate to the NRC that no functional damage has occurred to those features necessary for continued operation without undue risk to the health and safety of the public. The licensee must also demonstrate that the licensing basis has been maintained. Additionally, RG 1.166 provides guidance for evaluating the results obtained from a walkdown inspection of the plant after an earthquake. Listing the SSCs will allow the requirements to be addressed when the need exists. NRC staff issued **RAI 03.02.01-6** (eRAI 2916) requesting the applicant to provide

this list of SSCs necessary for continued operation or, as an alternative, to address the requirements.

The applicant's response dated August 6, 2009, (ML092220162) states that DCD Tier 2 Subsection 3.7.5.2, "Pre-Earthquake Planning and Post-Earthquake Actions," requires the COL applicant to submit to the NRC the procedures to be used for pre-earthquake planning and post-earthquake actions. COL License Information Item 3.20 in Tier 2 Table 1.9-1, Subsection 3.7.5.2 states that the procedures shall follow the guidelines recommended in Electric Power Research Institute (EPRI) Report NP–6695. In accordance with Subsection 3.7.5.2 of COL application Part 2 Tier 2, the procedures for pre-earthquake planning, which include a list of SSCs necessary for continued operation without undue risk to the health and safety of the public, will be developed before fuel loading. In the supplement response to this RAI dated January 5, 2010, (ML100080062) the applicant provides a candidate list of systems and equipment that require inspection either by a walkdown visual inspection or by an inspection of the process monitoring indicators in "Table1 Safe Shutdown Systems-Inspection Candidate for Continued Plant Operation after an Earthquake." The applicant indicates that the procedure for pre-earthquake planning and post-earthquake actions will include a detailed list of selected systems, subsystems and equipment, in addition to the method of inspection. The development schedule for these procedures is addressed above. This candidate list and the future detailed list will be incorporated into pre-earthquake planning and post-earthquake procedures to be addressed in the COL application, Chapter 13. As a result of COL License Information Item 3.20 and the applicant's pre-earthquake planning procedures to be developed, **RAI 03.02.01-6** is closed.

3.2.1.5 *Post Combined License Activities*

There are no post COL activities related to this section.

3.2.1.6 *Conclusion*

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to the seismic classification. With the exception of **Confirmatory Items 03.02.01-2, 03.02.01-3 and 03.02.01-5,** no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52 Appendix A Section VI.B.1, all nuclear safety issues relating to the seismic classification that were incorporated by reference have been resolved.

The staff reviewed the standard departures, supplement, and site-specific SSCs. The staff concluded that the STP Units 3 and 4 safety-related SSCs—including their supports—are properly classified as Seismic Category I, in accordance with Position C.1 of RG 1.29.

The staff's review confirmed that the applicant has adequately addressed the Tier 1 departures in accordance with Section 3.2.1 of NUREG–0800. The staff found it reasonable that the identified Tier 2 departures are characterized as not requiring prior NRC approval per 10 CFR Part 52 Appendix A, Section VIII.B.5.

Although simplified piping and instrumentation diagrams do not show seismic category boundaries, the applicant identifies no exceptions to RG 1.29. Per COL License Information Item 3.22 which is addressed in Section 3.7.3 of this SER through implementation of the COL

license information item, the applicant will meet Regulatory Position C.2 of RG 1.29 to prevent nonsafety-related SSCs from affecting any safety functions. Finally, the staff found that the design of the site-specific fire protection system SSCs conforms to the guidance in RG 1.189 and thus complies with Position C.5 of RG 1.29. This design constitutes an acceptable basis for satisfying, in part, GDC 2, which requires that all SSCs important to safety be designed to withstand the effects of natural phenomena, including earthquakes.

However, as a result of **Confirmatory Items 03.02.01-2, 03.02.01-3, and 03.02.01-5,** the staff was unable to finalize the conclusions relating to the seismic classification, in accordance with the NRC requirements.

3.2.2 Quality Group Classifications (Related to RG 1.206, Section 3.2.2, "System Quality Group Classification")

3.2.2.1 *Introduction*

This section of the FSAR evaluates the requirement to design, fabricate, erect, and test nuclear power plant SSCs important to safety to quality standards, which are commensurate with the importance of the safety function they perform. This evaluation is limited to pressure-retaining items and their supports. The requirement is applicable to both safety-related and nonsafety-related SSCs that perform functions important to safety including safety-related functions to (1) prevent or mitigate the consequences of accidents and malfunctions originating within the RCPB, (2) permit a shutdown of the reactor and maintain it in a safe-shutdown condition, and (3) retain radioactive material. RG 1.26, "Quality Group Classification and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," (Revision 4) provides the regulatory guidance for designing safety-related SSCs to quality standards.

3.2.2.2 *Summary of Application*

Section 3.2.2 of the STP Units 3 and 4 COL FSAR incorporates by reference Section 3.2.2 of the certified ABWR DCD, Revision 4, referenced in 10 CFR Part 52 Appendix A, with standard departures and supplements from the certified design. Section 3.2.1 of this SER lists the departures and supplements.

3.2.2.3 *Regulatory Basis*

The regulatory basis for reviewing the information incorporated by reference is in NUREG–1503.

In addition, relevant requirements of the NRC regulations and guidance for this area of review, and the associated acceptance criteria, are in Section 3.2.2 of NUREG–0800. Review interfaces with other Standard Review Plan (SRP) sections are also in Section 3.2.2 of NUREG–0800.

The specific acceptance criteria are listed below:

(a) 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 1, and 10 CFR 50.55a, as they relate to SSCs important to safety being designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed.

(b) An acceptable method of meeting the requirements of GDC 1 and 10 CFR 50.55a is in RG 1.26. This regulatory guide describes an acceptable method for determining quality standards for Quality Groups (QGs) B, C, and D water- and steam-containing components important to safety in light-water-cooled nuclear power plants.

3.2.2.4 *Technical Evaluation*

As documented in NUREG–1503, NRC staff reviewed and approved Section 3.2.2 of the certified ABWR DCD. The staff reviewed Section 3.2.2 of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this section.

The staff reviewed the STP Units 3 and 4 COL FSAR in accordance with Section 3.2.2 of NUREG–0800 and the guidance in RG 1.206 and RG 1.26, Revision 4. The review included an evaluation of the criteria used to establish the QG classifications and the application of the criteria to the classification of principal components included in Table 3.2.-1. To support and complete this review, the staff required additional information. The RAIs are discussed below under each review topic.

Scope

The applicant is expected to identify the classification of any site-specific SSCs that are not included in the ABWR DCD. COL application Table 3.2-1 includes additional SSCs that are not included in the Standard Safety Analysis Report (SSAR). As SRP 3.2.2 identifies, the QG QG classification does not apply to structures. However, it appears that certain safety-related components, such as the reactor service water (RSW) pumps and strainers, are not included in either SSAR Table 3.2-1 or COL application Table 3.2-1. **RAI 03.02.02-1** (eRAI 2920) requests the applicant to review the COL application for completeness, so as to identify any SSCs that have not been classified and to clarify when this QG classification information will be submitted. The applicant's response to this RAI modifies the list of SSC classified in DCD Table 3.2-1 and site-specific SSCs in FSAR Table 3.2-1 to include additional SSCs. FSAR Table 3.2-1, Revision 3 includes the classification of the identified site-specific SSCs With the addition of these site-specific SSCs, the staff concluded that the scope of the SSCs appears to be essentially complete and their classification consistent with RG 1.26. Therefore, **RAI 03.02.02-1** is resolved and all issues related to this RAI are closed.

Piping and Instrumentation Diagrams

The QG or corresponding American Society of Mechanical Engineers (ASME) Code Class should be shown on piping and instrumentation diagrams (P&IDs). The P&IDs included in the FSAR do not appear to identify the QG or the ASME Code Class. **RAI 03.02.02-2** (eRAI 2920) requests the applicant to clarify the QG or ASME Code Class boundaries on the P&IDs, or otherwise explain how the QG and ASME Code Class boundaries are identified. The applicant's response to **RAI 03.02.02-2** references DCD Tier 2 Figure 1.7-1, Sheets 1 and 2,

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3, for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

and DCD Table 3.2-3, which identify the correlation between the QG classifications and the ASME Code classifications. However, it appears that the P&IDs for site-specific systems do not include the QG boundaries. Although the classification tables identify the classifications, the applicant should also show QG boundaries on the P&IDs for site-specific systems that are outside the scope of the ABWR standard plant, such as Figure 3.0-1 for the RSW outside the control building. A similar P&ID concern is identified under the ITAAC associated with **RAI 03.02.02-8**. All concerns associated with **RAI 03.02.02-2** are considered closed.

Special Treatment for Risk-Significant SSCs

Certain systems important to safety that are nonsafety-related, such as the containment hydrogen and oxygen monitors and fuel servicing equipment, may be considered risk significant and special treatment may be required. **RAI 3.02.02-3** (eRAI 2920) requests the applicant to clarify whether any nonsafety-related, site-specific SSCs included in COL application Table 3.2-1 are considered risk significant and, if so, to identify the special treatment requirements applicable to these SSCs. The applicant's response to **RAI 3.02.02-3** clarifies that site-specific PRA Table 19K-4 identifies maintenance or testing requirements for risk-significant SSCs. Although this response does not address supplemental design and quality requirements, STP addressed site-specific, risk-significant SSCs in Appendix 19K. All issues related to **RAI 03.02.02-3** are resolved and the RAI is closed.

Nonmetallic Piping

NRC staff requested the applicant to identify whether any nonmetallic piping will be used in any risk-significant systems and, if so, to identify specific systems and applications (e.g., underground, sizes, etc.) where the nonmetallic piping will be used. **RAI 03.02.02-4** (eRAI 2920) requests the applicant to identify the basis for using nonmetallic piping, including the applicable ASME Codes, endorsed code cases, supplemental requirements/special treatments, and technical justifications such as an engineering evaluation. The applicant's response to this RAI clarifies that nonmetallic piping is not included in the STP COL application. All issues related to **RAI 03.02.02-4** are closed.

Codes and Standards

SECY-92-327 relates to the NRC review of ABWR ITAAC and noted that GEH should identify the applicable codes in the ITAAC/DAC and include the appropriate version in the SAR. The SSAR does not specifically identify which codes or standards apply to specific SSCs. In the COL application, Section 1.8 identifies limited codes and standards, but they do not appear to be complete or current. The NRC Staff Requirements Memoranda (SRM) dated July 21, 1993, refers to SECY-93-087. The SRM specifies that the staff will review evolutionary plant design applications using the newest codes and standards endorsed by the NRC; the staff will review unapproved revisions to the codes on a case-by-case basis. **RAI 03.02.02-5** (eRAI 2920) requests the applicant to identify a complete list of codes and standards; to clarify which editions are not NRC endorsed; and of those editions, to clarify whether the edition is current. The applicant's response to **RAI 03.02.02-5** references a complete listing of codes and standards in COL application Tables 1.8-21, 1.8-21a, DCD Table 5.2-1 for RCPB components, and Table 1.9S-1a (a new table). All issues related to **RAI 03.02.02-5** are closed.

ITAAC

SRP Section 14.3 states that the ITAAC for site-specific design features should be developed during the COL stage of this process. SRP 14.3 further notes that the safety classification of the SSCs is described in the design description of each system, and the functional drawings identify the boundaries of the ASME classification applicable to that particular safety class. In SRP Section 14.3, the Appendix C design description checklist also specifically includes the seismic classifications and the ASME Code classifications that should be verified as part of the ITAAC; the piping, equipment, and individual system components and supports all comprise a system. As SRP Section 14.3 also states, the ASME Code Class boundaries for mechanical equipment and piping are shown in the Tier 1 figures and form the basis for the basic configuration check (system) that is required for each individual system ITAAC.

FSAR Section 14.3S identifies the selection criteria and methodology in Section 14.3 of the referenced ABWR DCD for the certified ABWR design as the site-specific selection criteria and methodology utilized for the ITAAC. In general, the ITAAC for site-specific systems are developed to correspond with the interface criteria in Tier 1 of the referenced ABWR DCD. DCD Subsection 14.3.2.1 includes system and component classification information as the design information that should be included in Tier 1 design descriptions. DCD Subsection 14.3.2.2 states that the scope and content of the ITAAC correspond to the scope and content of the Tier 1 design descriptions. The site-specific ITAAC in Part 9 of the COL application include basic configuration ITAAC for site-specific systems. However, the definition of "basic configuration" in Section 1.1 of the ABWR central data management (CDM) does not specifically identify classifications as part of the basic configuration ITAAC for a building or a system.

RAI 03.02.02-6 (eRAI 2920) requests the applicant to clarify whether the ITAAC used for verifying the basic configuration include verifying the seismic category and the ASME Code classification for ASME systems. If not, the RAI asks the applicant to explain how the as-built system classifications are verified, such as through a generic piping design ITAAC described in the DCD.

Also, the ITAAC in Part 9 of the COL application does not specifically identify the ITAAC as to the classification of site-specific SSCs, such as Tier 1. The referenced ABWR DCD does not appear to identify any departures from Tier 1 system ITAAC for ASME Code and Seismic Category I requirements. NRC staff also requested the applicant to clarify whether the classification ITAAC for plant-specific SSCs, such as the UHS, are included in Tier 1 and if not, to explain why they are not considered.

The applicant's response to **RAI 03.02.02-6** dated August 27, 2009, (ML092430131) explains that a deliberate decision was made to specify the ASME Code Class in the Tier 1 design descriptions, but not to require a verification of the ASME Code Class as part of ITAAC. The response further states that the ABWR Certified Design Material/ITAAC Review Guidance (dated April 1994) was used as a guide for preparing the Tier 1 document. This guidance specifically indicates that there will be no ITAAC for the ASME Code and the QG classifications on the basis that welding is covered by configuration. NRC staff was unable to determine whether this ITAAC guidance was ever endorsed by the NRC, and if an ITAAC is not required, what documentation ensures the verification of the QG and the ASME Code Class. Although there is an ITAAC for ensuring that an ASME Stress Report exists, it is not clear whether the as-built ASME Code Class and Quality Group are verified as part of the as-built configuration. Under 10 CFR 52.47(b)(1), a DC application is required to contain the proposed ITAAC that are

necessary and sufficient for providing reasonable assurance that if the inspections, tests, and analyses are performed and the acceptance criteria are met, the construction and operation of a plant that incorporates the design certification are in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC regulations. Furthermore, RG 1.206 states that COL applicants referencing a certified design should also establish site-specific ITAAC, as appropriate evidence demonstrating compliance with the significant interface requirements (if any) established in Tier 1 of the generic DCD. For example, Table C.III.7-2 of RG 1.206 includes an ITAAC for verifying that the UHS is classified/designed as Seismic Category I. Therefore, the staff found that some type of inspection and verification is appropriate to establish that the as-built QGs/ASME Code Class and seismic classification are consistent with the Tier 1 design description and with the license. There should also be further clarification as to how the applicant will verify the as-built QGs/ASME Code Class and seismic classification, such as through QA inspections, the generic piping ITAAC, basic configuration ITAAC, or by independent organizations such as the ASME Authorized Inspector.

The revised RAI response dated February 10, 2010, (ML100490763) identified that classifications are verified though the design/QA process and therefore an ITAAC is not needed. Staff concurs that, consistent with the COL license information in ABWR DCD Subsection 1.1.11.1, the cited design/QA verification process is an acceptable alternative way to close the **RAI 03.02.02-6** open item without a separate ITAAC to verify quality group classification, provided there is some type of licensing commitment by the applicant to ensure the design verification process and as-built reconciliation are completed prior to fuel load. As identified in recently issued NRC interim staff guidance ESP/DC/COL-ISG-015 (ML093561416), this commitment may be represented by a FSAR commitment or license condition combined with an implementation schedule in order to support confirmation by the NRC via inspection.

Therefore, the staff issued **RAI 03.02-02-10** (eRAI 4463) requesting the applicant to identify a specific FSAR commitment to include verification of the classifications in the review of design reports in combination with the QA process cited in the revised response. The applicant's response to **RAI 03.02.02-10** dated April 15, 2010 (ML101090140) clarifies that a commitment will be added in Section 2.3.2S of the COL FSAR to include verification of the classifications in the review of the design reports in combination with the design/QA process. This commitment pertains to the safety classification of site-specific systems included in the COL application and the design verification will normally be completed before design outputs are used for activities such as procurement, manufacture or construction. If this timing cannot be achieved, the design verification will be completed before fuel loading. Therefore, **RAI 03.02.02-6** is closed and the verification of the proposed revision to the FSAR is being tracked as **Confirmatory item 03.02.02-10.**

Structural and Systems Engineering ITAAC

Concerning the application of ITAAC to site-specific structural and systems engineering, SRP 14.3.2 clarifies that design descriptions, figures (including key dimensions), and ITAAC should be developed and grouped by systems and building structures. Building structures and electrical systems are not classified by QGs, but seismic classification does apply. The review checklists for fluid systems, electrical systems, and building structures in Appendix C of SRP Section 14.3 should be used as guides for establishing consistent and complete Tier 1 information.

The STP site-specific ITAAC includes a basic configuration ITAAC but does not specifically identify an ITAAC to verify the seismic or ASME Code classification boundaries.

RAI 03.02.02-7 (eRAI 2920) requests the applicant to clarify whether ITAAC—such as the basic configuration ITAAC or generic piping ITAAC—are used to verify the seismic classification and ASME Code Class boundaries, and if they are not included in these ITAAC, to describe how the as-built classification boundaries are verified. ITAAC related to seismic classification are addressed in **RAI 03.02.01-3** in SER Section 3.2.1, and the applicant's response to **RAI 03.02.02-7** references the response to **RAI 03.02.02-6**. Therefore, **RAI 03.02.02-7** is closed and all QG classification ITAAC issues are addressed in the closure of **RAI 03.02.02-6.**

Piping Systems and Components ITAAC

Concerning the application of ITAAC to site-specific piping systems and components, SRP 14.3.3 states that the Tier 1 ASME code classification, safety classification, and seismic classification of piping systems should be indicated clearly on the figures or described in the design descriptions and should be consistent with ABWR DCD Tier 2, Section 3.2. System boundaries and interfaces should be clearly indicated in Tier 1, and the figures should be in accordance with the legends. ABWR DCD Table 14.3-12 for interface requirements states that the UHS should be classified as Seismic Category I. For certain site-specific systems such as the UHS and plant service water (PSW), the figures do not clearly show the ASME Code or the safety and seismic classifications. Seismic classification ITAAC is addressed in Section 3.2.1 of this SER. **RAI 03.02.02-8** (eRAI 2920) requests the applicant to clarify that the figures will be updated to include the classifications and boundaries. The applicant's response to this RAI does not address updating the FSAR figures to show classification boundaries, and the applicant's response to **RAI 03.02.02-2** references the tables for QG classifications. Although NRC staff can audit detailed P&IDs during the detailed design stage, QG boundaries should also be shown on the simplified P&IDs in the COL FSAR. Considering the revised response to RAI 03.02.02-6, a licensing commitment should also be cited by the applicant to update FSAR figures for P&IDs prior to fuel load, including an appropriate implementation schedule. **RAI 03.02.02-8** is closed and this concern is addressed by **RAI 03.02.02-11** (eRAI 4463)**.**

In **RAI 03.02.02-11**, the applicant was requested to identify a licensing commitment to update FSAR figures for P&IDs before fuel loading or the staff will defer the review of P&IDs until later, if this will be included during the annual updates. The applicant's response to RAI 03.02.02-11 dated April 15, 2010 (ML101090140) identifies that to provide clarity, COL application Part 9, Section 3.0, Figure 3.0-1 will be revised to add the ASME Code Class 3 designation to piping on the diagram for the UHS and RSW System. This proposed revision is being tracked as **Confirmatory Item 03.02.02-11**.

SRP Section 14.3.3 points out that safety-related piping systems should be designated in Tier 1 as Seismic Category I and ASME Code Class 1, 2, or 3. The COL application Tier 1 does not include ITAAC for site-specific, safety-related SSCs. The staff also requested the applicant to clarify whether classification ITAAC for plant-specific, safety-related systems such as the PSW should be included in Tier 1 or, if subject to change, should be identified as Tier 2*. The applicant's response to **RAI 03.02.02-8** references the response to **RAI 03.02.02-6** and clarifies that Tier 1 only applies to the DCD, not to the COL application. Therefore, all classification ITAAC concerns associated with Tier 1 are closed.

Plant Systems – ITAAC

Concerning the application of ITAAC to site-specific plant systems, SRP 14.3.7 states that plant systems that are not part of the core reactor systems are clearly described in Tier 1, including the key performance characteristics and safety functions. Seismic and ASME Code

classifications are characterized as a Tier 1 issue, important to safety that should be verified by ITAAC. Equipment and components that are not considered piping are still part of a system. **RAI 03.02.02-9** (eRAI 2920) requests the applicant to clearly describe whether there is an ITAAC to verify the as-built seismic and ASME Code Class of plant systems including equipment, components, and supports that are not part of the core reactor systems. Also, NRC staff requested the applicant to clarify whether this ITAAC is included in Tier 1. The applicant's response to **RAI 03.02.02-9** dated August 27, 2009, (ML092430131) references the response to **RAI 03.02.02-6**. Therefore, all classification ITAAC issues are addressed in the closure of **RAI 03.02.02-6** and **RAI 03.02.02-9** is closed.

3.2.2.5 *Post Combined License Activities*

There are no post COL activities related to this section.

3.2.2.6 *Conclusion*

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to the quality group classifications. With the exception of **confirmatory items 03.02.02-10 and 03.02.02-11**, no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52 Appendix A Section VI.B.1, all nuclear safety issues relating to the QG classifications that were incorporated by reference have been resolved.

The staff reviewed the standard departures, supplements, and the QG classifications of site-specific systems. The staff concluded that the STP Units 3 and 4 systems and components important to safety are properly classified and are consistent with RG 1.26. Safety-related systems and components such as the RSWS pumps and strainers, including their supports, are classified as QG C and are consistent with Regulatory Position C.2 in RG 1.26. There are no identified exceptions to RG 1.26 in the application and there is reasonable assurance that the QG classifications meet GDC 1 for pressure retaining components and their supports.

However, as a result of the above **confirmatory items**, the staff was unable to finalize the conclusions relating to the QG classifications, in accordance with the NRC requirements.

3.3 Wind and Tornado Loadings

Seismic Category I structures are designed to withstand extreme wind and tornado conditions in the area of the plant.

3.3.1 Wind Loadings

3.3.1.1 *Introduction*

The ABWR standard and site-specific plant structures that are Seismic Category I are designed for extreme wind phenomena. To meet the requirements of General Design Criteria (GDC) 2, the safety-related structures of STP Units 3 and 4 will be designed to withstand the effects of a design-wind velocity of a 100-year return period. This section describes and specifies the following:

- The design-wind velocity.
- The basis for the selection of the site-specific, design-basis wind
- The methods used to calculate wind loads on the SSCs.
- The procedures for treating the effect of the remainder of plant SSCs not designed for wind loads on safety-related SSCs.

The site-specific design wind loads is expected to be bounded by the design wind loads in the ABWR DCD.

3.3.1.2 *Summary of Application*

Section 3.3.1 of the STP Units 3 and 4 COL FSAR incorporates by reference Section 3.3.1 of the certified ABWR DCD, Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 3.3.1, the applicant provides the following:

Tier 1 Departure

- STD DEP T1 2.15-1 — Reclassification of Radwaste Building from Seismic Category I to Non-Seismic

This departure reclassifies the radwaste building (RWB) from Seismic Category I to non-seismic.

COL License Information Items

- COL License Information Item 3.1 — Site-Specific Design Basis Wind

In Subsection 3.3.3.1, the applicant provides the following site-specific supplement to address COL License Information Item 3.1:

> The site-specific design basis wind does not exceed the design basis wind in Table 2.0-1 of the referenced ABWR DCD.

- COL License information item 3.3 — Effect of Remainder of Plant Structures, Systems and Components Not Designed For Wind Loads

In Subsection 3.3.3.3, the applicant provides the following site-specific supplement to address COL License Information Item 3.3:

> The design criteria for plant SSCs not designed for wind loads are as follows: Such SSCs not designed for wind loads are analyzed using the 1.11 importance factor or are checked to ensure that their mode of failure will not affect the ability of safety-related SSCs to perform their intended safety functions.

Supplemental Information

In Subsection 3.3.1.1 of the STP Units 3 and 4 COL FSAR, the applicant provides the following supplement:

> The 177 kilometers per hour for the 50-year recurrence interval and 197 kilometers per hour for the 100-year recurrence interval velocities are based on

Reference 3.3-1, which is the "fastest mile." Per Reference 3.3-4 in Table 1609.3.1, these interval velocities correspond to a wind velocity (3 second gust) of 203 kilometers per hour (km/h) with a recurrence interval of 50 years and 225 km/h with a recurrence interval of 100 years.

In Subsection 3.3.1.2 of the STP Units 3 and 4 COL FSAR, the applicant provides the following supplements:

- Applied forces for the reactor building (RB) and the control building (CB) are in Appendices 3H.1 and 3H.2, respectively.
- The applied forces and the procedures used to determine the wind loads on the UHS are described in Appendix 3H.6.

3.3.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is in NUREG–1503. The regulatory basis and acceptance criteria for reviewing site-specific information, COL license information items, and supplemental information in the COL application are in NUREG–0800, Section 3.3.1.

In accordance with Section VIII, “Processes for Changes and Departures,” of, “Appendix A to Part 52--Design Certification Rule for the U.S. Advanced Boiling Water Reactor,” the applicant identifies one Tier 1 departure requiring prior NRC approval. This departure is subject to the requirements of 10 CFR Part 52 Appendix A, Section VIII.A.4.

3.3.1.4 *Technical Evaluation*

As documented in NUREG–1503, NRC staff reviewed and approved Section 3.3.1 of the certified ABWR DCD. The staff reviewed Section 3.3.1 of the STP Units 3 and 4 COL FSAR and checked the pertinent sections of the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff’s review confirmed that the information in the application and the information incorporated by reference address the required information relating to this section.

The staff reviewed the following information in the COL FSAR:

Tier 1 Departure

- STD DEP T1 2.15-1 — Reclassification of Radwaste Building from Seismic Category I to Non-Seismic

This departure is related to the reclassification of the RWB. The NRC staff’s evaluation of the acceptability of this departure is in Section 3.8.4 of this SER.

Supplemental Information

[1] See *“Finality of Referenced NRC Approvals”* in SER Section 1.1.3, for a discussion on the staff’s review related to verification of the scope of information to be included in a COL application that references a design certification.

Seismic Category I SSCs are designed according to Subsection 3.3.1.1, "Design Wind Velocity," of the referenced ABWR DCD, Revision 4, to withstand wind velocities of 177 km/h and 197 km/h for 50-year and 100-year MRIs (mean recurrence intervals), respectively. In a supplement to Subsection 3.3.1.1 of the STP Units 3 and 4 COL FSAR, the applicant states that:

> The 177 km/h for 50 year recurrence interval and 197 km/h for 100 year recurrence interval are based on Reference 3.3-1, which is "fastest mile." Per Reference 3.3-4 Table 1609.3.1, these correspond to a wind velocity (3 second gust) of 203 km/h with a recurrence interval of 50 years and 225 km/h with a recurrence interval of 100 years.

NRC staff issued **RAI 03.03.01-1 (eRAI 3220–Question 12852)** requesting that the applicant discuss, justify, and assure that ABWR DCD-defined wind velocities are based on the "fastest mile," as opposed to the "3-sec gust." The staff required the applicant to confirm that Equation 16-34 of IBC 2006 was used to convert wind velocities from the "fastest mile" to the "3-sec gust." The applicant's response to **RAI 03.03.01-1 (eRAI 3220–Question 12852)** dated August 26, 2009, (STP letter U7-C-STP-NRC-090111; Attachment 10, ML092430131) states that 50- and 100-year MRI wind speeds used in the ABWR DCD are based on Reference 3.3-1 and correspond to the "fastest mile" winds. The applicant also determined the "3-sec gust" wind speeds based on IBC 2006 for 50-year and 100-year MRIs and identified the following revisions to the COL FSAR, Revision 2:

- Reference 3.3-4 will be revised to show IBC 2006.
- COL FSAR Tier 2, Subsections 2.3S.1.3.1 and 3.3.1.1 and Table 2.0-2 will be revised to show the 224 km/h (139 mph) and the 3-second gust wind speeds for a recurrence interval of 100 years.

The staff's review noted that the wind design in the referenced ABWR DCD Revision 4, Reference 3.3-1, is based on the 1993 version of ASCE 7 (ASCE 7-93), which defined wind speed measurements as the "fastest mile." In 2005, the definition of wind velocities in ASCE 7 (ASCE 7-05) was changed to represent "3-sec gust" speeds. The "3-sec gust" wind velocities are higher than the "fastest mile" winds. Wind speeds can be converted from one measurement to the other by applying Equation 16-34 or Table 1609.3.1, "Equivalent Basic Wind Speeds," of the IBC 2006. The applicant's response to **RAI 03.03.01-1** (a) justifies this change, (b) verifies the "3-sec gust" wind speeds, and (c) commits to revise the pertinent sections of STP Units 3 and 4 COL FSAR, thereby adequately responding to the staff's request for clarification. Therefore, the staff concludes that the applicant has adequately responded to **RAI 03.03.01-1**, and this RAI is considered resolved and closed. Verification of the applicant's proposed changes in the next revision of the COL application is being tracked as **Confirmatory Item 03.03.01-1**.

With respect to the information in Section 3H.6.2, the staff issued **RAI 03.03.01-2 (eRAI 3220–Question 12853)** requesting that the applicant provide the technical basis for adopting a simplified approach for the conceptual design of the UHS basin and the pump house of each unit, by applying the free-field peak ground motion acceleration of 0.15 g in the two horizontal (N-S and E-W) directions and the vertical direction, thus ignoring the effects of seismic soil structure interaction (SSI). Furthermore, the staff asked the applicant to (1) discuss how the hydrodynamic effects of the water in the basin were considered; (2) describe in detail how the so-called final seismic analysis of the UHS structure will comply with the applicable acceptance criteria of SRP Sections 3.7 and 3.8; and (3) update the status of the FSAR in accordance with

10 CFR 50.71(e), which was tentatively scheduled to be submitted by the second quarter of 2009 for the staff to review. The applicant's response to **RAI 03.03.01-2 (eRAI 3220–Question 12853)** (ML092430131) states that the final UHS seismic analysis was performed by implementing SRP Sections 3.7 and 3.8 requirements and is documented in the enclosure of the applicant's response to **RAI 03.07.01-13 (eRAI 2924–Question 11783)** dated August 20, 2009 (STP letter U7-C-STP-NRC-090112, ML092360772). This enclosure also includes the basis for determining the hydrodynamic effects of the water in the basin. Attachment 1 to the response to **RAI 03.07.01-13** provides the schedule for submitting additional information. Furthermore, the applicant states that no additional COL application change is needed as a result of this response. The staff concludes that the resolution of **RAI 03.03.01-2** is contingent on the acceptance of the response to **RAI 03.07.01-13 (eRAI 2924–Question 11783**), which the staff evaluated in Section 3.7 of this SER. The resolution of RAI 03.03.01-2 is addressed under RAI 03.07.01-13. Therefore, **RAI 03.03.01-2 (eRAI 3220–Question 12853**) is resolved and closed.

COL License Information Items

- COL License Information Item 3.1 Site-Specific Design Basis Wind

COL License Information Item 3.3.3.1 in ABWR DCD, Revision 4, "Site-Specific Design Basis Wind," states:

> The site-specific design basis wind shall not exceed the design basis wind given in Table 2.0-1 (Subsection 2.2.1).

The staff verified STP's compliance with the above COL license information item. STP 3 and 4 COL FSAR, Revision 02, Subsection 3.3.3.1 states that, "The site-specific design basis wind does not exceed the design basis wind given in Table 2.0-1 of the reference ABWR DCD."

NRC staff issued **RAI 03.03.01-3 (eRAI 3220–Question 12855)** requesting that the applicant provide a justification, including comparative velocity data, to support the STP assertion that the site-specific, design-basis wind velocities do not exceed the design-basis wind velocities in Table 2.0-1 of the referenced ABWR DCD. The applicant's response to **RAI 03.03.01-3 (eRAI 3220–Question 12855)** (ML092430131) justifies the determination of the different wind velocities and shows that the plant-specific wind speeds are bounded by the assumed wind velocities in ABWR DCD, Revision 4. An excerpt of the comparison is summarized below.

Wind Speed Comparison of DCD Table 2.0-1 and ASCE 7-05 (STP Units 3 and 4)

	DCD Table 2.0-1				ASCE 7-05	
Mean Recurrence Interval (MRI) (yrs)	Fastest mile (Vfm)		3-Sec Gust (V3S)		3-Sec Gust (V3S)	
	km/h	mph	km/h	mph	km/h	mph
50	177	110	203	126	201	125
100	197	122	224	139	215	134

During the review and evaluation, the staff noted that several changes to the wind design codes and standards have occurred since COL License Information Item 3.1 was written and

documented in ABWR DCD. Therefore, comparing only wind speeds is not considered an adequate approach, because buildings are not designed only for velocities but to also resist internal and external wind loadings. Hence, an acceptable method is to compare the building loadings as expressed in the resulting wind velocity pressures for a given design-basis wind.

The staff performed a comparative set of calculations based on velocity pressures acting on a building. The results show that in spite of the several code and requirement changes (exposure categories, importance factor, "fastest mile" versus "3-sec gust," etc.), the resulting velocity pressures are very close.

Based on this independent evaluation, the staff concludes that the site-specific design wind (both velocity and loading) does not exceed the design-basis wind in Table 2.0-1 of the referenced ABWR DCD. Therefore, **RAI 03.03.01-3 (eRAI 3220–Question 12855)** is resolved and closed.

- COL License Information Item 3.3 Effect of Remainder Of Plant Structures, Systems and Components Not Designed For Wind Loads

Subsection 3.3.3.3 lists the following site-specific supplement related to COL License Information Item 3.3:

> The design criteria for plant structures, systems and components (SSCs) not designed for wind loads are as follows: Such SSCs not designed for wind loads are analyzed using the 1.11 importance factor or are checked to ensure that their mode of failure will not affect the ability of safety-related SSCs to perform their intended safety functions.

With respect to the supplement listed in Subsection 3.3.3.3, the staff issued **RAI 03.03.01-4 (eRAI 3220–Question 12856)** requesting a more detailed discussion of the approaches and analyses the applicant plans to use to ensure that SSCs not designed for wind loads are analyzed and checked to insure that their mode of failure will not affect the ability of safety-related SSCs to perform their intended safety functions. Also, the staff asked the applicant to discuss the codes and standards (e.g., ASCE-SEI 7-05) that will be used to ensure the realization of an expected SSC performance outcome. Furthermore, the discussion should refer to pertinent SRP acceptance criteria or guidance the applicant relied on to perform the analyses. The response to **RAI 03.03.01-4** (ML092430131) refers to the applicant's response to **RAI 03.03.01-5 (eRAI 3220–Question 12858)**. The resolution of **RAI 03.03.01-4** is addressed under **RAI 03.03.01-5** . Therefore, **RAI 03.03.01-4** is closed.

ABWR DCD Subsection 3.3.3.3, "Effect of Remainder of Plant SSC Not Designed for Wind Loads," directs the applicant to design SSCs not designed for wind loads to use an importance factor of 1.11 or to check that their mode of failure will not affect the performance of safety-related SSCs. Consequently, in STP Units 3 and 4 FSAR Subsection 3.3.3.3, the applicant commits to design the remainder of the SSCs based on an importance factor of 1.11. Because the proposed importance factor of 1.11 is not a part of the adopted ASCE 7-05 standard (or SRP Subsection 3.3.1.II), the staff issued **RAI 03.03.01-5** requesting that the applicant justify the use of importance factor1.11 instead of importance factor 1.15, per SRP Subsection 3.3.1.II. In addition, the staff requested that the applicant specify the remaining parameters of the basic wind equation used to determine the building wind loads.

The applicant's response to **RAI 03.03.01-5** ML092430131) confirms that the nonsafety-related SSCs located in close proximity to Seismic Category I structures will be designed to prevent II/I interactions. Close proximity is defined as when the distance between the Seismic Category I SSC and the nonsafety-related SSC is less than the height above the grade of the nonsafety-related SSC. Therefore, the severe wind design for no collapse of SSCs with II/I interactions shall be in accordance with ASCE 7-05. The applicant adds that COL FSAR Subsection 3.3.3.3 will be revised accordingly.

The staff noted that except for the additional importance factor of 1.15, as required SRP Subsection 3.3.1.II for a Seismic Category I SSC (100-year wind plus importance factor 1.15), the applicant's procedure described in the above response results in the same wind loadings used to design a Seismic Category I SSC. Such an approach meets the requirements of ASCE 7-05, Table 1-1, if nonsafety-related structures with a potential for II/I interactions are considered as Occupancy Category III structures, and if they are designated to be designed for a 100-year wind speed, per Table 6-1 (using an importance factor 1.15). Since building design according to ASCE 7-05 and IBC 2006 is intended to prevent the loss of life, such structures are not expected to collapse and are therefore not considered a threat to nearby safety-related SSCs.

However, the consideration of a seismic interaction per SRP 3.7.2.II.8(C), "Interaction of Non-Category I Structures with Category I SSCs," requires under Criterion C that safety margins against failure be equivalent to those of Category I SSCs. The SRP offers three different optional criteria to resolve II/I seismic interaction problems. Criterion C corresponds to the applicant's procedure for analyzing and designing the nonsafety-related SCCs against collapse under wind loadings.

The applicant's proposed procedure to determine wind loading for a nonsafety-related SSC differs from the design of a Seismic Category I SCC in not considering the additional importance factor of 1.15. Because other design assumptions (e.g., load combinations, allowable stresses, etc.) that affect the ultimate strength are not known, the staff also requested that the applicant evaluate and provide safety margins against the failure of nonsafety-related SSCs. The safety margins should be equivalent to Category I SSC safety margins.

The applicant's response to **RAI 03.03.01-5** also commits to revise COL FSAR Subsection 3.3.3.3 as follows:

> The design criteria for plant structures, systems and components (SSCs) not designed for wind loads are as follows: Such SSCs not designed for wind loads are analyzed using the 1.15 importance factor or are checked to ensure that their mode of failure will not affect the ability of safety-related SSCs to perform their intended safety functions.

In order to comply with the interaction requirements in SRP Subsection 3.7.2.II.8(C) described above, the applicant is required to provide and evaluate the safety margins against the failure of SSCs against wind loads whenever wind loads are the governing design loads on a structure. The safety margin shall be equivalent to the safety margin obtained for a Seismic Category I SSC. The revision shall also include a reference to the design parameters listed in the applicant's response to **RAI 03.03.01-5** regarding the design intended to prevent the collapse of SSCs with II/I interaction potential.

Therefore, the applicant's response was considered incomplete and needed to be augmented. The staff issued **RAI 03.03.01-9 (eRAI 3860–Question 14904)** requesting the applicant

specifically include and describe the evaluation of the safety margin of nonsafety-related SSCs against wind failure.

The applicant's response to **RAI 03.03.01-9 (**dated December 16, 2009; STP Letter U7-C-STP-NRC-090225; Attachment 1, ML093520627) states that the importance factor of 1.11, as described in FSAR Section 3.3.3.3 and incorporated by reference from the ABWR DCD, was approved in the ABWR FSER (NUREG–1503). However, to provide additional design margin, an importance factor of 1.15 will be used and Subsections 3.3.3.3 and Section 3.3.4 will be revised to reflect this change. The staff found this response acceptable and concludes that the design procedures for non-Seismic Category I structures with a potential for interaction with Seismic Category I structures ensures adequate safety, in accordance with the SRP requirements. Therefore, **RAI 03.03.01-9** is resolved and closed. Verification that the applicant's proposed changes appear in the next revision of the COL application is being tracked as **Confirmatory Item 03.03.01-9**. The staff's evaluation of the acceptability of the applicant's analysis of II/I interactions is provided in Section 3.7.2 of this SER.

STP Units 3 and 4 COL FSAR Tier 2, Subsection 2.3S.1.3.3, does not explicitly discuss the hurricane wind speeds. The 100-year return period value required in SRP Section 2.3 is presumed to include hurricane wind speed. According to the data described in FSAR Subsection 2.3S.1.3.3, there have been five Category 4 and 5 hurricanes in 155 years in the site region. GDC 2 requires the applicant to consider the effects of the most severe historically reported natural phenomena. The staff issued **RAI 03.03.01-6 (eRAI 3220–Question 12859)** requesting the applicant to clarify that the basic wind velocity interpolated from ASCE 7-05 Figure 6-1A covers the most severe hurricanes historically reported for the site region. The response to **RAI 03.03.01-6** (ML092430131) refers to the applicant's response to **RAI 02.03.01-21 (eRAI 1647–Question 6041)** dated May 26, 2009, (U7-C-STP-NRC-090049, ML091490166), which addresses hurricane winds and indicates that no additional COL application change is required. The staff evaluated **RAI 02.03.01-21** in Section 2.3.1 of this SER and found the response acceptable. Therefore, **RAI 03.03.01-6** is resolved and closed.

In STP Units 3 and 4 COL FSAR Tier 2, Revision 2 Subsections 2.3S.1.3.1 and 3.3.1.1, the applicant provides the procedures for and parameters of wind load design. Wind parameters are provided for 50- and 100-year MRIs. According to SRP 2.3.1 Section II, "Acceptance Criteria," SRP Acceptance Criterion 4 states that the Seismic Category I structures shall be designed to withstand the 100-year return period 3-second gust wind speeds. The staff issued **RAI 03.03.01-7 (eRAI 3220–Question 13159)** requesting **that** the applicant confirm that the site-specific Seismic Category I SSCs, including the UHS structure, will be designed to withstand the 100-year MRI 3-second gust winds. The applicant's response to **RAI 03.03.01-7** (ML092430131) states:

> As stated in Section 3H.6.4.3.2 of the enclosure to the response to **RAI 03.07.01-13 (eRAI 2924-Question 11783)** (see letter U7-C-STP-NRC-090112 dated August 20, 2009), the site-specific Seismic Category I structures, systems, and components (SSCs), including the Ultimate Heat Sink structure, are designed to withstand the 100-year recurrence interval 3-second gust winds. No additional COLA change is required for this response.

During the evaluation, the staff noted that in STP Units 3 and 4 COL FSAR Tier 2, Revision 2 Subsection 3H.6.4.3.2, "Severe Environmental Load," the applicant provides the procedures for and parameters of wind load design for site-specific Seismic Category I SCCs, including the UHS structures. The stated basic wind speed is 215 km/h (134 mph), which corresponds to the

100-year MRI wind speed at the STP Units 3 and 4 site. All of the remaining design parameters in Subsection 3H.6.4.3.2 comply with SRP 3.3.1.II, "Acceptance Criteria," including the importance factor 1.15, which is used in addition to the 100-year return period wind speed. Therefore, the staff concludes that the applicant has adequately responded to **RAI 03.03.01-7. RAI 03.07.01-7** is resolved and closed.

Subsection 3.3.1.2 and Section 3H.6 of the STP Units 3 and 4 FSAR, Revision 2, describe the applied forces and the procedures used to determine the wind loadings on the UHS and other site-specific Class I buildings and SSCs, specifying loads to be determined based on wind Exposure C. The referenced ABWR DCD, Revision 4, is based on a previous edition of the ASCE 7 Code (ASCE 7-93, Reference 3.3-1 in the ABWR DCD). Consequently, wind Exposure D was used to determine wind loadings on buildings and SSCs. SRP Subsection 3.3.1.II, "Acceptance Criteria," requires wind load designs to be based on the current ASCE/SEI 7-05 standard, which uses the changed wind exposure definitions. Wind exposure definitions were changed in 1998. The staff issued **RAI 03.03.01-8 (eRAI 3220–Question 13160)** asking the applicant to justify the use of Exposure Category C instead of D to ensure that the correct exposure coefficient is used for STP site-specific structures, including the UHS structure. The applicant's response to **RAI 03.03.01-8** (ML092430131) justifies the use of Exposure Category C, which meets the requirements of SRP 3.3.1 and is appropriate for determining the geographic location of STP Units 3 and 4 structures. During the evaluation, the staff noted that because the design documented in ABWR DCD, Revision 4, was based on a previous edition of the code, buildings were designed for wind Exposure Category D, which in older code versions represented open spaces (including shorelines) in hurricane-prone regions. Exposure definitions C and D were changed in the ASCE 7-98 edition, so that Exposure Category C and not D include the hurricane-prone shoreline regions. Exposure Category D also applies to structures within a 600-ft inland from a shoreline if the water surface extension is more than 5,000 ft, which is the case for the main cooling reservoir. Class I buildings are beyond the 600-ft range, as shown in Figure 2.1S-4, "Enlarged Site Area Map," of STP Units 3 and 4 FSAR Tier 2 Chapter 2, "Site Characteristics."

According to ASCE 7-05, Exposure Category C applies to all cases that are not applicable to Exposure Category B or D. Because Exposure Category D applies to all flat, unobstructed areas and water surfaces outside hurricane-prone regions, the correct exposure definition at the STP Units 3 and 4 site is Exposure Category C. Therefore, the staff concludes that the applicant has adequately responded to **RAI 03.03.01-8**, and this RAI is resolved and closed.

3.3.1.5 *Post Combined License Activities*

There are no post COL activities related to this section.

3.3.1.6 *Conclusion*

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to the tornado loadings. With the exception of **Confirmatory Items 03.03.01-1 and 03.03.01-9**, no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52 Appendix A, Section VI.B.1, all nuclear safety issues relating to the wind loadings that were incorporated by reference have been resolved.

In addition, the staff compared the additional COL license information in the application to the relevant NRC regulations and the acceptance criteria in NUREG–0800, Section 3.3.1. The staff's review confirmed that the applicant has adequately addressed the required information (COL license information items and the supplemental information) related to wind loadings. Specifically, the staff concludes that the information pertaining to the STP Units 3 and 4 COL application FSAR, Tier 2 Revision 2, Section 3.3.1 is within and consistent with the scope of the design certification. The information also complements and follows the ABWR DCD wind loadings design requirements regarding the site-specific SSCs. However, as a result of **Confirmatory items 03.03.01-1 and 03.03.01-9**, the staff was unable to finalize the conclusions relating to the wind loadings, in accordance with the NRC requirements.

3.3.2 Tornado Loadings

3.3.2.1 *Introduction*

This section of the FSAR addresses the ABWR standard and site-specific plant structures that are Seismic Category I and are designed for extreme tornado phenomena. To meet the requirements of GDC 2, the safety-related structures of STP Units 3 and 4 will be designed to withstand the effects of the design-basis tornado (DBT). This section describes and specifies the following:

- The design-basis tornado parameters.
- The basis for selecting the site-specific, design-basis tornado.
- The methods for calculating tornado loads on SSCs.
- The procedures for treating the effect of remainder of plant SSCs not designed for tornado loads on safety-related SSCs.

The site-specific design tornado loading is evaluated to ensure that it is bounded by the design tornado loading in the ABWR DCD.

3.3.2.2 *Summary of Application*

Section 3.3.2 of the STP Units 3 and 4 COL FSAR incorporates by reference Section 3.3.2 of the certified ABWR DCD, Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 3.3.2, the applicant provides the following departure and supplements:

Tier 1 Departure

- STD DEP T1 2.15-1 — Reclassification of Radwaste Building from Seismic Category I to Non-Seismic

This departure reclassifies the radwaste building (RWB) from Seismic Category 1 to non-seismic.

COL License Information Items

- COL License Information Item 3.2 Site-Specific Design Basis Tornado

This COL license information item provides site-specific supplemental information showing that the site-specific DBT does not exceed the DBT in Table 2.0-1 of the referenced ABWR DCD.

- COL License Information Item 3.4 Effect of Remainder of Plant Structures, Systems, and Components Not Designed for Tornado Loads

This COL license information item provides site-specific supplemental information showing that the design criteria for plant SSCs not designed for tornado loads are analyzed for the site-specific loadings, thus ensuring that their mode of failure will not affect the ability of safety-related SSCs to perform their intended safety functions.

Supplemental Information

In Subsection 3.3.2.2, "Determination of Forces on Structures," the applicant provides the following:

> The applied forces and procedure used to determine the tornado loading on the Ultimate Heat Sink is described in Appendix 3H.6.

In Section 3.3.4, "References," the applicant provides the following:

> 3.3-4 International Code Council, 2003 International Building Code.

3.3.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is in NUREG–1503.

The regulatory basis and acceptance criteria for reviewing the site-specific information, the COL license information items, and the supplemental information in the COL application are in Section 3.3.2 of NUREG–0800.

In addition, in accordance with Section VIII, "Processes for Changes and Departures," of, "Appendix A to Part 52--Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies one Tier 1 departure that requires prior NRC approval. This departure is subject to the requirements of Section VIII.A.4.

3.3.2.4 *Technical Evaluation*

As documented in NUREG–1503, NRC staff reviewed and approved Section 3.3.2 of the certified ABWR DCD. The staff reviewed Section 3.3.2 of the STP Units 3 and 4 COL FSAR and checked the pertinent sections of the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3, for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this section.

The staff reviewed the following information in the COL FSAR:

Tier 1 Departure

- STD DEP T1 2.15-1 Reclassification of Radwaste Building from Seismic Category I to Non-Seismic.

This departure addresses the determination that the RWB is not classified as a Seismic Category I structure. The staff evaluation of the acceptability of this departure is provided in Section 3.8.4 of this SER.

COL License Information Items

- COL License Information Item 3.2 Site-Specific Design Basis Tornado

The ABWR DCD uses Intensity Region I and assigns a Design Basis Tornado maximum wind speed of 300 mph. A complete list of tornado-related site parameters (consistent with the DBT parameters in RG 1.76) is given in the reference ABWR DCD, Tier 2, Revision 4, Table 2.0-1, and includes the following site parameter values for which the ABWR standard plant is designed:

- Maximum tornado wind speed of 483 km/h (300 mph)
- Translational velocity of 97 km/h (60 mph)
- Maximum rotational speed of 386 km/h (240 mph)
- Radius of 45.7 m (150 ft)
- Maximum pressure drop of 13.8 kPaD (2.0 psi), and
- Rate of pressure drop of 8.3 kPa/sec (1.2 psi/s)

The STP site is in the Tornado Intensity Region II according to R.G. 1.76. The parameters of the DBT for Region II are bounded by those of the Region I. The $1x10^{-7}$ per year probability of exceedance of wind speed calculated in NUREG/CR-4461 (Table 6-1) for the STP site is 196 mph.

In determining the tornado intensity region applicable to the STP site, information in Revision 2 of NUREG/CR-4461 was taken into consideration. That document was the basis for most of the technical revisions to RG 1.76. Based on Revision 1 of RG 1.76, the DBT characteristics for Tornado Intensity Region II, applicable to STP Units 3 and 4 are:

- Maximum wind speed of 200 mph (89 m/sec) (322 km/h)
- Translational speed of 40 mph (18 m/s) (64 km/h)
- Maximum rotational speed of 160 mph (72 m/s) (258 km/h)
- Radius of maximum rotational speed of 150 ft (45.7 m)
- Pressure drop of 0.9 pound per square inch (psi) (63 mbar), and
- Rate of pressure drop of 0.4 psi/sec (25 mbar/s)

Since the tornado-related site parameters identified in the ABRW DCD bound those for the STP site which is in Tornado Intensity Region II, the staff concludes that applicant is in compliance with COL License Information Item 3.2.

- COL License Information Item 3.4 Effect of Remainder of Plant Structures, Systems, and Components Not Designed for Tornado Loads

For an evaluation of COL License Information Item 3.4, see **RAI 3.03.02-6 (eRAI 3223-Question: 12887)** under the "Supplemental Information," discussion below.

Supplemental Information

NRC staff issued **RAI 03.03.02-1 (eRAI 3223-Question 12878)** requesting that the applicantdiscuss: (1) the aspects of structural and seismic analysis and design that are not in compliance with the applicable SRP Section 3.7 and 3.8 acceptance criteria, and justify each deviation from the SRP acceptance criteria; and (2) to discuss the site-specific analyses performed in order to maintain the structural integrity of the UHS structure subject to load combinations including the tornado loads. In the response to this RAI dated October 7, 2009 (U7-C-STP-NRC-090161, ML092860129), the applicant states that the only exception taken is that the three ground motion time histories are not statistically independent from each other. SRP Section 3.7.1 requires that when time histories are used, the three ground motion time histories must be shown to be statistically independent from each other. This deviation is justified because the maximum representative responses of interest for the Seismic Category I structures are obtained by performing separate analyses for each of the three components of earthquake motion, which are then combined using the Square Root of Sum of Squares (SRSS) rule in accordance with sub-section 2.2 (1) of RG 1.92, Revision 2. Thus the applicant's use of an alternate approach in accordance with Section 2.2 (1) of RG 1.92, Revision 2 is acceptable. With respect to SRP Section 3.8.4, the applicant states that no exception is taken, with the following comments on the applicability of some of the SRP requirements. Among the RGs listed in Section II under SRP acceptance criteria, only RG 1.142, 1.160, and 1.199 are applicable for the design and analysis of the site-specific Seismic Category I structures. This comment indicating that only RGs 1.142, 1.160, and 1.199 are applicable to the STP plants is for information only, and is thus deemed acceptable. Therefore, **RAI 03.03.02-1** is considered resolved and closed.

10 CFR Part 50 Appendix A, GDC 2 requires that SSCs important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornados, hurricanes, tsunami, floods, and seiches without loss of capability to perform their safety functions. The STP Ultimate Heat Sink structure is a site-specific Seismic Category I structure that should be designed to withstand the effects of tornado loading and missiles. In Subsection 3.3.2.2 of the STP Units 3 and 4 COL FSAR, the applicant states that the applied forces and procedures used to determine the tornado loading on the UHS are described in Section 3H.6. The staff reviewed Section 3H.6 and needed more information to complete the review of the integrity of the UHS. The staff issued **RAI 03.03.02-2 (eRAI 3223-Question 12881)** requesting that the applicant provide details on the design procedures used to ensure the structural integrity of UHS against tornado impact effects. In response to this RAI (ML092860129), the applicant states that the UHS will be designed to the Region II Design Basis Tornado specified in RG 1.76, as described in COL FSAR, Tier 2, Subsection 3H.6.4.3.3.1. The missile spectrum for the Region II DBT, as specified in SRP 3.5.1.4, will be used to assess the local damage and overall damage effects following the missile barrier design procedures given in SRP 3.5.3. The staff concludes that this is an acceptable approach because it conforms to RG 1.76 and meets the SRP acceptance criteria. Therefore, **RAI 03.03.02-2** is resolved and closed.

In Subsection 3H.6.4.3.3.1 of the COL FSAR, the applicant states that tornado missile impact effects on the UHS basin and cooling tower structures, and the RSW pump houses are

evaluated for local damage and global structural response using the US Department of Army, "Fundamentals of Protective Design for Conventional Weapons," November 1986, TM 5-855-1 formula and the procedure given in Bechtel Topical Report BC-TOP-9A, "Tornado and Extreme Wind Design Criteria for Nuclear Power Plants", respectively. Because these methods are not referenced in SRP Section 3.5.3, the staff issued **RAI 03.03.02-3 (eRAI 3223-Question 12883)** requesting that the applicant discuss the validity of these methods in light of the corresponding SRP acceptance criteria and justify any deviations. In the response to this RAI dated October 7, 2009 (ML092860129), the applicant confirms that the prediction of local damage in terms of penetration, perforation and spalling of concrete barriers will be performed using the TM 5-855-1 formula to remain consistent with that used in the DCD design for standard plant safety-related structures. In comparison to the National Defense Research Council (NDRC) formula specified in SRP 3.5.3 as acceptable, the TM 5-855-1 formula will predict higher penetration but less required thickness to prevent scabbing. However, actual thicknesses provided for the UHS basin, cooling tower enclosures and RSW pump house walls and slabs acting as missile barriers exceed the higher scabbing thickness predicted by the NDRC formula. Furthermore, the applicant states that the reference to BC-TOP-9A was removed in COL application Revision 2 and the structural response evaluation was not performed in accordance with BC-TOP-9A. Additionally, the applicant states that the ductility limits for the concrete barriers are in accordance with the limits specified in Appendix C of ACI 349-97 which is consistent with SRP Section 3.8.4. For the overall response calculation, the applicant follows the methods described in the ABWR DCD for rigid missiles and deformable missiles. In the determination of the minimum barrier thicknesses the applicant did not follow the SRP recommended approach, but demonstrated that the provided wall thicknesses exceed the SRP requirements, which is acceptable. The staff thus concludes that the methods used for local and overall missile damage prediction meet or exceed the SRP acceptance criteria. Therefore, **03.03.02-3** is resolved and the RAI is closed.

The load combinations for reinforced concrete structures specified in Appendix 3H.6.4.3.4.3 for site-specific structures are different when compared to the load combinations specified in the SRP, which endorses ACI 349-97 and RG 1.142. The staff issued **RAI 03.03.02-4 (eRAI 3223-Question 12885)**, requesting that the applicant explain these differences and justify the use of environmental durability factors defined in ACI 350-2001. In the response to this RAI dated October 7, 2009 (ML092860129) the applicant presents a table comparing the load combinations specified in COL application Revision 3 and in ACI 349-97 and states that the apparent differences arise because the operating basis earthquake is not used in the design basis of STP Units 3 and 4. Furthermore, the applicant states that the accident pressure load, reaction load, jet impingement load, and missile load are not applicable because the RSW piping is not a high energy line. Figure 9.2-7 of the DCD describes the RSW piping as Seismic Class I piping with a design pressure of 0.785 MPa (100 psig) and a design temperature of 50 °C. SRP Section 3.6.2 requires consideration of pipe break effects (i.e., accident pressure load, reaction load, jet impingement load, and missile load) from only high energy and medium energy piping. Therefore, the staff's evaluation found that such effects need not be considered for the RSW piping. Following ACI 350, the applicant has increased the load factor on hydrostatic load (F). The applicant has argued that ACI 350 was not available when the earlier United States nuclear power plants were built during the 1970s and 1980 and the use of durability factors is conservative for the design of the UHS structures. The staff reviewed the basis for the change in load combinations for site-specific structures and concludes that the new load combinations proposed by the applicant are conservative compared to those specified in SRP acceptance criteria. The applicant's response to **03.03.02-4** is satisfactory, and RAI is resolved. Verification that the applicant proposed changes appear in the next revision of the COL application is being tracked as **Confirmatory Item 03.03.02-4**.

The RWB at STP Units 3 and 4 is now designed as non-Seismic Category I structure. Because this building is in close proximity to the reactor building, the staff issued **RAI 03.03.02-5 (eRAI 3223-Question 12886)** asking the applicant to confirm that the design will prevent the collapse of this building on to adjacent Seismic Category I buildings and any missiles generated are bounded by the STP Units 3 and 4 DBT missiles. Since the above grade height of this building exceeds the distance to the RB, the applicant's response to this RAI dated October 7, 2009 (ML092860129), states that the RWB design shall satisfy the II/I requirements of not collapsing or coming into contact with the RB or other Seismic Category I SSC under Safe-Shutdown Earthquake (SSE) and tornado loads. The applicant has chosen to design the RWB for tornado design parameters defined in the DCD for the standard plant Seismic Category I structures (i.e., 300 mph tornado). This approach is conservative since the site-specific tornado for the STP site is a Region II tornado according to RG 1.76 (i.e., 200 mph tornado). Furthermore, the applicant has confirmed that the RWB is a typical structure found within the power block of nuclear power plants and it does not include any unique design or construction features which may provide a new tornado generated missile spectrum beyond those for typical nuclear power plants. Thus, any tornado-generated missile from the RWB is considered bounded by the STP Units 3 and 4 DBT-generated missiles. The staff reviewed the tornado design criteria proposed by the applicant and concludes that the design meets the SRP acceptance criteria (SRP Section 3.3.2 Acceptance Criterion 4B). The staff agreed with the judgment that any missiles generated from tornado induced failure of the RWB are bounded by the Region I DBT missiles used in the design of Seismic Category I structures. Therefore, the applicant's response is satisfactory and **RAI 03.03.02-5** is resolved and closed. The staff's evaluation of the acceptability of the applicant's analysis of II/I interactions is provided in Section 3.7.2 of this SER.

The STP Units 3 and 4 layout includes non-Seismic Category I structures that are not designed for tornado loadings and missile impacts and which may be in close proximity to Seismic Category I structures. The staff issued **RAI 03.03.02-6 (eRAI 3223-Question 12887)** asking the applicant to provide a description of the approaches and analyses used to ensure that site-specific SSCs not designed for tornado loads are analyzed and checked to prevent modes of failure that will affect the ability of safety-related SSCs to perform their intended safety functions. In the response to this RAI dated October 7, 2009 (ML092860129), the applicant confirms that site-specific SSCs, which are not designed for tornado loads and are within close proximity of the safety-related SSCs such that their collapse under tornado loading may impact the nearby safety-related SSCs, are evaluated for the site specific tornado loading parameters. The staff concludes that this aspect of the design is in conformance with the SRP Section 3.3.2 Acceptance Criterion 4B. The applicant's response to **RAI 03.03.02-6** is satisfactory, and this RAI is resolved. Verification that the applicant's proposed changes appear in the next revision of COL Application is being tracked as **Confirmatory Item 03.03.02-6**.

In the ABWR DCD design, the conversion of tornado wind velocity into loads on structures and elements followed the methods described in Bechtel Topical Report BC-TOP-3-A, Revision 3, "Tornado and Extreme Wind Design Criteria for Nuclear Power Plants." The Bechtel Topical Report, BC-TOP-3-A is not endorsed in SRP and the conversion of the design wind velocity into velocity pressure and design wind pressures in BC-TOP -3-A may be different from the procedures given in ASCE/SEI 7-05, which is approved in the SRP. The staff issued **RAI 03.03.02-7 (eRAI 3223-Question 13173)** requesting that the applicant clarify the approach for the design and analysis of STP Units 3 and 4 site-specific structures, including the UHS structure. In the response to this RAI dated October 7, 2009 (ML092860129), the applicant confirms that site-specific structures including the UHS structure will be designed to withstand the site-specific tornado loading using the procedures described in ASCE/SEI 7-05.

Accordingly, the applicant calculated a maximum velocity pressure using a maximum wind speed of 200 mph, which corresponds to Region II tornado intensity in RG 1.76. The staff concludes that this aspect of the design procedure for tornado loading on site-specific structures is in conformance with the acceptance criteria of SRP Section 3.3.2 which endorses the ASCE/SEI 7-05. Therefore, the applicant's response to **RAI 03.03.02-7** is satisfactory, and this RAI is resolved. Verification that the applicant's proposed changes appear in the next revision of the COL application is being tracked as **Confirmatory Item 03.03.02-7**.

In ABWR DCD, Revision 4, wind Exposure Category D was used to determine tornado loadings on buildings and SSCs, as required by the ASCE 7-93 standard (Reference 3.3-1 in ABWR DCD). SRP Subsection 3.3.1.II "SRP Acceptance Criteria," require tornado designs to be based on the current ASCE/SEI 7-05 standard, which uses the changed wind exposure definitions. Wind exposure definitions were changed in 1998. Therefore, the staff issued **RAI 03.03.02-8 (eRAI 3223-Question 13174)** requesting that the applicant clarify the exposure coefficient used for site-specific structures including the UHS structure. In the response to this RAI dated October 7, 2009 (ML092860129), the applicant justifies the use of Exposure Category C, which meets the acceptance criteria of SRP Section 3.3.2 and is appropriate for the geographic location of STP 3 and 4 structures. Furthermore, the applicant adds that a constant value of 0.87 will be used for a velocity pressure exposure coefficient as specified in SRP Section 3.3.2. The staff found that this aspect of the design procedure for tornado loading on site-specific structures is in conformance with the acceptance criteria of SRP 3.3.2. Therefore, the staff concludes that the applicant has satisfactorily responded to **RAI 03.03.02-8**, and this is resolved and closed.

In STP Units 3 and 4 COL FSAR, Part 2, Tier 2, Section 1.8 and Table 1.8-21, "Industrial Codes and Standards Applicable to ABWR", the applicant commits to use the International Building Code (IBC) 2006, which is also adopted by the State of Texas, and not IBC 2003 as referenced in Section 3.3.4 of COL FSAR. The staff issued **RAI 03.03.02-9 (eRAI 3223-Question 13175)** asking the applicant to reconcile the difference. In the response to this RAI dated October 7, 2009 (ML092860129), the applicant confirms that COL FSAR Tier 2, Section 3.3.4 will be revised to change the reference from IBC 2003 to IBC 2006. The staff found the applicant's response acceptable, and the RAI is resolved. Verification that the applicant's proposed changes appear in the next revision of the COL application is being tracked as **Confirmatory Item 03.03.02-9**.

3.3.2.5 *Post Combined License Activities*

There are no post COL activities related to this section.

3.3.2.6 *Conclusion*

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to the wind loadings. With the exception of **Confirmatory Items 03.03.02-4, -6, -7, and -9**, no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52 Appendix A, Section VI.B.1, all nuclear safety issues relating to the tornado loadings that were incorporated by reference have been resolved.

In addition, the staff compared the additional COL license information in the application to the relevant NRC regulations and the acceptance criteria in NUREG–0800, Subsection 3.3.2. The

staff's review confirmed that the applicant has adequately addressed the required information (COL license information items and the supplemental information) related to tornado loadings. Specifically, the staff concludes that the information pertaining to STP Units 3 and 4 COL FSAR Tier 2, Revision 2 Section 3.3.2, is within and consistent with the scope of the design certification. The information also complements and follows the ABWR DCD tornado loading design requirements regarding the site-specific SSCs. However, as a result of **Confirmatory items 03.03.02-4, -6, -7, and -9**, the staff was unable to finalize the conclusions relating to the tornado loadings, in accordance with the NRC requirements.

3.4 Water Level (Flood) Design

This chapter of the FSAR describes the design features and flood protection measures taken for structures at STP Units 3 and 4 to resist external floods from natural phenomena (probable maximum flood, tsunamis, precipitation, etc) and from single failure of man-made structures (e.g. failure of main cooling reservoir).

3.4.1 Flood Protection for Onsite Equipment Failure

3.4.1.1 *Introduction*

This section of the FSAR addresses internal flood protection for all structures, systems, and components (SSCs) of the plant whose failure could prevent a safe shutdown of the plant or result in an uncontrolled release of a significant amount of radioactivity.

Site-specific external flooding parameters are discussed in SER Sections 2.4.2 through 2.4.6. The review of the requirements to protect all safety-related facilities from external floods are discussed in SER Sections 2.4.10 and 2.4.14.

3.4.1.2 *Summary of Application*

Section 3.4.1 of the STP Units 3 and 4 COL FSAR incorporates by reference Section 3.4.1 of the certified ABWR DCD Revision 4 referenced in 10 CFR Part 52, Appendix A. In addition, in COL FSAR, the applicant provides the following:

Tier 1 Departures

- STD DEP T1 2.3-1 — Deletion of MSIV Closure and Scram on High Radiation

This departure eliminates the scram and main steam isolation valve (MSIV) automatic closure of the high main steamline radiation monitor (MSLRM) indication. This departure requires NRC review and approval in accordance with 10 CFR Part 52 Appendix A, Section VIII.A.4.

- STP DEP T1 5.0-1 — Site Parameters

This departure is discussed in Sections 2.4.2 through 2.4.6 and Sections 2.4.10 and 2.4.14 of this SER.

- STD DEP T1 2.15-1 Re-classification of Radwaste Building Substructure from Seismic Category I to Non-Seismic

This departure revises the seismic category of the RW/B substructure from Seismic Category I to non-seismic.

Tier 2 Departures Not Requiring Prior NRC Approval

- STD DEP 1.2-1 Control Building Annex

This departure relocates the reactor internal pump (RIP) motor-generator sets and associated support components to a new building (Control Building Annex) adjacent to the control building.

- STP DEP 1.2-2 Turbine Building

This departure changes the turbine building design, including the size of the condenser and circulating water piping.

- STP DEP 3.8-1 Resizing the Radwaste Building

This departure changes the dimensions and layout of the radwaste building.

- STP DEP 9.2-5 Reactor Service Water (RSW) System

This departure modifies the RSW system to increase the RSW flow rates and pipe sizes.

COL License Information Items

- COL License Information Item 3.5 Flood Elevation

This COL license information item addresses COL License Information Item 3.4.3.1 in the ABWR DCD. It describes all penetrations and doors that penetrate the exterior walls of Seismic Category I buildings located below the design-basis flood level to be watertight.

- COL License Information Item 3.6 Ground Water Elevation

This COL license information item addresses COL License Information Item 3.4.3.2 in the ABWR DCD. It describes ground water elevation as lower than 61.0 cm below grade.

- COL License Information Item 3.7 Flood Protection Requirements for Other Structures

This COL license information item addresses COL License Information Item 3.4.3.3 in the ABWR DCD. It describes the flood protection levels for the UHS and RSW Piping Tunnel.

3.4.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is in NUREG–1503.

The regulatory basis for reviewing COL license information items is in Section 3.4.1 of NUREG-0800.

In accordance with Section VIII, "Processes for Changes and Departures," of "Appendix A to Part 52--Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies Tier 1 and Tier 2 departures. Tier 1 departures require prior NRC approval and are subject to the requirements of 10 CFR Part 52 Appendix A, Section VIII.A.4. Tier 2 departures not requiring prior NRC approval are subject to the requirements of 10 CFR Part 52 Appendix A Section VIII.B.5, which are similar to the requirements in 10 CFR 50.59.

3.4.1.4 *Technical Evaluation*

As documented in NUREG–1503, NRC staff reviewed and approved Section 3.4.1 of the certified DCD for the ABWR design. The staff reviewed Section 3.4.1 of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this section.

The staff reviewed the information in the COL FSAR:

Tier 1 Departures

- STD DEP T1 2.3-1 — Deletion of MSIV Closure and Scram on High Radiation

This departure deletes the MSIV closure and scram on high radiation. The staff reviewed this departure and determined that it does not affect any Tier 1 information related to protection from internal flooding. In addition, the staff determined that the applicant is not seeking approval for the Tier 2 changes in COL FSAR Subsection 3.4.1.1.2. The removal of the MSIV closure on high radiation does not affect the previously approved analysis of internal flooding because the design bases do not credit the MSIV isolation as a mitigating strategy. The main steamline tunnel is designed to contain the worst-case flooding of a feedwater line break during a 2-hour period. The water discharged from a postulated feedwater line break will be contained in the Seismic Category I structure of the main steamline tunnel area and will not flood any safety-related equipment in the reactor building. On the basis of this information, the staff concluded that this departure from Subsection 3.4.1.1.2 of the certified ABWR DCD is acceptable with regard to protection from internal flooding.

- STD DEP T1 2.15-1 — Re-classification of Radwaste Building Substructure from Seismic Category I to Non-Seismic

NRC staff reviewed STP DEP T1 2.15-1, which re-classifies the radwaste building substructure from a Seismic Category I structure to a non-seismic structure. The review focused on the departure's impact on internal flood protection. As described in COL FSAR Subsection 3.4.1.1.2.3 and shown in Figures 1.2-23a through 1.2-23e, the radwaste building does not contain any safety-related equipment. The radwaste tanks are located below grade. Furthermore, the building's substructure can act as a large sump, given that it has the capacity to collect and hold any leakage within the building. Piping used to transfer liquid waste to the

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3 for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

radwaste building from other buildings is routed through a radwaste tunnel; the top of the tunnel is at grade level. Seals are used to prevent building-to-building flooding within the tunnel. In COL FSAR Subsection 3.4.1.1.2.3, the applicant states, "The structural design of this building is such that no internal flooding is expected or will occur under the worst case conditions from medium and large radwaste tanks." Given these design features, the staff concluded that this departure from Subsection 3.4.1.1.2.3 of the certified ABWR DCD is acceptable, with regard to protection from internal flooding.

Tier 2 Departures Not Requiring Prior NRC Approval

The applicant has proposed no Tier 2 departures requiring NRC review and approval, and plans to implement Tier 2 departures that do not require NRC review and approval, as permitted by 10 CFR Part 52 Appendix A, Section VIII.B.5. This regulation allows the applicant to depart from the ABWR DCD Tier 2 information without obtaining prior NRC approval if (among other provisions) the departure does not result in more than a minimal increase in (a) the likelihood of an occurrence of or the consequences from a malfunction of an SSC important to safety, or (b) the consequences of an accident previously evaluated in the plant-specific DCD. However, in order to assure that this requirement is being properly implemented, the following Tier 2 departures were selected for evaluation:

- STD DEP 1.2-1 Control Building Annex

NRC staff reviewed STD DEP 1.2-1, which relocates the RIP motor-generator sets and associated support components to a new building (Control Building Annex) adjacent to the control building. However, FSAR Subsection 3.4.3.3 does not address flood protection for the Control Building Annex. ABWR DCD COL Item 3.7, "Flood Protection Requirements for Other Structures," states that the COL applicant will demonstrate that the structures outside the scope of the ABWR Standard Plant meet the requirements of General Design Criterion (GDC) 2, "Design Bases for Protection Against Natural Phenomena," and the guidance of Regulatory Guide (RG) 1.102, "Flood Protection for Nuclear Power Plants," Section 3.4. During the Phase I review, which was based on Revision 1 of the applicant's COL request, the staff determined that this departure may affect the flood protection analysis incorporated by reference from the DCD. The Control Building Annex is a site-specific structure that is outside the scope of the design certification. During the Phase I review, the staff could not locate supporting information in the FSAR to confirm that internal flooding considerations relative to the Control Building Annex have been evaluated to ensure that safety-related equipment housed in the Control Building Annex will not be adversely affected. The staff issued **RAIs 03.04.01-2** and **03.04.01-3 (eRAI 9)** requesting the applicant to provide additional information related to STD DEP 1.2-1. **RAI 03.04.01-2** requests the applicant to address flood protection for the Control Building Annex. **RAI 03.04.01-3** requests the applicant to identify sources of flooding in the Control Building Annex and equipment in the Control Building Annex that requires protection from flooding.

Revision 2 of the COL Tier 2 FSAR Subsection 1.2.2.16.15 reads as follows:

> The Control Building Annex is a nonsafety-related structure located adjacent to the Control Building. It houses the two nonsafety-related Reactor Internal Pump Motor Generator sets, control panels, and the cooling water lines, HVAC system, and electrical lines that support the MG sets. The reactor internal pump motor-generator set equipment performs no safety-related function.

The staff concluded that Revision 2 of the COL Tier 2 FSAR adequately addresses the concerns raised in **RAIs 03.04.01-2** and **03.04.01-3**. Specifically, the Control Building Annex does not contain any safety-related systems or components. Furthermore, a flood event that occurs in the Control Building Annex will not affect any safety-related equipment in adjacent buildings (e.g., the control building and reactor building), because all penetrations and doors that penetrate the exterior walls of Seismic Category I buildings located below the design-basis flood level are watertight, as stated in COL Tier 2 FSAR Subsection 3.4.3.1.

The applicant's evaluation determined that this departure does not require prior NRC approval in accordance with 10 CFR Part 52 Appendix A, Section VIII.B.5. Within the review scope of this section, the staff found it reasonable that the departure does not require prior NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STP DEP 1.2-2 Turbine Building

NRC staff reviewed STP DEP 1.2-2, which changes the turbine building design, including the size of the condenser and circulating water piping. The review focused on the departure's impact on internal flood protection. As described in Section 3.0, Revision 2 of the COL Tier 2 Departures Report and Revision 2 of COL FSAR Subsection 3.4.1.1.2.5, the only two turbine building water systems with a sufficient capacity to fill the condenser pit and potentially propagate flood water into adjacent buildings are the circulating water system (CWS) and turbine building service water (TSW) system. The break flow from these systems is limited by automatic leak detectors that provide system isolation and shutdown. Even if automatic leak detection fails, two additional design features are used to prevent water from propagating into adjacent structures:

(1) A normally closed and alarmed door within the passageway between the turbine building and service building

(2) A sealing system used at both ends of the radwaste tunnel to prevent water flow either into or out of the tunnel

The Departures Report also notes that the only safety-related equipment inside the turbine building is instrumentation associated with the reactor protection system (RPS) and condensate pump motor trip circuit breakers. This safety-related equipment is located above the design-basis flood level.

The applicant's evaluation determined that this departure does not require prior NRC approval in accordance with 10 CFR Part 52 Appendix A, Section VIII.B.5. Within the review scope of this section, the staff found it reasonable that the departure does not require prior NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STP DEP 3.8-1 Resizing the Radwaste Building

NRC staff reviewed STP DEP 3.8-1, which changes the dimensions and layout of the radwaste building. As indicated in Section 3.0 of Revision 2 of the COL Tier 2 Departures Report and Revision 2 of COL FSAR Subsection 3.4.1.1.2.3, the radwaste building does not contain any safety-related equipment. Furthermore, the building's substructure acts as a large sump, given that it has the capacity to collect and hold any leakage within the building. Piping used to

transfer liquid waste to the radwaste building from other buildings is routed through a radwaste tunnel; the top of the tunnel is at grade level. Seals are provided for all penetrations from the tunnel to prevent building-to-building flooding.

The applicant's evaluation determined that this departure does not require prior NRC approval in accordance with 10 CFR Part 52 Appendix A, Section VIII.B.5. Within the review scope of this section, the staff found it reasonable that the departure does not require prior NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STP DEP 9.2-5 Reactor Service Water (RSW) System

NRC staff reviewed STP DEP 9.2-5, which modifies the RSW system, including substantial increases in RSW flow rates and pipe sizes that could significantly affect considerations regarding internal flooding. In the control building, three divisions of RSW/reactor building cooling water (RCW) are located in separate division-specific rooms that are in turn separated by watertight doors. Therefore, to assure that NRC approval is not required for this departure, the staff issued **RAI 03.04.01-4 (eRAI 10)** requesting the applicant to sufficiently demonstrate that the RSW modifications will not result in more severe consequences from internal flooding than previously assumed.

As indicated in Revision 2 (Section 3.0) of the COL Tier 2 Departures Report and Revision 2 of COL FSAR Table 9.2-13, the RSW flow rate was increased from 1,800 to 3,290 m^3/h. Due to this increase, the associated pipeline sizes were also increased. As described in Revision 2 of COL Tier 2 FSAR Sections 19R.1 and 19R.4.6, there are two sets of water level signals within each of the RCW heat exchanger division rooms located in the lower level of the control building. When the water level reaches 0.4 meters, the first set of sensors will alert operators. When the water level reaches 1.5 meters, the second set of sensors will alert operators and will also trip the RSW pumps and RSW system isolation valves in the affected division. Even if the RCW heat exchanger isolation valve fails to close and the water from the RSW supply or return lines drain into the affected heat exchanger room, the water elevation will not exceed 5 meters. The staff concluded that Revision 2 of the COL Tier 2 FSAR adequately addresses the concerns raised in **RAI03.04.01-4**, therefore this RAI is closed. Specifically, the applicant has properly implemented 10 CFR Part 52 Appendix A, Section VIII.B.5 given that the maximum flood water elevation associated with the RSW modifications represented in STP DEP 9.2-5 (5 meters) is bounded by the maximum flood water elevation in the ABWR DCD (5 meters).

The applicant's evaluation determined that this departure does not require prior NRC approval in accordance with 10 CFR Part 52 Appendix A, Section VIII.B.5. Within the review scope of this section, the staff found it reasonable that the departure does not require prior NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

COL License Information Items

- COL Information Item 3.5 Flood Elevation
- COL Information Item 3.6 Ground Water Elevation

The staff evaluated the flood elevation and groundwater elevation in SER Section 2.4 as they are related to external flood protection. However, the staff identified that there is one combined event scenario of storm surge-caused main coolant reservoir breach flooding which is not

addressed in the FSAR. In addition, the applicant indicated that the ground water model to determine the design groundwater level will be provided to the NRC by the end of August 2010. Therefore, the staff identified these two issues as two separate open items in Section 2.4 of this SER. These two open items will be resolved as soon as the applicant provides acceptable additional information.

- COL Information Item 3.7 Flood Protection Requirements for Other Structures

The staff noted that COL FSAR Section 9.2.5 describes the UHS as supplementary to the ABWR DCD. However, the UHS structure is not described in COL Information Item 3.7. Although the COL FSAR does not specifically address the UHS in their flooding analysis, the staff considered the UHS design information in its internal flooding evaluation. The staff noted that the UHS storage basin and the RSW pump house are located adjacent to each other (see FSAR Figures 1.2-33 and 1.2-34). There are electrical equipment and mechanical equipment rooms in the RSW pump house that are located below the RSW pumps and below the water level of the UHS storage basin. The basin wall separates the water inventory in the UHS basin from these rooms (see FSAR Figure 1.2-34, Section A) and includes penetrations through the mechanical room. RSW piping penetrates the basin wall between the mechanical equipment room and UHS storage basin (Figure 1.2-34, "Partial Plan Elevation -1' – 0"). Should there be a failure in the sealing system associated with RSW pipe penetrations into the UHS storage basin, it appears that water from the storage basin will flow into the RSW pump house. Information in Revision 1 of the FSAR was insufficient for the staff to determine (1) the functions of the RSW electrical and mechanical equipment that are described, (2) whether this equipment is safety-related, (3) how the equipment is protected from the effects of internal flooding, and (4) whether the protection of this equipment is consistent with the acceptance criteria in SRP 3.4.1. In **RAI 03.04.01-1 (eRAI 13)**, the staff requested the applicant to address these questions.

As described in FSAR Revision 2, Subsections 9.2.15.2.1 and 9.2.15.2.3 and Sections 19R.1 and 19R.4.2.4, the RSW electrical and mechanical equipment rooms in the RSW pump house are arranged on a divisional basis, similar to the arrangement of the RSW pumps on the upper elevation. The mechanical equipment rooms contain HVAC equipment that cools the RSW components. Interdivisional walls in the RSW pump house are substantial enough to withstand potential internal flood levels. Penetrations through these walls will utilize seals designed and rated to withstand these flood levels. Interdivisional watertight access doors will be used to protect the RSW pump rooms, electrical rooms, and HVAC rooms. Watertight doors located in the RSW pump house are remotely monitored, so that a control room alarm will be generated if a door is not closed and dogged (i.e., mechanically locked). Further assurance that watertight doors remain closed and dogged will be accomplished by means of walkdowns that are conducted once per shift.

However, there appeared to be no mention in FSAR Revision 2 of the methods used to assure the functionality of other aspects of the watertight doors (e.g., door seals, aging degradation, and procedural requirements for testing and maintaining the door seals). In accordance with SRP 3.4.1 Item III.2, the adequacy of the techniques used to prevent flooding, including watertight doors, should be assessed. The staff issued **RAI 03.04.01-6 (eRAI 2480)** requesting the applicant to provide additional details regarding the methods used to assure the functionality of the watertight doors. In a letter dated May 13, 2009 (ML091350198), the applicant responded to the RAI. The staff reviewed the applicant's response and concluded that Revision 2 of the COL Tier 2 FSAR as discussed below adequately addresses the concerns raised in **RAI 03.04.01-1** and **RAI 03.04.01-6** regarding the methods used to assure the functionality of watertight doors. As stated in COL FSAR Appendix 19K, watertight doors installed in the RSW

pump house are identified as important SSCs that are included as part of the Reliability Assurance Program (RAP). COL FSAR Table 19K-4, "Failure Modes and RAP Activities," indicates that during plant operation, the watertight doors will be subject to RAP-related inspections annually and after any major maintenance activities. Because the watertight doors are identified as risk-significant per the RAP, they will also be subject to the Maintenance Rule Program, as indicated in COL FSAR Section 17.6S. Typically, door inspections will be accomplished through the Preventive Maintenance Program, which will specify pertinent acceptance criteria for the doors (such as door seals). **RAI 03.04.01-1** and **RAI 03.04.01-6** are closed.

Technical Specification

The applicant has not identified any plant-specific TS changes that may affect internal flood protection.

ITAAC

The applicant notes that in FSAR Tier 1, ITAAC Item 6 in Table 3.0.5, "Reactor Service Water System (RSW)," removes testing for vacuum breakers because the vacuum breakers are not used in the STP Units 3 and 4 plant-specific design. The staff found this change acceptable.

In Revision 2 of FSAR Table 3.4-1, "Structures, Penetrations, and Access Openings Designed for Flood Protection," the applicant revised the values of the designed flood level (external), design ground water level, referenced plant grade, base slab, and actual plant grade. These changes are external flood parameters that are evaluated in Section 2.4 of this SER.

3.4.1.5 *Post Combined License Activities*

There are no post COL activities related to this section.

3.4.1.6 *Conclusion*

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information, and no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52 Appendix A, Section VI.B.1, all nuclear safety issues have been resolved.

The staff's review confirmed that the applicant has adequately addressed the Tier 1 departures in accordance with Section 3.4.1 of NUREG–0800.

The staff's review also confirmed that the applicant has adequately addressed COL License Information Item 3.7 in accordance with Section 3.4.1 of NUREG–0800.

The staff found it reasonable that the identified Tier 2 departures are characterized as not requiring prior NRC approval per 10 CFR Part 52 Appendix A, Section VIII.B.5.

Based on the results of this evaluation, the staff determined that the internal flood protection design is acceptable. The review of external flooding is in Section 2.4 of this SER.

3.4.2 Analysis and Test Procedures

3.4.2.1 *Introduction*

This section of the FSAR addresses analysis procedures for SSCs in the ABWR standard plant that are designed and analyzed for the maximum hydrostatic and hydrodynamic forces, in accordance with loads and load combinations indicated in DCD Subsections 3.8.4.3 and 3.8.5.3 using well-established methods based on the general principles of engineering mechanics. All Seismic Category I structures are in stable condition due to either moment or uplift forces that result from the proper load combinations, including the design-basis flood (DBF).

3.4.2.2 *Summary of Application*

Section 3.4.2 of the STP Units 3 and 4 COL FSAR incorporates by reference Section 3.4.2 of the certified ABWR DCD, Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 3.4.2, the applicant provides the following:

Tier 1 Departure

- STP DEP T1 5.0-1 Site Parameters (Table 3.4-1)

This departure changes the flood level from 30.5 cm below grade to 182.9 cm above grade (grade elevation is 1,036.3 cm above mean sea level [MSL]). This change in flood elevation results from the postulated failure assumption of the main cooling water reservoir embankment at the STP site and constitutes the DBF.

3.4.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is in NUREG–1503.

In accordance with Section VIII, "Processes and Changes and Departures" of "Appendix A to Part 52--Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies one Tier 1 departure requiring prior NRC approval. This departure is subject to the requirements of 10 CFR Part 52 Appendix A, Section VIII.A.4.

3.4.2.4 *Technical Evaluation*

As documented in NUREG–1503, NRC staff reviewed and approved Section 3.4.2 of the certified ABWR DCD. The staff reviewed Section 3.4.2 of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this section.

The staff reviewed the following information in the COL FSAR:

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3, for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

Tier 1 Departure

- STP DEP T1 5.0-1 Site Parameters (Table 3.4-1)

Section 3.4.2, "Analytical and Test Procedures," of ABWR DCD states, in part, that:

> Structures, systems, and components in the ABWR Standard Plant are designed and analyzed for the maximum hydrostatic and hydrodynamic forces in accordance with loads and load combinations indicated in Subsections 3.8.4.3 and 3.8.5.3 using well established methods based on the general principles of engineering mechanics. All Seismic Category I structures are in stable condition due to either moment or uplift forces which result from the proper load combinations including the design basis flood.

ABWR DCD Subsection 3.4.3.1, "Flood Elevation," further states that:

> The COL Applicant will ensure the design basis flood elevation for the ABWR Standard Plant structures will be 30.5 cm below grade (Section 3.4).

ABWR DCD Subsection 3.4.3.2, "Ground Water Elevation," states that:

> The COL Applicant will ensure the design basis ground water elevation for the ABWR Standard Plant structures will be 61.0 cm below grade (Section 3.4).

ABWR DCD Subsection 3.4.3.3, "Flood Protection Requirements for Other Structures," states that:

> The COL Applicant will demonstrate, for the structures outside the scope of the ABWR Standard Plant, that they meet the requirements of GDC 2 and the guidance of RG 1.102 (Subsection 3.4).

In light of the above listed ABWR DCD requirements covering analytical procedures and license information related to water level (flood) design considerations, in Section 3.4.2 of the STP Units 3 and 4 COL FSAR the applicant commits to the following engineering analysis and design approach:

> Since the design basis flood (DBF) elevation is at El. 40.0 ft (see Subsection 2.4S.2.2), 182.9 cm above the finished plant grade, the lateral hydrostatic and hydrodynamic pressures on the structures due to the design flood water level, as well as ground and soil pressures, are calculated.

Additionally, the applicant provides the following discussions in the STP DEP T1 5.0-1 Departure Report:

> The site design basis flood level is increased from that specified in the DCD. The certified design site parameter for site flooding is changed from 30.5 cm below grade to 182.9 cm above grade (grade being 1036.3 cm above mean sea level (MSL)) in order to handle a main cooling reservoir failure as a design basis event at STP.

> The main cooling reservoir at the South Texas site is a non-seismic category 1 dam; hence, its failure must be assumed in the worst possible location. This results in the site design basis flood

STP Units 3 and 4 safety-related SSCs are designed for, or protected from, this flooding event by watertight doors to prevent the entry of water into the reactor buildings and control buildings in case of a flood. Exterior doors located below the maximum flood elevation on the 12300 floor of the RB and CB are revised to be watertight doors. The UHS storage basin and the pump houses are watertight below the flood level.

The maximum design precipitation rate for rainfall at the STP Units 3 and 4 site is calculated to increase from 49.3 cm/hr to 50.3 cm/hr based on site meteorology studies. This value is one factor in determining the structural loading conditions for roof design. ABWR Seismic Category I structures have roofs without parapets or parapets with scuppers to supplement roof drains, so that large inventories of precipitation cannot accumulate. Therefore, the increase in the maximum rainfall rate does not result in a substantial increase in the roof design loading and does not affect the design of these structures.

The departure STD DEP T1 5.0-1introduces a new set of site-specific loads, including hydrodynamic loads not accounted for within the certified scope of ABWR DCD. The staff issued **RAI 03.04.02-1 (eRAI 3322–Question 13161)** requesting that the applicant discuss the site-specific flood design issues (the maximum flood level is 1,478.3 cm above MSL), including how the lateral hydrodynamic pressure on the structures due to the design flood water level, as well as the lateral soil pressure, is calculated. The staff also asked the applicant to discuss the extent to which IBC 2006, which references ASCE 7-05, was adopted at STP Units 3 and 4 and to justify its application for the flood design of STP SSCs.

In the response to this RAI dated October 7, 2009 (STP Letter U7-C-STP-NRC-090161, Attachment 10, ML092860129), the applicant describes the following design parameters taken from COL FSAR Part 2, Revision 2, Subsection 3H.2.4.2.3 and Section 2.4:

> DBFL is 6ft above grade; maximum water velocity is 4.72 ft/sec and maximum hydrodynamic force is 44 pounds per square foot of the projected submerged area.

For specific responses regarding the effects of these changed parameters on the design of Class I and nonsafety-related structures, the applicant refers to responses to four other RAIs. These are**: RAI 03.04.02-1, RAI 03.04.02-4**, and **RAI 03.04.02-5** in eRAI 3322; and **RAI 03.08.01-1** in eRAI 2962. The applicant further states that the flood protection design and associated stability safety factors of the site-specific, safety-related SSCs are analyzed based on the revised design-basis flood level (DBFL).

In the response to **RAI 03.04.02-1**, the applicant provides no response regarding the adequacy of using ASCE 7 guidelines for the flood design. According to SRP 3.4.2.II (3), where the flood level is above the proposed plant grade, the dynamic loads of wave action should be considered. Procedures for determining these dynamic loads are acceptable if they are in accordance with or equivalent to (as applicable) those delineated in the U.S. Army Coastal Engineering Research Center, “Shore Protection Manual” (Vol. I, June 2002, reprinted from the 1973 edition and Vol. II, June 2002, reprinted from 1973 edition); or in EM 1110-2-1100, “Coastal Engineering Manual” (Part II, Chapter 1); or in “Water Wave Mechanics” (U.S. Army Corps of Engineers, April 30, 2002). Any other proposed methods should be provided with adequate justifications and should be reviewed on a case-by-case basis. As a result of the

evaluation, the applicant's response is considered incomplete and needs to be augmented. The staff issued **RAI 03.04.02-9 (eRAI 4091–Question 15800)** requesting that the applicant modify and augment the response to **RAI 03.04.02-1** in order to evaluate the dynamic loads of wave action using the reference in SRP 3.4.2.II (3). **RAI 03.04.02-1 (eRAI 3322–Question 13161)** is considered closed and unresolved. The resolution of **RAI 03.04.02-9** is being tracked as **Open Item 03.04.02-9.**

In Part 7 of the application, the applicant performed an evaluation of the departure (STP DEP T1 5.0-1) from the maximum external flood level (442 cm above grade versus 0.305 m below grade). Part 7 of the application evaluates this departure and states that " … STP 3 & 4 safety-related SSCs are designed for, or protected from, this flooding event by watertight doors to prevent the entry of water into the reactor buildings and control buildings in case of a flood. Exterior doors located below the maximum flood elevation on the 12300 floor of the Reactor Building and Control Building are revised to be watertight doors. The UHS storage basin and the RSW pump houses are watertight below the flood level." The staff issued **RAI 03.04.02-2 (eRAI 3322–Question 13162)** asking the applicant to (1) discuss a more quantitative performance-based definition of a "watertight door" and applicable codes and standards used for the design; (2) list STP Units 3 and 4 site-specific Seismic Category I structures that include watertight doors and penetrations; (3) discuss how their watertightness is ensured; and (4) provide a detailed ITAAC table for safety-related, site-specific SSCs, including the UHS structure. In the response to this RAI dated October 7, 2009 (ML092860129), the applicant refers to the response to **RAI 03.08.01-3** (ML092610377) which addresses the location and design requirements for watertight doors, and proposes revision to COL FSAR Part 2 Revision 2, Subsection 3.8.6.4, and the response to **RAI 03.04.02-3** which proposes an ITAAC for below grade penetration seals. The response to **RAI 03.04.02-2** also states that "There are no exterior access openings or above grade penetrations below the design flood level in the site-specific Category I structures, including the Ultimate Heat Sink (UHS) Basin and the Reactor Service Water (RSW) Pump House."

Since the watertight doors are Seismic Category I SSCs, each exterior door under the DBFL that is located in any Seismic Category I structure should be given a unique component ID, a set of specific design parameters, and other conditions (e.g., controls and measures) that should be keyed into the corresponding plans to show the location of each door location. This information should be reflected in the ITAAC tables conveying the design requirements; the proposed inspections, tests, and analyses; and the acceptance criteria, including the need for as-built reconciliation that is required for Seismic Category I SSCs. All certified and plant-specific Seismic Category I SSCs should be considered, including the underground diesel tanks and vaults, if applicable. Compliance with RG1.102, "Flood Protection for Nuclear Power Plants," should also be indicated for the underground diesel tank access openings, if applicable. The staff needs this information to be able to conclude that the Seismic Category I doors are designed and installed to withstand the DBF during an accident.

Based on the above evaluation, the staff determined that the response to **RAI 03.04.02-2** is incomplete and needs more information. The staff issued **RAI 03.04.02-6 (eRAI 4058–Question 15788)** requesting that the applicant modify and augment the response to **RAI 03.04.02-2**. Therefore, **RAI 03.04.02-2** is considered closed and unresolved. This issue will be resolved by RAI 03.04.02-6 and is being tracked as **Open Item 03.04.02-6**.

Subsection 3.4.1.1.1, "Flood Protection from External Sources," of ABWR DCD Tier 2, Revision 4, states that Seismic Category I structures are protected from flooding by ensuring that tunnels below grade do not penetrate exterior walls, and the COL applicant will review the

use of penetration seals below grade and develop procedures, as necessary, to protect the plant against the effects of seal failure. The staff issued **RAI 03.04.02-3 (eRAI 3322–Question 13163)** requesting the applicant to confirm and specify the details of this design requirement, by providing the corresponding ITAAC items for site-specific structures including the UHS. The staff also requested that the applicant provide a discussion of the ITAAC contents to demonstrate that Seismic Category I structures are protected from flooding, by ensuring that tunnels below grade do not penetrate exterior walls and the integrity of penetration seals below grade is maintained.

In the response to this RAI dated October 7, 2009 (ML092860129), the applicant states that the UHS basin is not connected to the RSW piping tunnel and therefore, this ITAAC is not required for the UHS basin. The applicant also proposes to revise COL application Part 9, Table 3.0-5, to add a new Item 9 on flood protection features of the RSW piping tunnel and RSW pump house.

During the evaluation, the staff noted that Item 9.b of the proposed ITAAC Table 3.0-5 refers to tunnels below grade, while the correct text for the item should read "below design Basis Flood Level (DBFL)." The staff also determined that the applicant's proposed procedures should be in compliance with Subsection 3.4.1.1.1 requirements, because Section 3.4 of ABWR DCD Revision 4 is incorporated by reference, in its entirety, in the COL FSAR. These requirements include penetration seals that are reliable and emergency procedures that are in place to guide the plant response to a postulated seal failure followed by flooding. The staff requested that the applicant incorporate or refer to these items under the acceptance criteria in the ITAAC table in order to ensure adequate flood protection.

The staff therefore concludes that the applicant's response to **RAI 03.04.02-3** is incomplete. **RAI 03.04.02-3** is therefore closed and unresolved. The staff issued **RAI 03.04.02-7 (eRAI 4058–Question 15797)** requesting that the applicant address the above concern. The resolution of **RAI 03.04.02-7** is being tracked as **Open Item 03.04.02-7**.

COL License Information Item 3.7 (Table 1.9-1 of DCD Tier 2), "Flood Protection Requirements for Other Structures," requires a COL applicant to also provide procedures for designing nonsafety-related SSCs to withstand the effects of a DBF, in order not to impair adjacent safety-related SSCs from performing their safety functions (a II/I structural interaction concern resulting from a DBF–induced, nonsafety-related structural failure). The staff issued **RAI 03.04.02-4 (eRAI 3322–Question 13165)** requesting that the applicant discuss how STP Units 3 and 4 is addressing this COL license information item. In the response to this RAI dated October 7, 2009 (ML092860129), the applicant states that nonsafety-related SSCs that are located in close proximity to (i.e., within one building height) safety-related SSCs and could collapse onto safety-related SSCs will be designed for DBF loads. The maximum water velocity from the DBF produces an additional hydrodynamic load of 44 psf. The hydrodynamic and static water loads are added together to yield the total force on the structure from the water flow. The applicant further states that the catastrophic failure of nonsafety-related SSCs that are not designed to resist the DBF or other severe and extreme environmental loads (separation larger than one height) could result in floodwater-borne debris with some interaction potential. Since the maximum water velocity resulting from the DBF is 4.72 ft/sec, floodwater-borne debris with kinetic energy capable of damaging safety-related SSCs is not credible.

The staff's review noted that ABWR DCD Revision 4, Subsection 3.7.2.8, which discusses the interaction of a non-seismic category SSCs with Seismic Category I SSCs under Option (3), requires all non-category I SSCs to be analyzed and designed to prevent their failure under SSE

conditions with the same safety margin applicable to Seismic Category I SSCs. Based on similar II/I design considerations against DBF loads, the staff issued **RAI 03.04.02-8 (eRAI 4058–Question 15798)** requesting that the applicant provide design procedures for SSCs with an interaction potential to resist the site-specific external events, including DBF loads. Such procedures should include the corresponding ITAAC, the load parameters, load combinations, design acceptance criteria, and the safety margins against failure that are equivalent to those of Seismic Category I SSCs. The staff needs this information to conclude that there will be no adverse II/I interactions associated with the DBF. **RAI 03.04.02-4** is closed and unresolved. This issue will be resolved by **RAI 03.04.02-8** and this RAI is being tracked as **Open Item 03.04.02-8**.

Since the site DBFL is increased from what is specified in ABWR DCD Revision 4, Subsection 3.4.3.1, the staff issued **RAI 03.04.02-5 (eRAI 3322–Question 13166)** requesting that the applicant indicate if there are any piping, access openings, or tunnels that penetrate the exterior walls of in-scope Seismic Category I structures below the DBFL elevation, whose design and analysis against DBF effects might be affected, and if applicable, to discuss how the design and analysis of these items were adjusted to account for the elevated DBFL. The staff also asked the applicant to address the same question for the site-specific UHS structure.

In the response to this RAI dated October 7, 2009 (ML092860129), the applicant states:

> There are seals which protect the exterior penetrations and external seismic gaps between the Category I structures, below grade. These seals will be designed to take into account the increase in hydrostatic head due to the design basis flood, which has been revised to 182.9 cm above grade (see COLA Part 2, Tier 2, Section 3H.2.4.2.3). The tunnels do not penetrate walls of the Category I structures. A conceptual detail of the interface between the tunnels and Category I structures is described in the response to RAI 03.08.04-15 (see letter U7-C-STP-NRC-090160, dated October 5, 2009, (ML092860129)). The site-specific structures, including the Ultimate Heat Sink (UHS) Basin and Reactor Service Water (RSW) Pump House, do not have any access openings below design basis flood level. Piping and other penetrations to these structures are located inside the tunnels and, therefore, are protected against flooding.

The staff's evaluation concluded that the applicant's response to **RAI 03.04.02-5** adequately addresses the questions and provides additional clarifications concerning the changed conditions that affect the design of penetrations and seals located under the DBFL. Therefore, **RAI 3322–Question 13166** is closed and resolved.

3.4.2.5 *Post Combined License Activities*

There are no post COL activities related to this section.

3.4.2.6 *Conclusion*

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to the analysis and test procedures. However, as a result of **Open Items 03.04.02-6, 03.04.02-7, 03.04.02-8,**

and 03.04.02-9, the staff was unable to finalize the conclusions relating to the analytical and test procedures, in accordance with NRC requirements.

3.5 Missile Protection

This chapter of the FSAR discusses how the Seismic Category I structures have been analyzed and designed to be protected from a wide spectrum of missiles (e.g., missiles from rotating and pressurized equipment, gravitational missiles, and missiles generated from tornado winds). Once a potential missile is identified, its statistical significance is determined (a significant missile is one that could cause unacceptable consequences or violate the guidelines of 10 CFR Part 100).

3.5.1 Missile Selection

Seismic Category I structures have been analyzed and designed to be protected from a wide spectrum of missiles (e.g., missiles from rotating and pressurized equipment, gravitational missiles, and missiles generated from tornado winds). Once a potential missile is identified, its statistical significance is determined (a significant missile is one that could cause unacceptable consequences or violate the guidelines of 10 CFR Part 100).

3.5.1.1 *Internally Generated Missiles (Outside Containment)*

Subsection 3.5.1.1 of the STP COL FSAR incorporates by reference Subsection 3.5.1.1, "Internally Generated Missiles (Outside Containment)," of the certified ABWR DCD, Revision 4, referenced in 10 CFR Part 52, Appendix A. with no departures or supplements. Subsection 3.5.1.1 of the ABWR DCD includes the Tier 1 and Tier 2 information. NRC staff reviewed the application and considered the referenced DCD to ensure that no issue relating to this section remains for review.[1] The staff's review confirmed there is no outstanding information, outside of the DCD, related to this subsection. Pursuant to 10 CFR 52.63(a)(5) and Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the internally generated missiles have been resolved.

3.5.1.2 *Internally Generated Missiles Inside Containment*

3.5.1.2.1 Introduction

This FSAR subsection addresses missiles that could result from a plant-related failure or incident inside the containment. This subsection describes the design of the structures, shields, and barriers that have been designed to withstand missile effects; the possible missile loadings; and the procedures to which each barrier has been designed to resist missile impact.

3.5.1.2.2 Summary of Application

Subsection 3.5.1.2 of the COL FSAR incorporates by reference Subsection 3.5.1.2 of the certified ABWR DCD, Revision 4, referenced in 10 CFR Part 52, Appendix A, with no departures. In addition, in FSAR Section 3.5.4, "COL License Information," the applicant provides the following:

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[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3 for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

COL License Information Item

- COL License Information Item 3.14 Maintenance Equipment Missile Prevention Inside Containment

This COL license information item states that the applicant will provide procedures to "ensure that maintenance equipment inside containment, such as hoists, will either be removed prior to operation, moved to a location where they are not a potential hazard to safety-related equipment, or seismically restrained to prevent them from becoming a missile."

3.5.1.2.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG–1503. The regulatory basis for reviewing COL license information items is in Subsection 3.5.1.2 of NUREG–0800.

3.5.1.2.4 Technical Evaluation

As documented in NUREG–1503, NRC staff reviewed and approved Subsection 3.5.1.2 of the certified ABWR DCD. The staff reviewed Subsection 3.5.1.2 of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the relevant information related to internally generated missiles inside the containment.

The staff reviewed the information in the COL FSAR:

Combined License Information Item

- COL License Information Item 3.14 Maintenance Equipment Missile Prevention Inside Containment

COL License Information Item 3.14 specifies that a COL applicant should provide procedures to ensure that all equipment inside the containment, such as hoists, which are required during maintenance, will either be (1) removed before operation; (2) moved to a location where the equipment is not a potential hazard to safety-related equipment; or (3) seismically restrained to prevent the equipment from becoming a missile.

In Tier 2 Subsection 3.5.4.6, "Maintenance Equipment Missile Prevention Inside Containment," of the STP Units 3 and 4 COL FSAR, Revision 2, the applicant states that procedural controls will be established to ensure that unsecured maintenance equipment will be (1) removed from the containment before operation; (2) moved to a safe location; or (3) restrained to prevent the equipment from becoming a missile. However, the applicant does not provide a schedule as to when these procedural controls will be implemented. NRC staff believes that these procedural controls should be in-place before fuel loading. Therefore, the staff issued **RAI 03.05.01.02-1**

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3, for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

(eRAI 2701) requesting the applicant to provide a schedule for implementing the procedural controls.

The applicant's response to **RAI 03.05.01.02-1** dated May 26, 2009 (ML091490166), states that procedural controls will be established before fuel loading, as reflected in FSAR Subsection 13.5.3.3.1, "Administrative Procedures," (Items 2 and 4). The procedures will ensure, as described in DCD Tier 2 Subsections 3.5.4.6 and 3.5.1.2.3(3), that maintenance equipment inside the containment (such as hoists) will either be (a) removed before operation; (b) moved to a location where the equipment will not be a potential hazard to safety-related equipment; or (c) seismically restrained to prevent the equipment from becoming a missile.

The staff reviewed the applicant's response to **RAI 03.05.01.02-1** regarding the schedule for implementing the procedural controls. The staff found the response acceptable because it follows the staff's recommendation that these procedural controls should be in place before fuel loading. In addition, the staff confirmed that FSAR Tier 2, Revision 3, dated September 16, 2009, was revised as committed to in the RAI response. Accordingly, the staff found that the applicant has adequately addressed this issue, and **RAI 03.05.01.02-1** is therefore resolved and closed.

Section 13.5 of this SER addresses the staff's evaluation of plant procedures, including procedures to remove or seismically restrain equipment when not in use, such as a hoist that is used during maintenance, to prevent it from becoming a missile.

ITAAC

NRC staff reviewed the STP Units 3 and 4 COL application ITAAC in accordance with the guidance in SRP Section 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria," Revision 3. The staff found no need for additional ITAAC in this subsection.

Technical Specifications

NRC staff reviewed the TS in the ABWR DCD and in the STP Units 3 and 4 COL application against 10 CFR 50.36, "Technical Specifications." There are no TS applicable to Tier 2 Subsection 3.5.1.2 of the STP Units 3 and 4 COL application. The staff concluded that no additional TS are needed for this subsection.

3.5.1.2.5 Post Combined License Activities

The post COL activities related to COL License Information Item 3.14 include establishing procedures before fuel loading to ensure that maintenance equipment inside the containment, such as hoists, will either be (1) removed before operation; (2) moved to a location where the equipment will not be a potential hazard to safety-related equipment; or (3) seismically restrained to prevent the equipment from becoming a missile.

3.5.1.2.6 Conclusion

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information, and no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to

10 CFR 52.63(a)(5) and Part 52 Appendix A, Section VI.B.1, all nuclear safety issues relating to the missiles protection that were incorporated by reference have been resolved.

The NRC staff's review concluded that the applicant has adequately addressed the COL license information item, with regard to internally generated missiles inside the containment. The applicant's information satisfies GDC 4 and the guidelines of SRP Subsection 3.5.1.2, Revision 3. Therefore, the staff determined that there are adequate protective features for STP Units 3 and 4 that protect the SSCs important to safety from internally generated missiles inside the containment.

3.5.1.3 *Turbine Missiles*

3.5.1.3.1 Introduction

This section of the FSAR addresses the requirements that SSCs important to safety shall be designed and protected against the effects of missiles that might result from equipment failures. The failure of a rotor in a large steam turbine may result in the generation of high-energy missiles that could affect safety-related SSCs. The probability of a turbine missile generation should be sufficiently low so that the risk from turbine missiles to safety-related SSCs is acceptably small.

3.5.1.3.2 Summary of Application

Subsection 3.5.1.3 of the STP Units 3 and 4 COL FSAR incorporates by reference Subsection 3.5.1.3 of the certified ABWR DCD Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Subsection 3.5.1.3, the applicant provides the following:

Tier 2 Departure Not Requiring Prior NRC Approval

- STP DEP 3.5-1 Missile Protection

This departure addresses turbine orientation and one site-specific supplement related to the probability of turbine missile generation and the missile ejection zone.

In the COL FSAR, the applicant provides revised turbine missile probability guidelines in Table 3.5-1, "Requirement for the Probability of Missile Generation," and a schematic of the locations of turbines and their potential missile trajectories in Figure 3.5-2, "Low-Trajectory Turbine Missile Ejection Zone."

COL License Information Item

- COL License Information Item 3.13 Turbine System Maintenance Program

The applicant commits (COM 3.5-1) to develop before fuel loading a turbine system maintenance program that will include a probability calculation of turbine missile generation and will show that the turbine meets the minimum requirements as presented in Table 3.5-1.

3.5.1.3.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG–1503. The regulatory basis for reviewing the COL license information items is in SRP Subsection 3.5.1.3.

In accordance with Section VIII, "Processes and Changes and Departures," of "Appendix A to Part 52--Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies one Tier 2 departure not requiring prior NRC approval. This departure is subject to the requirements of 10 CFR Part 52 Appendix A, Section VIII.B.5, which are similar to the requirements in 10 CFR 50.59.

3.5.1.3.4 Technical Evaluation

As documented in NUREG–1503, NRC staff reviewed and approved Subsection 3.5.1.3 of the certified ABWR DCD. The staff reviewed Subsection 3.5.1.3 of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this subsection.

The staff reviewed the information in the COL FSAR:

Tier 2 Departure Not Requiring Prior NRC Approval

- STP DEP 3.5-1 Missile Protection

This departure addresses turbine orientation and one site-specific supplement related to the probability of turbine missile generation and the missile ejection zone in Table 3.5-1 and Figure 3.5-2, respectively. The applicant proposes to replace the first paragraph in Subsection 3.5.1.1.1.3 of the ABWR DCD to state that the orientation of STP Units 3 and 4 is unfavorable with respect to the safety-related SSCs of the adjacent ABWR (i.e., the STP Unit 3 turbine generator is unfavorably orientated toward STP Unit 4 safety-related SSCs, and vice versa).

It should be noted that ABWR DCD Subsection 3.5.1.1.1.3 refers to Figure 3.5-2, "ABWR Standard Plant Low-Trajectory Turbine Missile Ejection Zone," of the ABWR DCD for the building structure orientation, with respect to the turbine building and the nuclear island. Figure 3.5-2 illustrates the ABWR plant as a single unit with the turbine generator located south of the nuclear island; the shaft is oriented along the north-south axis so that safety-related systems are located outside of the high-velocity, low-trajectory missile strike zone. With this information, the ABWR design is considered to favorably orient the turbine building with respect to safety-related SCCs defined in RG 1.115.

However, the STP Units 3 and 4 site has two ABWR units situated side-by-side, as shown in site-specific supplemental information Figure 3.5-2 of the STP Units 3 and 4 COL FSAR. With this dual-unit site plan, the applicant considers the turbine generators to be unfavorably oriented with respect to the other nuclear island that contains safety-related SSCs. NRC staff agreed with the applicant's designation that the STP Unit 3 turbine generator is unfavorably orientated in relation to STP Unit 4 safety-related SSCs, and vice versa.

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3, for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

RG 1.115 and SRP Subsection 3.5.1.3 state that for an unfavorable turbine generator orientation, the probability of generating a turbine missile (P_1) must be ≤ 1 x 10^{-5} per year, which is considered the minimum reliability requirement for loading the turbine and bringing the system on line. STP Units 3 and 4 COL FSAR Subsection 3.5.1.1.3 states that a value of 1 x 10^{-2} per year per plant was chosen as a conservative value for the product of strike and damage probabilities (P_2 x P_3), and the resulting probability of unacceptable damage from a main steam turbine missile (P_4)—which is the product of the probabilities for missile generation, strike, and damage (P_1 x P_2 x P_3)—is < 1 x 10^{-7}. The P_4 value of < 1 x 10^{-7} meets the SRP acceptance criteria and the guidance of RG 1.115.

The applicant's evaluation in accordance with Item B.5 of Section VIII of Appendix A to 10 CFR Part 52 determined that this departure does not require prior NRC approval. Within the review scope of this section, the staff found it reasonable that this departure does not require prior NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

COL License Information Item

- COL License Information Item 3.13 Turbine System Maintenance Program

ABWR DCD Subsection 3.5.4.5 states that the COL applicant will submit for NRC approval, within 3 years of obtaining an operating license, a turbine system maintenance program that will include probability calculations of turbine missile generation based on NRC-approved methodology, or the COL applicant will volumetrically inspect all low-pressure turbine rotors at the second refueling outage and every other (alternate) refueling outage thereafter, until a maintenance program is approved by NRC staff.

The staff reviewed COL License Information Item 3.13 (in Subsection 3.5.4.5), which states that "a turbine system maintenance program will be made available for NRC review prior to fuel load that includes a probability calculation of turbine missile generation and shows that the turbine meets the minimum requirements in Table 3.5-1." Table 3.5-1 modifies the action to be taken for an unfavorable turbine orientation to coincide with the site-specific orientation between STP Units 3 and 4. The staff compared the proposed Table 3.5-1 with the acceptance criteria for an unfavorably oriented turbine listed in Table 3.5.1.3-1 of the SRP. The staff noted that the proposed changes in Table 3.5-1 for the licensee's action are in agreement with the SRP acceptance criteria. However, in the application, the applicant commits (COM 3.5-1) to submit the probability calculation of turbine missile generation before fuel loading rather than within 3 years of obtaining an operating license. The staff found that COL License Information Item 3.13 is inconsistent with the requirements established by the staff's FSER of the referenced ABWR DCD; the staff thus requested additional information from the applicant. The staff issued **RAI 03.05.01.03-1 (eRAI 2960)** requesting the applicant to revise the submittal timeline for these two items from before fuel loading to within 3 years of obtaining an operating license.

The applicant's response to **RAI 03.05.01.03-1** dated August 27, 2009 (ML092430131), and the supplemental response dated December 8, 2009 (ML093440181), propose to revise Subsection 3.5.4.5 of the FSAR to state that the turbine system maintenance program will be submitted within 3 years following the receipt of the COL. The staff found this response acceptable and **RAI 03.05.01.03-1** is resolved. Verification of the revision to the FSAR is being tracked as **Confirmatory Item 03.05.01.03-1**.

Therefore, the staff found that the effects of turbine missiles on safety-related SSCs are acceptably small for the co-located ABWR plants for STP Units 3 and 4 because the probability of generating a turbine missile is less than 1×10^{-5} per year, which meets the guidance of RG 1.115 and SRP Subsection 3.5.1.3 for plants with an unfavorable turbine orientation.

3.5.1.3.5 Post Combined License Activities

The applicant identifies the following commitment:

- Commitment (COM 3.5-1) – Submit for NRC approval within 3 years of obtaining an operating license, a turbine system maintenance program that includes probability calculations of turbine missile generation based on NRC-approved methodology.

3.5.1.3.6 Conclusion

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to the turbine missiles. With the exception of **Confirmatory Item 03.05.01.03-1**, no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52 Appendix A, Section VI.B.1, all nuclear safety issues relating to the turbine missiles that were incorporated by reference have been resolved.

The staff considered the STP Units 3 and 4 COL site-specific information item STP DEP 3.5-1 in Subsection 3.5.1.3, which documents that the turbine orientation is unfavorable using the guidance in RG 1.115. The staff concluded that the applicant's information in Subsection 3.5.1.3 is acceptable because it ensures that the turbine missile evaluation for co-located ABWR units meets the guidance of SRP Subsection 3.5.1.3, in that the probability of a turbine missile generation is acceptably small, and therefore ensures that the requirements of GDC 4 to 10 CFR Part 50 are met for protecting safety-related SSCs against the effects of turbine missiles. The staff found it reasonable that the identified Tier 2 departure is characterized as not requiring prior NRC approval per 10 CFR PART 52 Appendix A, Section VIII.B.5.

However, as a result of **Confirmatory Item 03.05.01.03-1**, the staff was unable to finalize the conclusions relating to the turbine missiles, in accordance with the NRC requirements.

3.5.1.4 *Missiles Generated by Natural Phenomena (Related to RG 1.206, Section C.I.3.5.1.4, "Missiles Generated by Tornadoes and Extreme Winds")*

3.5.1.4.1 Introduction

This FSAR section addresses missiles that could result from a plant-related failure or incident, including failures outside of the containment; environmentally generated missiles; and site-proximity missiles. This section also describes the structures, shields, and barriers that have been designed to withstand missile effects; the possible missile loadings; and the procedures to which each barrier has been designed so as to resist missile impact.

3.5.1.4.2 Summary of Application

Subsection 3.5.1.4 of the STP COL FSAR incorporates by reference Subsection 3.5.1.4 of the certified ABWR DCD Revision 4, referenced in 10 CFR Part 52, Appendix A. There are no departures, DCD interface requirements, or ITAAC associated with this subsection.

In addition, in FSAR Section 3.5.4, "COL License Information," the applicant provides the following:

COL License Information Items

- COL License Information Item 3.10 Missiles Generated by Other Natural Phenomena

This COL license information item discusses the statement from the applicant that "all missiles generated by other natural phenomena are bounded by the reference ABWR DCD tornado missiles specified in Subsection 3.5.1.4."

- COL License Information Item 3.12 Impact of Failure of Out of ABWR Standard Plant Scope Non-Safety-Related Structures, Systems, and Components Due to a Design Basis Tornado

This COL license information item discusses the applicant's statement that nonsafety-related SSCs "are analyzed for the design basis tornado missile to ensure that their failure will not affect the ability of safety-related SSCs from performing their intended safety functions."

3.5.1.4.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG–1503.

The regulatory basis and acceptance criteria for reviewing COL license information items are in Subsection 3.5.1.4 of NUREG–0800.

3.5.1.4.4 Technical Evaluation

As documented in NUREG–1503, NRC staff reviewed and approved Subsection 3.5.1.4 of the certified ABWR DCD. The staff reviewed Subsection 3.5.1.4 of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic[1]. The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this subsection.

The staff reviewed the information in the COL FSAR:

COL License Information Items

- COL License Information Item 3.10 Missiles Generated by Other Natural Phenomena

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3 for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

COL License Information Item 3.10 instructs a COL applicant referencing the ABWR DCD to identify missiles generated by other site-specific natural phenomena and hazards that may be more limiting than those considered in the DCD. The applicant is also instructed to provide protection against any identified missiles.

In STP Units 3 and 4 COL FSAR Subsection 3.5.4.2, the application indicates that the only missiles identified for the STP Units 3 and 4 site that are generated by natural phenomena are those generated by tornadoes and hurricanes. Tornado missiles govern the design of the SSCs. The referenced ABWR DCD tornado wind speeds exceed those specified by RG 1.76, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants," Revision 1, for the STP site. Therefore, all missiles generated by other natural phenomena are bounded by the referenced ABWR DCD, Subsection 3.5.1.4, "Tornado Missiles."

NRC staff concluded that the assessment of possible hazards attributable to missiles generated by the design-basis tornado and other extreme winds is acceptable and conforms to the requirements of GDC 2 and 4, as they relate to tornado-generated missiles. This conclusion is based on the staff's finding that the applicant has met the requirements of GDC 2 and 4 by meeting the guidance of RG 1.76.

- COL License Information Item 3.12 — Impact of Failure of Out of ABWR Standard Plant Scope Non-Safety-Related Structures, Systems, and Components Due to a Design Basis Tornado

COL License Information Item 3.12 instructs a COL applicant referencing the ABWR DCD to evaluate all nonsafety-related SSCs that are out of the scope of the ABWR DCD, but whose failure could adversely impact the safety functions of safety-related SSCs.

STP Units 3 and 4 COL FSAR Tier 2 Subsection 3.5.4.4 states that, in the design, safety-related SSCs are protected from tornado missiles by being located underground or in tornado-proof structures. Plant SSCs not housed in tornado-proof structures are analyzed for the design-basis tornado missile to ensure that the failure of these SSCs will not prevent a safety-related SSC from performing its intended safety function.

Also, in STP Units 3 and 4 COL FSAR Subsection 3.5.4.7, the application states that non-tornado-resistant structures are constructed from materials such as reinforced concrete block or structural steel with metal siding and roof deck. Potential missiles or debris from these materials, when subjected to winds of tornado intensity, would not generate missiles more severe than the design-basis tornado missiles defined in ABWR DCD Subsection 3.5.1.4. In Subsection 3.5.1.4, tornado-generated missiles were determined to be the limiting natural phenomenon hazard in the design of all structures required for a safe shutdown of the nuclear power plant. Therefore the failure of SSCs outside the scope of the standard plant design will not generate missiles that are more severe than the design-basis tornado missiles already utilized as the design basis for plant safety-related SSCs.

The NRC staff's review agreed with STPNOC that the failure of SSCs outside the scope of the standard plant design will not generate missiles that are more severe than the design-basis tornado missiles already utilized as the design basis for plant safety-related SSCs.

ITAAC

NRC staff reviewed the COL application ITAAC using detailed review guidance and checklists from SRP 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria," Revision 3. This review included a review of the site-specific ITAAC in the COL application, Part 9, Section 3, which was not included as part of the DCD. For COL FSAR Subsection 3.5.1.4, the staff found that no additional ITAAC items are required to be included in the site-specific ITAAC.

Technical Specifications

NRC staff reviewed the TS in the ABWR DCD and in the STP Units 3 and 4 COL application against 10 CFR 50.36, "Technical Specifications." With regard to the protection provided for SSCs against missiles generated by natural phenomena (i.e., tornadoes and hurricanes), there are no TS applicable to Tier 2 Subsection 3.5 of the STP Units 3 and 4 COL application. The staff concluded that no additional TS are needed for this subsection.

3.5.1.4.5 Post Combined License Activities

There are no post COL activities related to this subsection.

3.5.1.4.6 Conclusion

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information, and no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52 Appendix A, Section VI.B.1, all nuclear safety issues relating to the missiles generated by natural phenomena that were incorporated by reference have been resolved.

NRC staff reviewed the information in STP Units 3 and 4 COL FSAR Revision 2, Tier 1 and 2, and the evaluation discussed above. The staff found that the applicant has adequately addressed the COL license information items and the application satisfies the guidelines of Subsection 3.5.1.4, "Missiles Generated by Tornados and Extreme Winds," of NUREG–0800.

The basis for this acceptance is the conformance of the applicant's design criteria that protect against the effects of natural phenomena to the Commission's regulations, as stated in the GDC, and to applicable RGs and national standards.

3.5.1.5 *Site Proximity Missiles Except Aircraft*

3.5.1.5.1 Introduction

Safety-related structures, systems, and components (SSCs) are designed and constructed not to fail or not to cause a failure in the event of a postulated credible missile impact, such as from site-proximity missiles (except aircraft). These SSCs include some that, if they do fail, could (1) cause the failure of the integrity of the reactor coolant system (RCS), (2) degrade the performance of any plant feature required for a safe shutdown of the reactor to an unacceptable level, or (3) lead to offsite radiological consequences.

3.5.1.5.2 Summary of Application

Subsection 3.5.1.5 of the STP Units 3 and 4 COL FSAR incorporates by reference Subsection 3.5.1.5 of the certified ABWR DCD Revision 4, referenced in 10 CFR Part 52, Appendix A, with no departures.

In addition, in FSAR Subsection 3.5.4.3, the applicant provides the following:

This COL license information item addresses the site-proximity missiles and aircraft hazards.

COL License Information Item

- COL License Information Item 3.11 Site Proximity Missiles and Aircraft Hazards

This COL license information item identifies potential site-proximity missiles or aircraft hazards.

3.5.1.5.3 Regulatory Basis

The regulatory basis for the review of the information incorporated by reference is in NUREG–1503.

The regulatory basis for the review of the COL license information items is in Subsection 3.5.1.5 of NUREG–0800.

In addition, the following regulatory requirements in 10 CFR Part 100 and 10 CFR Part 52 also apply:

10 CFR 100.20, "Factors to Be Considered When Evaluating Sites," as they relate to the requirement that the site characteristics should be evaluated to determine whether the risk to individuals and society of potential plant accidents is low. This requirement is met if the probability of site-proximity missiles (except aircraft) have the potential for radiological consequences greater than the 10 CFR 50.34(a)(1) exposure guidelines required by 10 CFR Part 100 of less than about 1×10^{-7} per year.

10 CFR 100.21(e) states that potential hazards associated with nearby transportation routes and industrial or military facilities must be evaluated and site parameters must be established so that potential hazards from these routes and facilities will pose no undue risk to the type of facility proposed for that site.

10 CFR 52.79(a)(1)(iv) relates to the factors to be considered in the evaluation of sites that require the location and description of industrial, military, or transportation facilities and routes and that meet the requirements of 10 CFR 52.79(a)(1)(vi), as they relate to compliance with 10 CFR Part 100.

The acceptance criteria are based on meeting the following relevant requirements of 10 CFR Part 52 and 10 CFR Part 100:

1. Event Probability: The identification of design-basis events resulting from the presence of hazardous materials or activities in the vicinity of the plant or plants of a specified type is acceptable if all postulated types of accidents are included for which the expected rate of occurrence of potential exposures resulting in radiological doses in excess of the

10 CFR 50.34(a)(1) limits, as they relate to the requirements of 10 CFR Part 100 and are estimated to exceed the NRC staff objective of an order of magnitude of 10^{-7} per year.

2. Design-Basis Events: The effects of design-basis events have been adequately considered in accordance with 10 CFR 100.20(b), if analyses of the effects of those accidents on the safety-related features of the plant or plants of a specified type have been performed and measures have been taken (e.g., hardening, fire protection) to mitigate the consequences of such events.

The other acceptance criteria are based on the guidance in RG 1.91, "Evaluation of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants," regarding the evaluation of explosions postulated to occur on transportation routes near nuclear power plants.

3.5.1.5.4 Technical Evaluation

As documented in NUREG–1503, NRC staff reviewed and approved Subsection 3.5.1.5 of the certified ABWR DCD.

NRC staff reviewed Subsection 3.5.1.5 of the STP Units 3 and 4 COL FSAR and considered the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.

The staff independently reviewed Subsection 3.5.4.3 of the STP Units 3 and 4 COL FSAR. Based on this review, the staff found that the applicant has appropriately incorporated by reference Subsection 3.5.1.5 of the ABWR FSAR. The staff's review of this application is summarized below:

COL License Information Item

- COL License Information Item 3.11 Site Proximity Missiles and Aircraft Hazards

In this COL license information item the applicant states, "no site proximity missiles or aircraft hazards were identified for this site. For details, see Subsection 2.2S.2.7.2.

In STP Units 3 and 4 COL FSAR Section 2.2S.3, the applicant discusses and evaluates external events that have a potential for missile generation. In Section 2.2S, the applicant concludes that none of the potential site-specific external event hazards results in an unacceptable effect important to the safe operation of STP Units 3 and 4.

NRC staff issued **RAI 03.05.01.05-1 (eRAI 2905)** requesting the applicant to address the effects from a potential turbine missile impact at STP Units 1 and 2, as an external hazard to the safe operation of STP Units 3 and 4. In the response to **RAI 03.05.01.05-1** dated August 6, 2009 (ML092220162), the applicant provides an estimate of the probability of damage to safety-related systems at Units 3 and 4 from a turbine failure at Unit 1 or 2 to be 1.1×10^{-8} per year, which is less than the acceptance criterion of 10^{-7} per year. The staff found the applicant's response reasonable and acceptable.

3.5.1.5.5 Post Combined License Activities

There are no post COL activities related to this subsection.

3.5.1.5.6 Conclusion

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. . NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information, and no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the site-proximity missiles except aircraft that were incorporated by reference have been resolved.

In addition, the staff compared the additional COL license information in the application to the relevant NRC regulations and acceptance criteria in NUREG–0800, Subsection 3.5.1.5.

The staff's review confirmed that the applicant has adequately addressed the COL license information in accordance with Subsection 3.5.1.5 of NUREG–0800.

3.5.1.6 *Aircraft Hazards*

3.5.1.6.1 Introduction

Safety-related SSCs are designed and constructed not to fail or not to cause a failure in the event of a postulated credible missile impact, such as from aircraft. These SSCs include some that, if they do fail, could (1) cause the failure of the integrity of the RCS, (2) degrade the performance of any plant feature required for a safe shutdown of the reactor to an unacceptable level, or (3) lead to offsite radiological consequences.

3.5.1.6.2 Summary of Application

Subsection 3.5.1.6 of the STP Units 3 and 4 COL FSAR incorporates by reference Subsection 3.5.1.6 of the certified ABWR DCD Revision 4, referenced in 10 CFR Part 52, Appendix A with no departures.

In addition, in FSAR Subsection 3.5.4.3, the applicant provides the following:

COL License Information Item

- COL License Information Item 3.11 Site Proximity Missiles and Aircraft Hazards

This COL license information item addresses the site-proximity missiles and aircraft hazards.

3.5.1.6.3 Regulatory Basis

The regulatory basis for the information incorporated by reference is in NUREG–1503.

The regulatory basis for the review of the COL license information item is in Section 3.5.1.6 of NUREG–0800.

In addition, the following regulatory requirements in 10 CFR Part 100 and 10 CFR Part 52 also apply:

10 CFR 100.20, "Factors to Be Considered When Evaluating Sites," as they relate to the requirement that the site characteristics be evaluated to determine whether the risk to

individuals and society from potential plant accidents is low. This requirement is met if the probability of an aircraft hazard has the potential for radiological consequences greater than the 10 CFR 50.34(a)(1) exposure guidelines, as required by 10 CFR Part 100, of less than about 1×10^{-7} per year.

10 CFR 100.21(e) states that potential hazards associated with nearby transportation routes and industrial or military facilities must be evaluated and site parameters must be established, so that potential hazards from those routes and facilities pose no undue risk to the type of facility proposed for that site.

10 CFR 52.79(a)(1)(iv), as it relates to the factors to be considered in the evaluation of sites that require the location and description of industrial, military, or transportation facilities and routes; and the requirements of 10 CFR 52.79(a)(1)(vi), as they relate to compliance with 10 CFR Part 100.

The acceptance criteria are based on meeting the following relevant requirements of 10 CFR Part 52 and 10 CFR Part 100:

1. Event Probability: The identification of design-basis events resulting from the presence of hazardous materials or activities in the vicinity of the plant or plants of a specified type is acceptable if all postulated types of accidents are included for which the expected rate of occurrence of potential exposures resulting in radiological dose in excess of the 10 CFR 50.34(a)(1) limits as they relate to the requirements of 10 CFR Part 100 and are estimated to exceed the NRC staff objective of an order of magnitude of 10^{-7} per year.

2. Design-Basis Events: The effects of design-basis events have been adequately considered in accordance with 10 CFR 100.20(b), if analyses of the effects of those accidents on the safety-related features of the plant or plants of specified type have been performed and measures have been taken (e.g., hardening, fire protection) to mitigate the consequences of such events.

The other acceptance criteria are based on the guidance in NUREG–0800 Standard Review Plan 3.5.1.6, "Aircraft Hazards."

3.5.1.6.4 Technical Evaluation

As documented in NUREG–1503, NRC staff reviewed and approved Subsection 3.5.1.6 of the certified ABWR DCD. The staff reviewed Subsection 3.5.1.6 of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this subsection.

The staff independently reviewed Subsection 3.5.4.3 of the STP 3 and 4 COL FSAR. Based on this review, the staff found that the applicant has appropriately incorporated by reference

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3 for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

Subsection 3.5.1.6 of the ABWR DCD. The staff's review of this application is summarized below:

COL License Information Item

- COL License Information Item 3.11 Site-Proximity Missiles and Aircraft Hazards

The applicant discusses and evaluates aircraft hazards in STP Units 3 and 4 FSAR Subsection 2.2S.2.7.2. The applicant also addresses and evaluates potential aircraft hazards following the approach and methodology outlined in NUREG–0800 SRP 3.5.1.6, "Aircraft Hazards." In STP Units 3 and 4 FSAR Subsection 2.2S.2.7.2, the applicant assesses the probability of aircraft accidents resulting in radiological consequences greater than the 10 CFR Part 100 exposure guidelines.

Due to the close proximity of Federal Airway V-70 to the STP Units 3 and 4 site, the acceptance criteria in Subsection 3.5.1.6 of NUREG–0800 that require the plant to be at least 2 statute miles from the nearest edge of military training routes are not met. Therefore, the applicant performed an aircraft accident probability analysis. The applicant estimated the total probability of an aircraft accident to be 1.16×10^{-7} per year, which meets the NUREG–0800 acceptance criteria of about 10^{-7} per year. The applicant has not provided detailed information regarding the input data and assumptions used to calculate that probability. Therefore, NRC staff issued **RAI 03.05.01.06-1 (eRAI 2906)** requesting the applicant to provide additional details. The applicant's response to RAI 03.05.01.06-1 (eRAI 2906) dated September 14, 2009 (ML092590490), provides additional information and revises the estimate of the probability of an aircraft crash into the plant to 1.09×10^{-7} per year. The staff also obtained flight operation data within 5 and 10 miles of STP Units 3 and 4 from the Federal Aviation Administration (FAA). The staff performed a confirmatory analysis to determine the aircraft accident probability per year by conservatively applying these FAA data. The staff calculated the probability of an aircraft crash per year and found that the results are within the acceptable criterion of an order of magnitude of 1×10^{-7}. Therefore, the staff concluded that the applicant's determined aircraft accident probability per year is reasonable and acceptable. However, the proposed FSAR changes to Subsection 2.2S.2.7.2 will be confirmed in the next FSAR revision. Verification of this FSAR update is being tracked as **Confirmatory Item 03.05.01.06-1**.

3.5.1.6.5 Post Combined License Activities

There are no post COL activities related to this subsection.

3.5.1.6.6 Conclusion

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. . NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to the aircraft hazards. With the exception of the **Confirmatory Item 03.05.01.06-1,** no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the aircraft hazards that were incorporated by reference have been resolved.

The staff's review confirmed that the applicant has addressed the COL license information in accordance with Subsection 3.5.1.6 of NUREG–0800 and the regulatory requirements of 10 CFR 100.20, 10 CFR 100.21, and 10 CFR 52.79. However, as a result of the **Confirmatory**

Item 03.05.01.06-1, the staff was unable to finalize the conclusions relating to the aircraft hazards in accordance with the NRC requirements.

3.5.2 Structures, Systems, and Components (SSCs) to be Protected from Externally Generated Missiles

3.5.2.1 *Introduction*

This section of the FSAR addresses the safety-related SSCs in the plant that are required to safely shut down the reactor and maintain it in a safe condition assuming an additional single failure. These items must therefore all be protected from externally generated missiles. All of the safety-related systems identified are located in buildings that are designed as tornado resistant. Because the tornado missiles are the design-basis missiles, these SSCs are adequately protected.

3.5.2.2 *Summary of Application*

Section 3.5.2 of the COL FSAR, Revision 2, incorporates by reference Section 3.5.2 of the certified ABWR DCD, Revision 4, referenced in 10 CFR Part 52 Appendix A, with no departures. In addition, in FSAR Section 3.5.4, "COL License Information," the applicant provides the following:

COL License Information Items

- COL License Information Item 3.9 Protection of the Ultimate Heat Sink

This COL license information item addresses compliance with RG 1.27, as it relates to the capability of the UHS and connecting conduits to withstand the effects of externally generated missiles.

- COL License Information Item 3.15 Failure of Structures, Systems, and Components Outside ABWR Standard Plant Scope

This COL license information item addresses the effects from the failure of non-tornado-resistant SSCs when subjected to winds of tornado intensity.

3.5.2.3 *Regulatory Basis*

The regulatory basis for the review of the information incorporated by reference is in NUREG-1503. The regulatory basis and acceptance criteria for reviewing COL license information items are in Section 3.5.2 of NUREG–0800.

3.5.2.4 *Technical Evaluation*

As documented in NUREG-1503, NRC staff reviewed and approved Section 3.5.2 of the certified ABWR DCD. The staff reviewed Section 3.5 of the STP Units 3 and 4 COL FSAR, and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represent the complete scope

of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this section.

The staff reviewed the information in the COL FSAR:

Combined License Information Items

- COL License Information Item 3.9 Protection of Ultimate Heat Sink

COL License Information Item 3.9, which is addressed in ABWR DCD Tier 2, Subsection 3.5.4.1, "Protection of Ultimate Heat Sink," specifies that a COL applicant referencing the ABWR DCD should demonstrate compliance with RG 1.27, "Ultimate Heat Sink for Nuclear Power Plants," as it relates to the UHS and connecting conduits that are capable of withstanding the effects of externally generated missiles.

STP Units 3 and 4 COL FSAR, Revision 3, Tier 2 Section 3.5.2 refers to Appendix 3H.6, "Site-Specific Seismic Category I Structures," for the analysis demonstrating compliance with RG 1.27. Appendix 3H.6 provides the structural analysis and design for site-specific Seismic Category I structures, including those associated with the UHS; the UHS basin; the UHS cooling tower enclosures; and related reactor service water (RSW) pump houses and tunnels. The analyses described in Tier 2, COL application FSAR Revision 2, Section 3H.6 indicate that the site-specific UHS structures and related connecting conduits, specifically the RSW tunnel, can withstand design-basis, tornado-generated missiles.

NRC staff found the applicant's response to COL License Information Item 3.9 acceptable because the STP Units 3 and 4 COL application meets Regulatory Positions C.2 and C.3 of RG 1.27, regarding the UHS and connecting conduits that are capable of withstanding the effects of externally generated missiles. Therefore, the staff concluded that the SSCs that should be protected from externally generated missiles are in compliance with GDC 2.

- COL License Information Item 3.15 Failure of SSCs Outside ABWR Standard Plant Scope

COL License Information Item 3.15 specifies that a COL applicant referencing the ABWR DCD should ensure that any failure of SSCs resulting from externally generated missiles outside the ABWR DCD standard plant scope shall not prevent safety-related SSCs from performing their intended safety function. The applicant should also demonstrate the adequacy of these designs for external missile protection.

In STP Units 3 and 4 COL FSAR Revision 3, Tier 2 Subsection 3.5.4.7, "Failure of SSCs Outside ABWR Standard Plant Scope," the applicant states that non-tornado-resistant structures are constructed from materials such as reinforced concrete block or structural steel with metal siding and roof deck. Potential missiles or debris from these materials, when subjected to winds of tornado intensity, would not generate missiles more severe than the design-basis tornado missiles defined in ABWR DCD Tier 2, Subsection 3.5.1.4, "Missiles Generated by Natural Phenomenon." In ABWR DCD Tier 2, Subsection 3.5.1.4, tornado-

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3 for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

generated missiles were determined to be the limiting natural hazard phenomena in the design of all structures required for a safe shutdown of the nuclear power plant. Therefore, the failure of SSCs outside the scope of the standard plant design will not generate missiles that are more severe that the design-basis tornado missiles already utilized as the design basis for plant safety-related SSCs.

NRC staff reviewed the applicant's response to COL License Information Item 3.15 and found the response acceptable, because the STP Units 3 and 4 COL application meets the guidance in Section III(3) of SRP Section 3.5.2, "Structures, Systems, and Components to be Protected from Externally Generated Missiles," Revision 3.

ITAAC

NRC staff reviewed the STP Units 3 and 4 COL application ITAAC in accordance with the guidance in SRP Section 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria," Revision 3. The staff found that no additional ITAAC are needed in connection with this STP Units 3 and 4 COL application, FSAR Revision 2, Tier 2 Section 3.5.2.

Technical Specifications

NRC staff reviewed the TS in the ABWR DCD and in the STP Units 3 and 4 COL application against 10 CFR 50.36, "Technical Specifications." With regard to the protection provided for SSCs against externally generated missiles, there are no TS applicable to Tier 2 Subsection 3.5 of the STP Units 3 and 4 COL application. The staff concluded that no additional TS are needed for this subsection.

3.5.2.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

3.5.2.6 *Conclusion*

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information, and no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52 Appendix A, Section VI.B.1, all nuclear safety issues relating to the SSCs to be protected from externally generated missiles that were incorporated by reference have been resolved.

The staff's review found that the application has adequately addressed the COL license information items with regard to SSCs that should be protected from externally generated missiles, in accordance with the guidelines of SRP Section 3.5.2, Revision 3. Therefore, the staff concluded that the applicant has provided adequate protection and protective features for STP Units 3 and 4 to protect SSCs important to safety against externally generated missiles.

3.5.3 Barrier Design Procedures

3.5.3.1 *Introduction*

This section of the FSAR addresses missile barriers and protection structures designed to withstand and absorb missile impact loads to prevent damage to safety-related SSCs. The design is based on the overall response of a structure or barrier to missile impact, which depends largely upon the location of the impact (e.g., near mid-span or near a support); dynamic properties of the structure or barrier and the missile; and the kinetic energy of the missile. In general, the assumption is that the impact will be plastic, with all of the initial momentum of the missile transferred to the structure or barrier and only a portion of the kinetic energy absorbed as strain energy within the structure or barrier.

3.5.3.2 *Summary of Application*

Section 3.5.3 of the STP Units 3 and 4 COL FSAR incorporates by reference Section 3.5.3 of the certified ABWR DCD, Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 3.5.3, the applicant provides the following:

Tier 2 Departure Not Requiring Prior NRC Approval

- STD DEP 3.5-1 Missile Protection

This departure addresses the change from a single unit with a favorable turbine generator placement and orientation to a dual unit in which the turbine generator placement and orientation is considered unfavorable to essential systems of the adjoining unit, per RG 1.115.

COL License Information Items

- COL License Information Item 3.9 Protection of Ultimate Heat Sink

This COL license information item addresses compliance with RG1.27, as it relates to the capability of the ultimate heat sink (UHS) and connecting conduits to withstand the effects of externally generated missiles, as demonstrated in Appendix 3H.6.

- COL License Information Item 3.10 Missiles Generated by Other Natural Phenomena

This COL license information item addresses missiles generated by natural phenomena (e.g., tornadoes and hurricanes).

- COL License Information Item 3.12 Impact of Failure of Out of ABWR Standard Plant Scope Non-Safety-Related Structures, Systems, and Components due to a Design Basis Tornado

This COL license information item addresses the protection of safety-related SSCs from tornado missiles by being either underground or housed in a tornado missile-proof structure.

- COL License Information Item 3.15 Failure of Structures, Systems, and Components Outside ABWR Standard Plant Scope

This COL license information item addresses non-tornado-resistant structures that are constructed from materials, such as reinforced concrete block, and/or structural steel with a metal siding and roof deck.

3.5.3.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is in NUREG–1503.

The regulatory basis for reviewing the COL license information items is in Section 3.5.3 of NUREG–0800.

In addition, in accordance with Section VIII, "Processes for Changes and Departures," of, "Appendix A to Part 52--Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies one Tier 2 departure. This departure is subject to the requirements of 10 CFR Part 52 Appendix A Section VIII.B.5, which are similar to the requirements in 10 CFR 50.59.

3.5.3.4 *Technical Evaluation*

As documented in NUREG–1503, NRC staff reviewed and approved Section 3.5.3 of the certified ABWR DCD. The staff reviewed Section 3.5.3 of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this section.

The staff reviewed the information in the COL FSAR:

Tier 2 Departure Not Requiring Prior NRC Approval

- STD DEP 3.5-1 Missile Protection

This departure addresses the STP Units 3 and 4 turbine generator placement and orientation in relation to essential systems of the adjoining unit. This departure is not within the scope of Section 3.5.3, "Barrier Design Procedures." Therefore, no evaluation of its acceptability is provided in this section. Refer to Section 3.5.1 of this SER for the staff's evaluation of this departure.

COL License Information Items

- COL License Information Item 3.9 Protection of Ultimate Heat Sink

ABWR DCD Subsection 3.5.4.1 describes the following design requirement regarding COL License Information Item 3.9:

[1] See "Finality of Referenced NRC Approvals" in SER Section 1.1.3, for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

> Compliance with Regulatory Guide 1.27 as related to the ultimate heat sink and connecting conduits being capable of withstanding the effects of externally generated missiles shall be demonstrated (Subsection 3.5.2).

In COL FSAR Subsection 3.5.4.1, the applicant states that:

> Compliance with Regulatory Guide 1.27 as related to the UHS and connecting conduits being capable of withstanding the effects of externally generated missiles is demonstrated in Appendix 3H.6.

In 10 CFR Part 50 Appendix A, GDC 2 requires that SSCs important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornados, hurricanes, tsunami, floods, and seiches without loss of capability to perform their safety functions. Site-specific Seismic Category I structures at STP Units 3 and 4 should be designed to withstand the impact of tornado generated missiles. COL application Part 2, Tier 2, Section 3H.6 provides a detailed description of the analysis and design of site-specific structures. Specifically, Subsection 3H.6.4.3.3.1, "Tornado Loads (Wt)," describes the load parameters and load combinations used in the design of the UHS and connecting conduits to withstand tornado missiles. However, the staff found that information related to the design of Seismic Category I structures at STP 3 and 4 to withstand the impact of tornado-generated missiles as presented in Section 3H.6 and pertaining to COL License Information Item 3.9 was not complete.

In **RAI 03.05.03-1 (RAI 3224-Question 12888),** the staff requested that the applicant provide a comparative discussion of the proposed structural design criteria with their corresponding SRP acceptance criteria, including the basis for any deviation from the SRP criteria for Sections 3H.6.4, "Structural Design Criteria," and 3H.6.5, "Seismic Analysis." In addition, the staff requested that the applicant provide the rationale for concluding that applicable acceptance criteria of SRP Sections 3.5.3, 3.7.2 and 3.8.4 are complied with for Subsections 3H.6.6.1, "Analytical Model," 3H.6.6.2.1, "UHS Basin, UHS Cooling Tower Enclosure, and RSW Pump House;" 3H.6.6.2.2, "RSW Piping Tunnels;" 3H.6.6.3, "Structural Design;" 3H.6.6.4, "Foundations;" and 3H.6.6.5, "Stability Evaluations."

In a letter dated October 7, 2009, (STP Letter U7-C-STP-NRC-090161, ML092860129), the applicant responded to this **RAI 03.05.03-1,** including listing and justifying deviations from pertinent SRP positions as well as making reference to the response to **RAI 03.03.02-1**. The staff found that the applicant's technical approach for addressing COL License Information Item 3.9 is in accordance with applicable regulatory positions of the SRP Section 3.5.3, RG 1.76 and RG 1.142. The applicant also references the following codes: ACI 349-97, ANSI/AISC 690-94, ACI 350 and ASCE 7-05. Furthermore, questions regarding the validation of the code versions have been addressed in Section 3.8.4 and elsewhere in the SER, and thus need not be considered here. Based on the above staff findings including the applicant's compliance with applicable regulatory positions of the SRP Section 3.5.3, RG 1.76 and RG 1.142, the staff concluded that **RAI 03.05.03-1** is resolved and closed.

In **RAI 03.05.03-2 (eRAI 3224 Question: 12889),** the staff requested that the applicant provide more detailed description of design procedures for predicting local damage of concrete and steel barriers. In the response to this RAI dated October 7, 2009 (ML092860129), the applicant states that the local damage prediction is conducted using the TM 5-855-1 formula as described in the response to **RAI 03.03.02-3** for concrete structures and using the Ballistic Research Laboratory (BRL) formula for steel barriers. Furthermore, the applicant states that the RSW piping tunnels are also designed for tornado-generated missiles. Although all of the RSW piping

tunnels except the access shafts are buried, conservatively, no credit is taken for the soil above the tunnels for shielding against tornado-generated missiles. The staff evaluated this response and concluded that the missile design procedures adopted by the applicant meet the acceptance criteria of SRP 3.5.3 for the design of concrete and steel barriers to withstand the impact of tornado-generated missiles. Therefore, the response to **RAI 03.05.03-2** is satisfactory and the RAI is resolved. Confirmation that the COL application is revised as proposed in the response to this RAI is being tracked as **Confirmatory Item 03.05.03-2**.

- COL License Information Item 3.10 Missiles Generated by Other Natural Phenomena

In COL FSAR Subsection 3.5.4.2, "Missiles Generated by Other Natural Phenomena," the applicant stated:

> The only missiles generated by natural phenomena that have been identified, are those generated by tornados and hurricanes. Of tornado and hurricane missiles, tornado missiles govern the design of safety-related structures, systems, and components. The reference ABWR DCD tornado wind speeds (300 mph) exceed those specified in Regulatory Guide 1.76, Revision 1 for this site and exceed the design basis wind speed for this site. Therefore all missiles generated by other natural phenomena are bounded by the reference ABWR DCD tornado missiles specified in Subsection 3.5.1.4.

The staff evaluated the applicant's technical rationale for addressing COL License Information Item 3.10. The staff found that the applicant's technical approach and justification for addressing COL License Information Item 3.10 are adequate and acceptable from the standpoint of assuring structural integrity because (1) the referenced ABWR DCD tornado wind speeds (300 mph) exceed those specified in RG 1.76, Revision 1, for this site and exceed the design-basis wind speed for this site; and (2) all missiles generated by other natural phenomena are bounded by the referenced ABWR DCD tornado missiles specified in Subsection 3.5.1.4.

Additional staff evaluation of COL License Information Item 3.10 is provided in Section 3.5.4 of this SER.

- COL License Information Item 3.12 Impact of Failure of Out of ABWR Standard Plant Scope Non-Safety-Related Structures, Systems, and Components due to a Design Basis Tornado

In COL FSAR Subsection 3.5.4.4, the applicant states the following:

> In general, safety-related SSCs are protected from tornado missiles by being either underground or housed in a tornado missile proof structure. The design criteria for systems and components (not housed in tornado structures) are as follows: Such plant SSCs are analyzed for the design basis tornado missiles to ensure that their failure will not affect the ability of safety-related SSCs from performing their intended safety functions.

NRC staff evaluated the applicant's technical rationale for addressing COL License Information Item 3.12. The staff notes that the STP Units 3 and 4 layout includes non-Seismic Category I structures that are not designed for tornado loadings and missile impacts and may be in close proximity to Seismic Category I structures. The staff issued **RAI 03.05.03-3 (eRAI 3224 Question: 12891)** asking the applicant to provide a detailed discussion of the approaches and

analyses used to ensure that site-specific SSCs not designed for a tornado-generated missile impact are analyzed and checked to prevent modes of failure that will affect the ability of safety-related SSCs to perform their intended safety functions. The applicant's response to **RAI 03.05.03-3** dated October 7, 2009 (ML092860129), confirms that site-specific SSCs not designed for tornado loads that are in close proximity to the safety-related SSCs so that their collapse under the tornado loading may impact the nearby safety-related SSCs are evaluated for the site-specific tornado loading parameters. This evaluation is to ensure that they will not collapse onto the safety-related SSCc under tornado loading. The applicant further confirms that tornado loading includes the loads from tornado-generated missiles. Since the site-specific structures will be evaluated to ensure that they do not impact adjacent Seismic Category I structures for the site-specific tornado, the staff concludes that this design procedure meets SRP Section 3.3.2 Acceptance Criterion 4A. Therefore, the applicant's response is satisfactory and **RAI 03.05.03-3** is resolved and closed.

- COL License Information Item 3.15 Failure of Structures, Systems, and Components Outside ABWR Standard Plant Scope

In COL FSAR Subsection 3.5.4.7, the applicant states the following:

> Non-tornado resistant structures are constructed from materials such as reinforced concrete block, and/or structural steel with metal siding and roof deck. Potential missiles or debris from these materials, resulting from failure of structure or from items blown off, when subjected to winds of tornado intensity, would not generate missiles more severe than the design basis tornado missiles defined in Subsection 3.5.1.4 (Reference 3.5-10).

NRC staff evaluated COL License Information Item 3.15 and issued **RAI 03.05.03-4 (eRAI 3224 Question: 13154)**, requesting that the applicant to provide further justification that potential missiles or debris resulting from structural failure or from items blown off, when subjected to winds of tornado intensity, would not generate missiles more severe than the design-basis tornado missiles defined in Subsection 3.5.1.4. The applicant's response to **RAI 03.05.03-4** dated October 7, 2009 (ML092860129) states that ABWR non-tornado-resistant structures are similar to those found in typical nuclear power plants in the United States. These structures do not use any unique design or construction features that could introduce new or more airborne-capable missiles. Therefore, the impacts of missiles that may be blown off or generated from the collapse of these structures are considered to be bounded by the impact of the NRC missile spectrum considered for the design of safety-related SSCs. The staff's evaluation of this response found that the applicant presents a reasonable basis for the conclusion, which includes referencing the tornado missile spectrum defined in R.G.1.76. Thus, the response to **RAI 03.05.03-4** is adequate, and this RAI is resolved and closed.

3.5.3.5 *Post Combined License Activities*

There are no post COL activities related to this section.

3.5.3.6 *Conclusion*

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information related to "Barrier Design Procedures." With the exception of the **Confirmatory Item 03.05.03-2**, no outstanding

information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52 Appendix A, Section VI.B.1, all nuclear safety issues relating to the Environmental Qualification of Mechanical and Electrical Equipment that were incorporated by reference have been resolved.

The staff found it reasonable that the identified Tier 2 departure is characterized as not requiring prior NRC approval per 10 CFR Part 52 Appendix A, Section VIII.B.5. The staff's review confirmed that the applicant has adequately addressed the COL license information in accordance with Section 3.5.3 of NUREG–0800.

Specifically, the staff concluded that the information pertaining to STP Units 3 and 4 COL FSAR Tier 2, Revision 3, Section 3.5.3 is within and consistent with the scope of the design certification. The information also complements and follows the ABWR DCD requirements regarding the site-specific SSCs.

However, as a result of **Confirmatory Item 03.05.03-2**, the staff was unable to finalize the conclusions relating to "Barrier Design Procedures" in accordance with the NRC requirements.

3.6 Protection Against Dynamic Effects Associated with the Postulated Rupture of Piping

3.6.1 Postulated Piping Failures in Fluid Systems Inside and Outside of Containment (Related to RG 1.206, Section C.I.3.6.1, "Postulated Piping Failures in Fluid Systems Outside of Containment")

3.6.1.1 *Introduction*

This section of the FSAR addresses the design bases, description, and safety evaluation for determining the effects of postulated piping failures in fluid systems outside of the containment and the necessary protective measures.

3.6.1.2 *Summary of Application*

Section 3.6.1 of the STP Units 3 and 4 COL FSAR incorporates by reference Section 3.6.1 of the certified ABWR DCD Revision 4 referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 3.6.1, the applicant provides the following:

Tier 2 Departure Not Requiring Prior NRC Approval

- STD DEP 3.6-1 Main Steam Tunnel Concrete Thickness

This departure decreases the wall thickness in the main steam tunnel.

COL License Information Item

- COL License Information Item 3.16 Details of Pipe Break Analysis Results and Protection Methods

The applicant provides supplemental information in Subsection 3.6.5.1 to address this COL license information item. The applicant adds that "The details of pipe break analysis results and

protection methods will be provided for NRC review as part of the ITAAC in the reference ABWR DCD Tier 1 Section 3.3."

3.6.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is in NUREG–1503. In addition, the relevant requirements of the Commission's regulations for the plant design to protect against postulated piping failures in fluid systems outside of the containment, and the associated acceptance criteria, are in Section 3.6.1 of NUREG–0800.

In accordance with Section VIII, "Processes for Changes and Departures," of, "Appendix A to Part 52--Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies one Tier 2 departure not requiring prior NRC approval. This departure is subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.B.5, which are similar to the requirements in 10 CFR 50.59.

In addition, the regulatory basis for reviewing COL License Information Item 3.16 is the guidance provided by Section 3.6.1 of NUREG–0800, Branch Technical Position (BTP) 3-3 on protection against postulated piping failures in fluid systems outside of the containment, and BTP 3-4 on postulated rupture locations in fluid system piping inside and outside of the containment.

3.6.1.4 *Technical Evaluation*

As documented in NUREG–1503, NRC staff reviewed and approved Section 3.6.1 of the generic DCD for the ABWR design. The staff reviewed Section 3.6.1 of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this section.

The staff reviewed the information in the COL FSAR:

Tier 2 Departure Not Requiring Prior NRC Approval

- STD DEP 3.6-1 Main Steam Tunnel Concrete Thickness

In STD DEP 3.6-1, the applicant justifies a change in the main steam tunnel wall thickness. ABWR DCD Tier 2 Subsection 3.6.1.3.2.3 specifies a 2-meter (6-foot) minimum wall thickness for concrete in the main steam tunnel. The applicant proposes a minimum main steam tunnel wall thickness of 1.6 m (5.2 feet) or greater. The applicant states that the steam tunnel is designed to handle the consequences of high-energy pipe breaks. Therefore, the proposed change does not have an impact on the safety conclusion reached in NUREG–1503. Because the steam tunnel walls are Seismic Category I structures, the NRC staff's structural evaluation of the main steam tunnel is included in Subsection 3.8.4.3.1.2 of this SER.

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3, for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

The applicant's evaluation in accordance with Item B.5 of Section VIII of 10 CFR Part 52, Appendix A determined that this departure does not require prior NRC approval. Within the review scope of this section, the staff found it reasonable that the departure does not require prior NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

COL License Information Item

- COL License Information Item 3.16 Details of Pipe Break Analysis Results and Protection Methods

In Subsection 3.6.5.1, the applicant proposes to address COL License Information Item 3.16 by referencing the ITAAC in the referenced ABWR DCD Tier 1, Section 3.3. This ITAAC addresses the as-built pipe break analysis results and protection methods.

NRC staff reviewed the applicant's proposal using the review procedures described in Section 3.6.1 of NUREG–0800. The staff determined that additional information is needed because the applicant's response to COL License Information Item 3.16 does not address the as-designed pipe break analysis. The response only addresses the as-built pipe design. The staff issued **RAI 03.06.01-1** (**eRAI 129)** requesting the applicant to either justify how ITAAC 3.3 covers the level of detail described in COL License Information Item 3.16, or to propose changes to the ITAAC to address information for both the as-designed and the as-built pipe break hazards. The staff also asked the applicant to provide a description pertaining to the closure schedule of the as-designed pipe break hazards analysis in Tier 2.

The applicant's response to **RAI 03.06.01-1** dated June 12, 2008 (ML081710126), states that ITAAC 3.3, Item 2 requires inspections of both the Pipe Break Analysis Report and the as-built high and moderate energy pipe break mitigation features (including spatial separation). However, the acceptance criteria do not specify that the Pipe Break Analysis Report will be made available for the staff to review before installation. The expectation is that all design-related ITAAC will be scheduled following the completion of the applicable design documents early in the construction phase. The applicant will revise Subsection 3.6.5.1 of the COL FSAR to include a commitment to notify NRC staff of the availability of the Pipe Break Hazards Analysis Report(s) before installing the relevant systems or components. The necessary details of that information will be provided in the next revision of the COL FSAR 3 months after completing the Pipe Break Analysis Report(s).

The staff found this response insufficient. Therefore, the staff issued **RAI 03.06.01-2 (eRAI 3209)** requesting the applicant to (1) complete and submit the as-designed Pipe Break Analysis Report within the COL review phase; (2) propose a site-specific ITAAC to address the as-designed Pipe Break Analysis Report, with a license condition that provides a description pertaining to the closure schedule of the report; or (3) propose an acceptable alternative.

The applicant's response to **RAI 03.06.01-2** (ML092430131) states the following:

> As summarized in the FSER, the piping DAC clearly cover the aspects of the design of the piping system necessary for issuance of the design certification. The DCD includes the ITAAC that were determined to be necessary to support the safety determination for the ABWR piping.

The applicant's response also states:

> As such, it is clear that the Pipe Break Analysis Report will be prepared for the as-designed condition, as well as requiring reconciliation of the as-built condition. Although ITAAC 3.3.2 states in the acceptance criteria that the Pipe Break Analysis Report must exist for the as-built plant, this DAC is a requirement for the final product, which includes the design basis and the as-built reconciliation.

In addition, the applicant's response notes that the piping design acceptance criteria (DAC) are a requirement for the final product, which includes the design-basis and the as-built reconciliation. However, the staff stated that the DAC (as identified in DCD Tier 1 ITAAC 3.3.2 and as defined in Table 7, "Piping Design Acceptance Criteria," of the ABWR DCD Introduction) do not cover the full scope of the Pipe Break Analysis Report, as identified in COL License Information Item 3.16.

The staff still considered the applicant's response to **RAI 03.06.01-2** unacceptable. Therefore, the staff issued **RAI 03.06.01-3 (eRAI 4087)** requesting the applicant to (1) complete and submit the as-designed Pipe Break Analysis Report within the COL review phase; (2) propose a site-specific ITAAC to address the as-designed Pipe Break Analysis Report with a license condition that provides a description pertaining to the closure schedule of the report; or (3) propose an acceptable alternative.

The applicant's response to **RAI 03.06.01-3** dated March 24, 2010 (ML100880058), proposes to create a new site-specific ITAAC in COL application Part 9, Section 3.0. The proposed site-specific ITAAC will contain a post-COL requirement related to the as-designed Pipe Break Analysis Report.

The applicant's response also states that the current schedule shows that the pipe break analysis report for the high-energy and moderate-energy piping in the as-designed plant will be completed and ready for review by the end of 2012. The current completion date is from the integrated project schedule, and is subject to potential future adjustments. As part of the applicant's periodic issuance of the project schedule and ITAAC schedule to the NRC, the NRC will be informed of any schedule changes.

The staff evaluated the applicant's RAI responses described above (including the proposed changes to the COL application) and found the changes acceptable. The applicant has addressed the staff's concerns in **RAI 03.06.01-1** (and subsequent RAIs), therefore **RAI 03.06.01-3** is resolved, and **RAI 03.06.01-1 and RAI 03.06.01-2** are closed. Verification of the applicant's proposed update of COL FSAR Tier 2, Subsection 3.6.5.1, "Details of Pipe Break Analysis Results and Protection Methods," and COL application Part 9, Table 3.0-14 are being tracked as **Confirmatory Item 03.06.01-3**.

3.6.1.5 *Post Combined License Activities*

In COL License Information Item 3.16 (Subsection 3.6.5.1 of the STP FSAR), the applicant will provide the details of the pipe break analysis results and protection methods for NRC to review, as part of the site-specific ITAAC closure.

3.6.1.6 *Conclusion*

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. NRC staff reviewed the application and checked the referenced DCD. The staff's review

confirmed that the applicant has addressed the required information relating to the postulated piping failures in fluid systems inside and outside of the containment. With the exception of **Confirmatory Item 03.06.01-3**, no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the postulated piping failures in fluid systems inside and outside of the containment that were incorporated by reference have been resolved.

In addition, the staff compared the additional COL license information in the application to the relevant NRC regulations; the acceptance criteria defined in NUREG–0800, Section 3.6.1; and to other NRC regulatory guides. The staff concluded that the applicant is in compliance with the NRC regulations.

The applicant also identifies a Tier 2 departure. The staff found it reasonable that the Tier 2 departure is characterized as not requiring prior NRC approval, per 10 CFR Part 52, Appendix A, Section VIII.B.5.

The applicant adequately addresses COL Information Item 3.6.5.1 pertaining to the review of the pipe hazards analysis, and this item can be considered closed. However, as a result of **Confirmatory Item 03.06.01-3,** the staff was unable to finalize the conclusions relating to the postulated piping failures in fluid systems inside and outside of the containment, in accordance with the NRC requirements.

3.6.2 Determination of Break Locations and Dynamic Effects Associated with the Postulated Rupture of Piping

3.6.2.1 *Introduction*

This section of the FSAR evaluates (1) the design bases for locating postulated breaks and cracks in high- and moderate-energy piping systems inside and outside the containment; (2) the procedures used to define the jet thrust reaction at the break location; (3) the procedures used to define the jet impingement loading on adjacent essential SSCs; (4) the pipe whip restraint design; and (5) the protective assembly design. Pipe breaks in several high-energy systems, including the reactor coolant loop and surge line, are replaced by small leakage cracks when the leak-before-break criteria are applied. Jet impingement and pipe whip effects are not evaluated for these small leakage cracks.

3.6.2.2 *Summary of Application*

Section 3.6.2 of the STP Units 3 and 4 COL FSAR incorporates by reference Section 3.6 of the ABWR DCD, Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, the applicant provides an as-designed ITAAC in COL application Part 9, Table 3.0-14, “Pipe Break Analysis Report for the As-designed Plant.”

Tier 2 Departure Not Requiring Prior NRC Approval

- STP DEP Admin

This administrative departure changes references to certain figures.

COL License Information Items

- COL License Information Item 3.16 Details of Pipe Break Analysis Results and Protection Methods

This COL license information item addresses details of pipe break analysis results and protection methods.

- COL License Information Item 3.18 Inservice Inspection of Piping in Containment Penetration Areas

This COL license information item addresses inservice inspections of piping in containment penetration areas.

3.6.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is in Section 3.6 of NUREG-1503.

In accordance with Section VIII, "Processes for Changes and Departures," of 10 CFR Part 52, Appendix A, the applicant identifies one Tier 2 departure as an administrative departure not requiring prior NRC approval. This departure is subject to the requirements of Appendix A to 10 CFR Part 52, Subsection VIII.B.5, which are similar to the requirements in 10 CFR 50.59.

The regulatory basis and acceptance criteria for reviewing the COL license information items are in NUREG–0800, Section 3.6.2.

3.6.2.4 *Technical Evaluation*

As documented in NUREG–1503, NRC staff reviewed and approved Section 3.6.2 of the certified ABWR DCD. The staff reviewed Section 3.6.2 of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this section.

In addition, the staff reviewed the following in the COL FSAR:

Tier 2 Departure Not Requiring Prior NRC Approval

- STP DEP Admin

Revision 2 of the COL application corrects the reference to Figure 3.6-4 from Figure 3.6-3 in Subsection 3.6.2.3.3. NRC staff found these changes acceptable. The applicant's evaluation determined that this departure does not require prior NRC approval, in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5. Within the review scope of this section, the staff found it

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3, for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

reasonable that this departure does not require prior NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

COL License Information Items

- COL License Information Item 3.16 — Details of Pipe Break Analysis Results and Protection Methods
- COL License Information Item 3.18 — Inservice Inspection of Piping in Containment Penetration Areas

In evaluating COL License Information Item 3.16, the staff was concerned that the applicant does not clearly indicate when the as-designed pipe break analysis results and protection methods will be made available to NRC staff for review. FSAR Subsection 3.6.5.1, "Details of Pipe Break Analysis Results and Protection Methods," states that the details of the pipe break analysis results and protection methods (COL License Information Item 3.16) will be presented to NRC staff for review as part of the ITAAC in the referenced ABWR DCD Tier 1, Section 3.3. Item 2 of Table 3.3 of ABWR DCD Tier 1 Section 3.3 includes an ITAAC related to a pipe break analysis report for the as-built plant (as opposed to the as-designed plant). However, it should be noted that Subsection 3.6.5.1 of the referenced ABWR DCD refers to Subsection 3.6.2.5 and states that these details of the pipe break analysis results and protection methods shall be provided by the COL applicant for the operating license review (as opposed to the as-built reconciliation described in STP FSAR Subsection 3.6.5.1). It should also be noted that as identified in RG 1.206 Section C.III.4.3, for each COL action or information item that cannot be resolved before the issuance of a license, the COL application should justify why the item has not been resolved. In addition, the applicant should supply the NRC with a schedule for completing the detailed engineering information—in this case, the as-designed pipe break analysis results—to allow for the coordination of activities with the NRC Construction Inspection Program following the issuance of the COL. It is not clear in the FSAR information described above, when the applicant will make the details of the as-designed pipe break analysis available for NRC review. Therefore, the staff issued **RAI 03.06.01-1 (eRAI 129)** requesting the applicant to address the above issues associated with COL License Information Item 3.16. The applicant's response to **RAI 03.06.01-1** (letter dated June 12, 2008, [ML081710126]) suggests that this report is part of the overall scope of ITAAC 3.3 Item 2, and proposes to revise Subsection 3.6.5.1 to notify the NRC of the availability of the design Pipe Break Hazards Analysis Report before installing the affected systems or components. The staff did not consider this response sufficient because ITAAC 3.3 Item 2 only addresses the as-built aspect of the Pipe Break Hazard Analysis Report, not the as-designed aspect. The staff issued **RAI 03.06.01-2 (eRAI 3209)** requesting this information.

The applicant's response to **RAI 03.06.01-2** (dated August 27, 2009, [ML092430131]) states that the pipe break analysis report will be prepared for the as-designed condition and will require reconciliation of the as-built condition. Although ITAAC 3.3.2 states in the acceptance criteria that the pipe break analysis report must exist for the as-built plant, the design acceptance criteria (DAC) (as identified in DCD Tier 1 ITAAC 3.3.2 and defined in Table 7, "Piping Design Acceptance Criteria," of the ABWR DCD "Introduction") are a requirement for the final product, which includes the design basis and the as-built reconciliation. The staff's review of the applicant's response found that the applicant still has not adequately addressed the as-designed pipe break analysis issue. Specifically, the DAC do not cover the full scope of the pipe break analysis report as identified in COL License Information Item 3.16. The staff therefore issued **RAI 03.06.01-3** requesting the applicant to (1) complete and submit the as-

designed pipe break analysis report during the COL review phase; or (2) propose a site-specific ITAAC to address the as-designed pipe break analysis report with a license condition that describes the closure schedule of the report; or (3) provide an acceptable alternative.

The applicant's response to **RAI 03.06.01-3** (dated May 4, 2010, [ML100880058]) proposes to create a new site-specific ITAAC in COL application Part 9, Section 3.0. The proposed site-specific ITAAC contains a post-COL requirement related to the as-designed pipe break analysis report. The applicant also states that the as-designed pipe break analysis report will be available before the installation of the high- and moderate-energy piping described in FSAR Section 3.6. Furthermore, the applicant's response adds that the current schedule shows the high- and moderate-energy pipe break analysis report for the as-designed plant will be completed and ready for review by the end of 2012. The current completion date is from the integrated project schedule and is subject to potential future adjustments. As part of the applicant's periodic issuance of the project and ITAAC schedules, the NRC will be informed of any schedule changes per 10 CFR 52.99(a).

The staff found that the applicant's response to **RAI 03.06.01-3** satisfactorily reconciles the concerns stated above (including the proposed changes to the COL application, Part 9, in the RAI response) and adequately addresses the staff's concern related to the completion of the as-designed pipe break analysis report. The applicant's response is therefore acceptable and **RAI 03.06.01-3** is resolved and **RAI 03.06.01-1 and RAI 03.06.01-2** are closed. Verification that the proposed changes to the site-specific ITAAC appear in the COL application, Part 9, is being tracked as **Confirmatory Item 03.06.01-3**.

A second staff concern identified in the FSAR Section 3.6 review is related to the inservice inspection of piping welds in containment penetration areas. FSAR Subsection 3.6.5.3, "Inservice Inspection of Piping in Containment Penetration Areas," states that a 100-percent volumetric inservice examination of all accessible pipe welds in the containment penetration area will be conducted during each inspection interval, as defined in IWA-2400, ASME Code Section XI (COL License Information Item 3.18). This information is inconsistent with the provision in Branch Technical Position (BTP) 3-4, A.(ii).(7) and ABWR DCD Subsection 3.6.2.1.4.2. The provision in BTP 3-4 and in the ABWR DCD requires that a 100-percent volumetric inservice examination of all pipe welds (as opposed to all of the accessible pipe welds as stated in the STP FSAR Subsection 3.6.5.3) in the containment penetration area should be conducted during each inspection interval, as defined in IWA-2400, ASME Code Section XI.

As stated in both the ABWR DCD and the FSAR, the COL applicant is responsible for designing all ASME Code Class 1, 2, and 3 components for accessibility to perform preservice and inservice inspections. It is therefore the applicant's responsibility to ensure that sufficient access exists for all of the pipe welds in the containment penetration area. The staff issued **RAI 03.06.02-1 (eRAI 3896)** requesting the applicant to address this discrepancy. The applicant's response to **RAI 03.06.02-1** (dated December 16, 2009 [ML093520627]) concurs with the staff's position. The applicant adds that COL License Information Item 3.18 will be revised to conduct a 100-percent volumetric inservice examination of all pipe welds in the containment penetration area. The staff found the applicant's response acceptable, and **RAI 03.06.02-1** is considered resolved. Verification that the proposed change to COL License Information Item 3.18 in this FSAR section is being tracked as **Confirmatory Item 03.06.02-1.**

3.6.2.5 *Post Combined License Activities*

The applicant will submit the as-designed pipe break hazard report, as described in ITAAC Table 3.0-14.

3.6.2.6 *Conclusion*

The NRC staff's finding related to the information incorporated by reference is in NUREG–1503. NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to the determination of break locations and dynamic effects associated with the postulated rupture of piping. With the exception of **Confirmatory Items 03.06.01-3 and 03.06.02-1**, no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52 Appendix A, Section VI.B.1, all nuclear safety issues relating to the determination of break locations and dynamic effects associated with the postulated rupture of piping that were incorporated by reference have been resolved.

In addition, the staff compared the additional COL license information items in the application to the relevant NRC regulations; the acceptance criteria defined in NUREG–0800, Section 3.6.2; and other NRC regulatory guides including RG 1.206 Sections C.III.1, Chapter 3, C.I.3.6.2 and C.III.4.3.

The staff found it reasonable that the identified Tier 2 departure is characterized as not requiring prior NRC approval, per 10 CFR Part 52, Appendix A, Section VIII.B.5.

The staff's review concluded that the applicant has adequately addressed the COL license information items. The applicant has provided sufficient information to ensure that SSCs important to safety will be appropriately protected against the effects of postulated pipe failures. However, as a result of **Confirmatory Items 03.06.01-3 and 03.06.02-1**, the staff was unable to finalize the conclusions relating to the determination of break locations and dynamic effects associated with the postulated rupture of piping, in accordance with the NRC requirements.

3.6.3 Leak-Before-Break Evaluation Procedures

Leak-before-break methodology for pipe break postulation will not be used for the STP Units 3 and 4 ABWR plant design.

3.6.4 As-Built Inspection of High-energy Pipe Break Mitigation Features

Section 3.6.4 of the STP Units 3 and 4 COL FSAR incorporates by reference 3.6.4, "As-Built Inspection of High-energy Pipe Break Mitigation Features," of the ABWR DCD, Revision 4, referenced in 10 CFR Part 52, Appendix A, with no departures or supplements. NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remains for review.[1] The staff's review confirmed that there is no outstanding issue related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to this section have been resolved.

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3 for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

3.7 Seismic Design

To be provided at a later date.

3.8 Seismic Category I Structures

To be provided at a later date.

3.9 Mechanical Systems and Components

3.9.1 Special Topics for Mechanical Components

This section of the FSAR addresses the design transients and methods of analysis used for all Seismic Category I components, component supports, core support (CS) structures, and reactor internals designated as Class 1, 2, 3 and CS under ASME Code, Section III, and those not covered by the Code. Also included are the assumptions and procedures used for the inclusion of transients in the design and fatigue evaluation of ASME Code Class 1 and CS components and the computer programs used in the design and analysis of Seismic Category I components and their supports, as well as experimental and inelastic analytical techniques.

Section 3.9.1 of the STP COL FSAR incorporates by reference, with no departures or supplements, Section 3.9.1, "Special Topics for Mechanical Components," of the certified ABWR DCD, Revision 4, which is referenced in 10 CFR Part 52, Appendix A. NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remains for review.[1] The staff's review confirmed that there is no outstanding issue related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52 Appendix A Section VI.B.1, all nuclear safety issues relating to the Special Topics for Mechanical Components have been resolved.

3.9.2 Dynamic Testing and Analysis (Related to RG 1.206, Section 3.9.2, "Dynamic Testing and Analysis of Systems, Components, and Equipment")

To be provided at a later date.

3.9.3 ASME Code Class 1, 2, and 3 Components, Component Supports, and Core Support Structures

3.9.3.1 *Introduction*

The structural integrity and functional capability of pressure-retaining components, their supports, and core support structures are ensured by designing them in accordance with ASME Code Section III, or other industrial standards. The loading combinations and their respective stress limits, the design and installation of pressure-relief devices, and the design and structural integrity of ASME Code Class 1, 2, and 3 components and component supports are included.

The criteria for the SSC design include the following considerations:

- Loading combinations, design transients, and stress limits

[1] See "Finality of Referenced NRC Approvals" in SER Section 1.1.3 for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

- Pump and valve operability assurance
- Design and installation criteria of Class 1, 2, and 3 pressure-relieving devices
- Component and piping supports

3.9.3.2 *Summary of Application*

Section 3.9.3 of the STP Units 3 and 4 COL FSAR, Revision 2, incorporates by reference Section 3.9.3 of the certified ABWR DCD, Revision 4, referenced in 10 CFR Part 52, Appendix A.

In addition, in FSAR Section 3.9.3, the applicant provides the following:

Tier 1 Departure

- STD DEP T1 2.4-3 RCIC Turbine/Pump

The applicant combines the reactor core isolation cooling (RCIC) turbine and the RCIC pump into a single assembly unit and incorporate a new requirement, which states that the RCIC turbine–pump assembly will be constructed in accordance with the requirements of ASME Code Section III for Class 2 components.

In Subsections 3.9.1.9 and 3.9.3.4.4, the applicant deletes the RCIC pump as one of the pumps because it is now part of the RCIC turbine-pump assembly.

To account for both the RCIC turbine and RCIC pump as part of a single assembly, the applicant replaces “RCIC Turbine” with “RCIC Turbine-Pump” in the title and description of FSAR Subsections 3.9.3.2.1.5 and 3.9.3.2.2.

Tier 2 Departure Not Requiring Prior NRC Approval

- STD DEP 6C-1 Containment Debris Protection for ECCS Strainers

This departure incorporates the new complex ECCS (e.g., cassette-type) strainer design.

COL License Information Items

- COL License Information Item 3.28 ASME Class 2 and 3 or Quality Group D Components with 60-Year Life

The applicant adds a supplement in FSAR Subsection 3.9.7.2 to address COL License Information Item 3.28, which states:

> The ASME Class 2 and 3 or Quality Group D components that are subjected to cyclic loadings, including operating vibration loads and thermal transients effects, of a magnitude and/or duration so severe the 60-year design life cannot be assured by required Code calculations and, if similar designs have not already been evaluated, will be identified and an appropriate analysis will be available to demonstrate the required design life or designs to mitigate the magnitude or duration of the cyclic loads will be available for review prior to fuel load.

- COL License Information Item 3.30 Audit of Design Specification and Design Reports

The applicant adds the following site-specific supplement to address COL License Information Item 3.30 in Subsection 3.9.7.4 of the FSAR:

> The design specification and design reports required by ASME Code for vessels, pumps, valves and piping systems for the purpose of audit will be made available for NRC review.
>
> The piping system design is consistent with the construction practices, including inspection and examination methods of the ASME Code 1989 edition with no addenda.
>
> ASME Code editions and addenda other than those in Tables 1.8-21 and 3.2-3 will not be used to design ASME Code Class 1, 2 and 3 pressure retaining components and supports.

3.9.3.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is in NUREG–1503.

In accordance with Section VIII, "Processes for Changes and Departures" of "Appendix A to Part 52--Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies Tier 1 and Tier 2 departures. Tier 1 departures require prior NRC approval and are subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.A.4. Tier 2 departures not requiring prior NRC approval are subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.B.5, which are similar to the requirements in 10 CFR 50.59.

The regulatory basis for reviewing the COL license information items is in Section 3.9.3 of NUREG–0800. The applicable regulatory requirements for the ASME Code Class 1, 2, and 3 components, component supports, and core support structures are as follows:

- 10 CFR 50.55a; and GDC 1, 2, 4, 14, and 15.

3.9.3.4 *Technical Evaluation*

As documented in NUREG–1503, NRC staff reviewed and approved Section 3.9.3 of the certified ABWR DCD. The staff reviewed Section 3.9.3 of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this section.

The staff reviewed the information in the COL FSAR:

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3, for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

Tier 1 Departure

- STD DEP T1 2.4-3 RCIC Turbine/Pump

NRC staff reviewed STD DEP T1 2.4-3 related to combining the RCIC turbine and RCIC pump into a single-assembly unit. The RCIC turbine-pump assembly will be constructed in accordance with the requirements of ASME Code Section III for Class 2 components, which is consistent with the information in Revision 2 of FSAR Figure 2.4.4a.

According to ASME Section III NCA, Section 9200, the term construction is defined as:

> *Construction (as used in Division 1)*. An all-inclusive term comprising materials, design, fabrication, examination, testing, inspection, and certification required in the manufacture and installation of an item.

Based on the ASME Code definition of "construction," the staff concluded that the RCIC turbine and pump assembly will be designed, manufactured, and installed as an ASME Section III, Class 2 component. In addition, the applicant is committed to test and qualify the complete turbine-pump assembly via dynamic testing, in accordance with IEEE Std-344. Therefore, revisions to STP FSAR Subsections 3.9.3.1.8, 3.9.3.1.9, 3.9.3.2.1.5, 3.9.3.2.2, and 3.9.3.4.4 as part of STD DEP T1 2.4.3 are acceptable. This departure and the review of additional changes made in the departure are discussed in Subsection 5.4.6.4 of this SER.

Tier 2 Departure Not Requiring Prior NRC Approval

- STD DEP 6C-1 Containment Debris Protection for ECCS Strainers

Although the applicant identifies Tier 2 Departure STD DEP 6C-1 as not requiring prior NRC approval, NRC staff found it necessary to evaluate the departure within the scope of conformance with RG 1.82 Revision 3, because the applicant has voluntarily committed to conform to this guidance. In STP Units 3 and 4 COL FSAR Revision 2, Appendix 6C states that the ABWR design commits to the guidance in RG 1.82 and to the "Utility Resolution Guidance for ECCS Suction Strainer Blockage," in NEDO–32686-A. However, the information in the application is not sufficient for the staff to confirm that STP Units 3 and 4 ECCS debris strainers meet the above guidance and GSI-191. Therefore, the staff issued **RAI 06.02.02-23** (eRAI 4116) requesting the applicant to submit a calculation report on sizing the suppression pool recirculation suction debris strainers and related reference so that the ECCS strainers can be designed to withstand these loads. In the response to this RAI dated January 13, 2010, (STPNOC Letter U7-C-STP-NRC-100007, ML100141735) the applicant refers to an analysis of these loads for the cassette-type strainer (that will be used on STP Units 3 and 4), which includes a referenced Japanese ABWR (RJABWR). In reviewing the applicant's response, the staff found references to stress reports associated with the ECCS strainers. The staff found that the documents incompletely address the concerns of GSI-191and RG-1.82. Therefore, the staff issued **RAI 03.09.03-5** (eRAI 4555) requesting the applicant to provide the following information:

- Design and Service Level A–D loads and load combinations, including seismic with hydrodynamic of sloshing effect.
- The principal construction code of the strainer design.
- The pressure load on the strainer from SRV (sparger) discharge and the basis for using this pressure load.
- The classification of the strainer and its supports.

In the response to the first part of the **RAI 03.09.03-5** dated May 3, 2010, (ML101250475), the applicant states that the load combinations for the RJABWR are described in Section 5.5 of each proprietary structural analysis report made available for NRC to review, as noted in the response to **RAI 06.02.02-23** dated January 13, 2010 (ML100141735). The load combinations for STP Units 3 and 4 will be the same as those shown in DCD Tier 2 Table 3.9-2. The load combinations evaluated for the RJABWR do not match the load combinations required to be evaluated in Table 3.9-2 of the DCD. This load combination is similar to "Plant Event 8," with the load combination of normal (N) plus a large-break LOCA (LBL) plus a safe-shutdown earthquake (SSE). The RJABWR stress report confirmed that the load combination N plus LBL meets Service Level C stress allowable values (1.5S for the membrane and 1.8S for the membrane + bending), without the SSE loading. The DCD requires this load combination plus the SSE to meet the Service Level D stress allowable values (2.0S for the membrane and 2.4S for the membrane + bending). It is likely that the STP Units 3 and 4 calculated loads will be within the allowable ASME limits for Service Level D due to the significant margin between the calculated RJABWR stresses versus the ASME allowable stresses (at least 95 MPa). This RJABWR load analysis provides reasonable assurance that the STP Units 3 and 4 strainers will meet ASME Code requirements for the load combinations in Table 3.9-2. If ASME stresses are not met, the specific structural element or member will be strengthened. Regarding the seismic sloshing loads, the suction strainers are fully submerged during seismic events, so the sloshing loads are not applicable.

The staff reviewed the response to the first part of the RAI and found that the RJABWR stress report does not demonstrate that the load combinations of the strainer analysis meet the Service Level D stress allowable values, as stated in ABWR DCD Subsections 3.9.1.1 and 3.9.1.4.

ABWR DCD Subsection 3.9.1.1 states that the plant operating conditions defined in Subsection 3.9.3.1.1 are identified as normal, upset, emergency, faulted, or testing. Appropriate Service Levels (A, B, C, D, or testing) defined in ASME Code Section III are designated as design limits. The design and analysis of safety-related piping and equipment using the specific applicable thermal-hydraulic transients, which are derived from the system behavior during the events listed in Table 3.9-1, are documented in the design specification and/or stress report of the respective equipment. Table 3.9-2 shows the loading combinations and the standard acceptance criteria.

ABWR DCD Subsection 3.9.1.4 requires all Seismic Category I equipment to be evaluated for the faulted (Service Level D) loading conditions identified in Tables 3.9-1 and 3.9-2. In all cases, the calculated actual stresses are required to be within the allowable Service Level D limits. Deformations under faulted conditions are required to be evaluated in critical areas, and the necessary design deformation limits (e.g., as clearance limits) have to be satisfied.

The staff found that the applicant's response to the first part of the RAI fails to meet the DCD Therefore, the staff issued supplemental **RAI 03.09.03-7 (eRAI 4794)**.

In addition, in the response to the first part of the RAI, the applicant states that the suction strainers are fully submerged during seismic events, so sloshing loads are not applicable.

The staff concurred that the sloshing loads are not applicable for the strainers, because the suction strainers are fully submerged during seismic events.

The applicant's response to the second part of the **RAI 03.09.03-5** states that the RJABWR was designed and evaluated in accordance with the Japanese Society of Mechanical Engineers (JSME) Code. The application of this code is conservative compared with the ASME Boiler and Pressure Vessel Code to be applied to STP Units 3 and 4, as shown in the STP Units 3 and 4 COL application, Part 2 Tier 2 Table 1.8-21a. This difference is due to the lower material property limits (e.g., tensile strength, yield strength, and allowable stress) and lower allowable stress level limits (membrane stress, local membrane stress, and membrane plus bending stress), which are applied in the JSME Code compared with the ASME Code. The three types of austenitic stainless steels used to construct the STP Units 3 and 4 cassette-type strainers (Types 304 plate, 304L plate, and SA-193 Gr. 8 bolts) were evaluated using material stress/strength properties that are lower (more conservative) than the properties specified in the ASME Code.

The staff reviewed the applicant's response to the second part of the RAI and found that the RJABWR stress report does not meet ABWR DCD Section 5.2.1 requirements specifying that the ASME Code will be used to design, fabricate, and construct the ABWR components. Therefore, this part of the response is not acceptable. The staff requested additional information in supplemental **RAI 03.09.03-7**.

The applicant's response to the third part of the **RAI 03.09.03-5** states that the pressure load on the strainer as a result of the SRV discharge in the RJABWR was based on the jointly developed ABWR test program, which is described in DCD Tier 2 Section 3B—including References 3B-1, 3B-2, 3B-3, 3B-4, 3B-11, and 3B-13. The STP Units 3 and 4 SRV loadings will be calculated in accordance with the same methodology. These loads will be finalized in 2010.

The staff reviewed the response to the third part of the question and found that the applicant does not completely address the pressure difference across the strainer that is affected by the SRV discharge during the LOCA condition. Based on the failure to address the pressure difference, the staff found the response unacceptable. The staff requested additional information in supplemental **RAI 03.09.03-7**.

The applicant's response to the fourth part of the **RAI 03.09.03-5** states that the strainer and its supports were evaluated using ASME Code Class 2 acceptance criteria for membrane, local membrane, and membrane plus bending stresses. This is conservative as this Code Class is generally applied only to pressure-retaining vessels, which is not the case for the cassette strainers.

The staff reviewed the response to the fourth part of the question and found that the strainer and its supports were evaluated using ASME Code Class 2 acceptance criteria. Therefore, this response is acceptable.

The resolutions of the applicant's responses to the supplemental questions asked under **RAI 03.09.03-7** are being tracked as **Open Item 03.09.03-7**.

COL License Information Item

- COL License Information Item 3.28 ASME Class 2 and 3 or Quality Group D Components with 60-Year Life

The applicant adds a supplement in FSAR Subsection 3.9.7.2 to address COL License Information Item 3.28. The applicant commits (COM 3.9-2) to identify and perform an appropriate analysis of the ASME Class 2 and 3 or Quality Group D components that are subjected to cyclic loadings, including operating vibration loads and thermal transients effects, of a magnitude and/or duration so severe that the 60-year design life cannot be assured by required Code calculations, or if similar designs have not already been evaluated to demonstrate the required design life or designs to mitigate the magnitude or duration of the cyclic loads. The list and analyses of these ASME Class 2 and 3 or Quality Group D components will be available for review before fuel loading, (i.e., during reviews of final component design reports [ITAAC]).

The staff reviewed the applicant's commitment and found it to be in accordance with the requirements of SRP Section 3.9.3. The applicant will perform fatigue evaluations for all ASME Class 2 and 3 components, component supports, and core support structures that are subject to thermal cyclic effects or dynamic cyclic loads as specified in SRP Section 3.9.3 Appendix A, Section 4.A. In addition, as required by SRP Section 3.9.3, the applicant will perform fatigue evaluations to demonstrate that the components can withstand vibration loads and transient thermal effects for the 60-year design life of the plant. This evaluation is required to be referenced in the ASME Design Report. The staff will have the opportunity to review the scope, methods, and results of the fatigue evaluations to demonstrate the required 60-year design life or designs to mitigate the magnitude or duration of the cyclic loads in the ITAAC added to allow review of component design reports to address COL License Information Item 3.30. Therefore, the proposed supplement in FSAR Subsection 3.9.7.2 to address COL License Information Item 3.28 is acceptable.

- COL License Information Item 3.30 Audit of Design Specification and Design Reports

To comply with the requirement in Subsection 3.9.7.4 of the ABWR DCD, Revision 4, the applicant has stated that the design specifications and design reports required by the ASME Code for vessels, pumps, valves, and piping systems for the purpose of an audit will be made available for NRC review. However, the applicant has not provided a schedule for when these design specifications and reports will be available for NRC staff to review. Therefore, the staff issued **RAI 03.09.03-1 (eRAI 2265)** requesting the applicant to provide a schedule as to when the staff can audit the following:

1. Design specifications for all risk-significant ASME Class 1, 2, and 3 components.
2. Design reports for all risk-significant ASME Class 1, 2, and 3 components.

In the response to this RAI dated April 14, 2009, (ML091060501) the applicant states that Table 1 contains a list of safety-related, risk-significant, ASME Class 1, 2, and 3 mechanical components. This list was developed based on information in FSAR Table 3.2-1, "Classification Summary," and Tables 19K-1 through 19K-4 in Appendix 19K, "PRA Based Reliability and Maintenance." Table 1 also contains the current best estimate of the scheduled completion dates (calendar quarter) for the associated ASME Design Specifications and Design Reports ready for NRC to audit (from Q2-09 to Q4-11). These dates also represent the schedule for the design specifications to be ready for submittal to vendors for bidding, and the corresponding

design reports to be accepted by the owner. However, with some of these completion dates, the audit will not be completed before the safety review of this section is completed (currently scheduled for November 2010). Verification that the applicant's Design Specifications meet the regulations, descriptions, and acceptance criteria in the DCD is required to make the safety determination for this area of review. In addition, the staff reviewed the Table 1 list of risk-significant items and found that Table 1 does not include the pressure vessel design and the control rod drive mechanism in the list of risk-significant components to be audited. Therefore, the staff concluded the applicant's response to **RAI 03.09.03-1** is not acceptable. **RAI 03.09.03-1** is supplemented by **RAI 03.09.03-3 (eRAI 3093)** and subsequently, by **RAI 03.09.03-4 (eRAI 3689)**. **RAI 03.09.03-1** is closed.

In **RAI 03.09.03-3 (eRAI 3093)**, the staff requested the applicant to provide the following:

1. Modify the schedule for risk-significant design specifications so that all risk-significant component design specifications are completed early enough to support an audit during the COL application review.

2. Add the pressure vessel, reactor internals, and control rod drive mechanism to the list of risk-significant components to be audited. The design specifications will need to be completed during the COL application review.

3. Either provide a schedule for the risk-significant component design reports that will support the review or provide an alternative, as discussed in RG 1.206 Section C.III.4.3. ITAAC were used to address this situation in another design.

In the response to this RAI dated July 27, 2009, (ML092100215) the applicant states that the development of ASME Design Specifications and Design Reports for piping systems is the subject of a Design Acceptance Criterion (DAC) in ABWR ITAAC # 3.3.1. The DAC is incorporated by reference in the STP COL application, and the expectation is that the primary purpose of an audit will be to support the eventual closure of the DAC. For the purpose of facilitating the staff's audit of design specifications for risk-significant ASME Class 1, 2, and 3 components, as requested in Item 1, the current schedule shows that the design specifications for the risk-significant ASME Class 1, 2, and 3 components listed in Table 1 of the RAI response will be completed before the end of the second quarter of 2010. The dates associated with each component in Table 1 of the RAI response represent the current dates from the integrated project schedule and are subject to possible future adjustments. As part of the applicant's periodic issuance of the project schedule to the NRC, the NRC will be kept informed of any changes. The proposed schedule should support the NRC audit of the design specifications before the end of the COL review. This will provide the staff with confidence that the design specifications contain sufficient detail to provide a complete basis for the construction of these components, as required by the ASME Code. The staff found this response unacceptable and issued **RAI 03.09.03-6 (eRAI 4793)** requesting the applicant to make a list of design specification available for the audit and the schedule of the audit to support the public milestone schedule for the COL review. Therefore, Item 1 of **RAI 03.09.03-6** is being tracked as **Open Item 03.09.03-6** until the audit of the design specification is successfully completed.

As requested above in Item 2, the reactor pressure vessel, reactor internals, and control rod drives were added to the list of risk-significant ASME Code Class 1, 2, and 3 components in Table 1 of the RAI response. The staff found this acceptable.

With regard to Item 3, the applicant states that the production schedule of design reports is substantially dependent on the placement of orders for components, in relation to the need to support the schedule for plant construction. Many of the design reports are not anticipated to be completed before the end of the COL review. Therefore, to better facilitate the staff's audit of design reports for risk-significant ASME Class 1, 2, and 3 components, and in accordance with Option 1 of R.G. 1.206 Section C.III.4.3, the specific schedule information for when those design reports will be completed is in Table 1 of the RAI response, in relation to their governing ITAAC. Inclusion of the subject design reports in the ITAAC schedule that is periodically provided to the staff will allow for the coordination of audits with the completion of the ITAAC. The design reports shall be available for audit at least 12 months before the system functional arrangement ITAAC closure. The staff found this response unacceptable and Item 3 in **RAI 03.09.03-3** is supplemented by **RAI 03.09.03-4 (eRAI 3689)**.

In **RAI 03.09.03-4 (eRAI 3689)**, the staff provided the following discussion:

As called for in COL License Information Item 3.30, "Audit of Design Specification and Design Report," the design specifications will be made available for audit during the technical review period. The staff will schedule an audit to conduct the review. However, the COL license item also required the design reports to be made available. In Table 1 of response Document U7-C-STP-NRC-090085, the applicant estimates the availability dates of the design reports for the NRC to audit from Q2-10 to Q4-13. The estimated dates occur after the technical review is scheduled to be complete, so the reports will not be available for the staff to review during the license review. In addition, staff will not be able to take them into account when making the safety determination for the license.

10 CFR Part 52 Appendix A, Section IV.A.2.e requires the applicant to provide information to address the COL license information items. 10 CFR 52.79 (d)(3), requires that the FSAR demonstrate that all requirements and restrictions set forth in the referenced design certification rule be satisfied by the date of issuance of the combined license. The COL License Information Item 3.30 requires that design specification and reports be made available for the NRC to audit. The audit is needed to verify that the methodologies in the DCD were followed and that the regulations were met. RG 1.206 Section C.III.4.3 provides guidance for COL license information items that cannot be resolved before the issuance of the license. This same issue was successfully addressed for another application through the addition of an ITAAC, which allowed for the verification that the design reports met the ASME Code and regulations.

In the response to **RAI 03.09.03-4 (eRAI 3689)** dated October 21, 2009, (ML092960451) and the revised response dated December 30, 2009, (ML100050185) the applicant states that a new site-specific ITAAC (RG 1.206, C.III.4.3 Option 2) will be added in the COL application, Part 9, to provide a specific post-COL requirement for verifying the design reports for the ASME Class 1, 2, and 3 components. COL application Part 9, Section 3.0 will be revised in a future revision to incorporate the new site-specific ITAAC. The staff reviewed the responses to **RAIs 03.09.03-3 (eRAI 3093) and 03.09.03-4 (eRAI 3689).** The staff found the responses acceptable because the design reports will be reviewed through an ITAAC, and the staff will be notified when the design reports are available. The resolution of **RAI 03.09.03-4** is being tracked as **Confirmatory Item 03.09.03-4** until the COL FSAR is updated and issued to the NRC.

In addition to the auditing of design specifications and design reports, COL License Information Item 3.30 (Section 3.9.7.4 of the ABWR DCD) also has a requirement that the COL applicant shall ensure that the piping system design is consistent with construction practices of the ASME

Code edition and addenda, including the inspection and examination methods, as endorsed in 10 CFR 50.55a at the time of the application. The COL applicant has committed to use the ASME Code 1989 edition, with no addenda for this activity. This is consistent with DCD Tier 2 Tables 1.8-21 and 3.2-3, which require the ASME Code 1989 edition with no addenda to be used for the piping design. The COL applicant has not elected to use the ASME Code editions and addenda, other than those listed in Tables 1.8-21 and 3.2-3 for the design of pressure-retaining components and supports. Therefore, as required by Subsection 3.9.7.4 of the ABWR DCD, the applicant has not identified the applicable portions of the ASME Code editions and addenda for NRC review and approval in the COL application. Detailed evaluation of the ASME Code edition is in Subsection 5.2.1.1 of this SER.

Based on the above information and the need to conduct an audit to resolve Open Item 03.09.03-6, the staff determined that the COL applicant has not adequately addressed COL License Information Item 3.30.

3.9.3.5 *Post Combined License Activities*

The applicant identifies the following commitments:

- Commitment (COM 3.9-2) - Perform fatigue evaluations for all ASME Class 2 and 3 components, component supports, and core support structures that are subject to thermal cyclic effects or dynamic cyclic loads.

- The applicant will provide the ASME Code design report for audit as described in ITAAC Table 3.0-13

3.9.3.6 *Conclusion*

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to the ASME Code Class 1, 2, and 3 components, component supports, and core support structures.

However, as a result of **open and confirmatory items**, the staff was unable to finalize the conclusions relating to the ASME Code Class 1, 2, and 3 components, component supports, and core support structures in accordance with the NRC requirements.

3.9.4 Control Rod Drive (CRD) (Related to RG 1.206, Section 3.9.4, "Control Rod Drive Systems")

This section of the FSAR addresses the design of the control rod drive system (CRDS) up to its interface with the control rods. Those components of the CRDS that are part of the primary pressure boundary are classified as Seismic Category I, quality group (QG) A and are designed according to ASME Code Section III Class 1 requirements and the QA requirements of 10 CFR Part 50, Appendix B.

The CRDS in the ABWR design consists of fine motion CRD mechanisms and the CRD hydraulic system. The CRDS will be capable of reliably controlling reactivity changes either under conditions of anticipated normal plant operational occurrences or under postulated accident conditions.

Section 3.9.4 of the STP COL FSAR incorporates by reference, with no departures or supplements, Section 3.9.4, "Control Rod Drive (CRD)," of the certified ABWR DCD, Revision 4, which is referenced in 10 CFR Part 52, Appendix A. NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remains for review.[1] The staff's review confirmed that there is no outstanding issue related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52 Appendix A Section VI.B.1, all nuclear safety issues relating to the Control Rod Drive have been resolved.

3.9.5 Reactor Pressure Vessel Internals

3.9.5.1 *Introduction*

This section of the FSAR addresses the structural and functional integrity of the major reactor pressure vessel (RPV) internals, including core support structures. Certain reactor internals support the core and safety-related instrumentation. Other RPV internals direct coolant flow, separate steam, hold material surveillance specimens, and support instrumentation utilized for plant operation.

The section also includes the load combinations, allowable stress and deformation limits, and other criteria used in the design of the reactor internals.

3.9.5.2 *Summary of Application*

Section 3.9.5 of the STP Units 3 and 4 COL FSAR incorporates by reference Section 3.9.5 of the certified ABWR DCD, Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 3.9.5, the applicant provides the following:

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- STD DEP 3.9-1 Reactor Internal Materials

This departure specifies that there are two levels of incore guide tube stabilizers. The upper stabilizer is welded to the shroud, made from stainless steel. The lower stabilizer is welded to the shroud support, made from Ni-Cr-Fe alloy. The material of the stabilizers needs to be the same or similar material as the components to be welded in order to minimize differential thermal expansion. Therefore, the upper stabilizer needs to be stainless steel and the lower stabilizer needs to be Ni-Cr-Fe Alloy.

3.9.5.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is in NUREG–1503. In addition, the relevant requirements of the Commission's regulations for the RPV internals, and the associated acceptance criteria, are in Section 3.9.5 of NUREG–0800.

In accordance with Section VIII, "Processes and Changes and Departures," of, "Appendix A to Part 52--Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies a Tier 2 departure. This departure is subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.B.5, which are similar to the requirements in 10 CFR 50.59.

[1] See "Finality of Referenced NRC Approvals" in SER Section 1.1.3 for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

3.9.5.4 *Technical Evaluation*

As documented in NUREG–1503, NRC staff reviewed and approved Section 3.9.5 of the certified ABWR DCD. The staff reviewed Section 3.9.5 of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this section.

The staff reviewed the information in the COL FSAR:

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- STD DEP 3.9-1 Reactor Internal Materials

ABWR DCD Subsection 3.9.5.1.2.9 states that two levels of stainless steel stabilizer lattice work of clamps, tie bars, and spacers give lateral support and rigidity to the guide tubes. In STP Units 3 and 4 COL FSAR Subsection 3.9.5.1.2.9, "Incore Guide Tubes and Stabilizers," the applicant has revised the referenced DCD text to remove stainless steel as the material for both levels of incore guide tube stabilizers. In STP COL Part 7 "Departures Report," Section 3, the applicant indicates that the purpose of STD DEP 3.9-1 is to specify that there are two levels of incore guide tube stabilizers made from different materials. The applicant also states that the material of the stabilizer needs to be the same as or similar to the component to be welded in order to minimize thermal expansion. Therefore, the lower stabilizer welded to the shroud support (Ni-Cr-Fe alloy) is made from Ni-Cr-Fe; the upper stabilizer welded to the shroud (stainless steel) is made from stainless steel. The materials used to fabricate the shroud and shroud support are similar to those proposed for the two levels of incore guide tube stabilizers. STP COL FSAR Section 4.5.2.1 states that the shroud support is fabricated from Ni-Cr-Fe Alloy 600 and the shroud is fabricated from stainless steel. On this basis, NRC staff found that STD DEP 3.9-1 is acceptable. The staff's review of the reactor internal and core support structure materials, including the shroud and shroud support materials, is in SER Section 4.5.2.

The applicant's evaluation determined that this departure does not require prior NRC approval, in accordance with 10 CFR Part 52 Appendix A, Section VIII.B.5. Within the review scope of this section, the staff found it reasonable that this departure does not require prior NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

3.9.5.5 *Post Combined License Activities*

There are no post COL activities related to this section.

3.9.5.6 *Conclusion*

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. The staff reviewed the application and checked the referenced DCD. The staff's review

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3, for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

confirmed that the applicant has addressed the required information, and no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52 Appendix A, Section VI.B.1, all nuclear safety issues relating to the RPV internals that were incorporated by reference have been resolved.

The staff compared the information in the application to the relevant NRC regulations; the acceptance criteria in NUREG–0800, Section 3.9.5; and to other NRC regulatory guides. The staff found it reasonable that the identified Tier 2 departure is characterized as not requiring prior NRC approval, per 10 CFR Part 52, Appendix A, Section VIII.B.5.

3.9.6 Testing of Pumps and Valves [Related To RG 1.206, Section 3.9.6, "Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints"]

3.9.6.1 *Introduction*

This section of the FSAR describes the following programs:

- Functional design and qualification of pumps, valves, and dynamic restraints
- Inservice testing (IST) operational program for pumps, valves and dynamic restrains, and
- Motor operated valve (MOV) testing operational program.

3.9.6.2 *Summary of Application*

Section 3.9.6 of the STP Units 3 and 4 COL FSAR incorporates by reference Section 3.9.6 of the certified ABWR DCD Revision 4, referenced in 10 CFR Part 52, Appendix A.

In addition, on March 31, 2010, the applicant submitted a proposed revision to the STP FSAR that will modify Section 3.9 of ABWR DCD Tier 2 with respect to the functional design, qualification, and IST programs for pumps, valves, and dynamic restraints to be used at STP Units 3 and 4. Specifically, the modified sections include Section 3.9.2, "Dynamic Testing and Analysis"; Section 3.9.3, "ASME Code Class 1, 2, and 3 Components, Component Supports, and Core Support Structures"; Section 3.9.6, "Testing of Pumps and Valves"; and Section 3.9.8, "References."

ABWR DCD Tier 2 Subsection 3.9.3.2, "Pump and Valve Operability Assurance," describes the design for and qualification of active ASME *Boiler and Pressure Vessel Code* (BPV Code) Section III pumps and valves. For example, in ABWR DCD Tier 2, Subsection 3.9.3.2 specifies that safety-related valves and pumps are qualified by testing, by analysis, and by satisfying the stress and deformation criteria at critical locations within the pumps and valves. ABWR DCD Tier 2 Subsection 3.9.3.4, "Component Supports," includes provisions for design specifications that are applicable to dynamic restraints. ABWR DCD Tier 2, Section 3.9.6 includes additional provisions for the design and qualification of pumps and valves. The planned STP FSAR revision will modify ABWR DCD Tier 2 Section 3.9.3 to specify the use of ASME Standard QME-1-2007, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants." The planned STP revision will also modify ABWR DCD Tier 2, Subsection 3.9.3.4 to describe the IST Program for dynamic restraints (snubbers) to be used at STP Units 3 and 4.

Section 3.9.6 of ABWR DCD Tier 2 specifies that IST of safety-related pumps and valves will be performed in accordance with the requirements of the ASME/ANSI OMa-1988 Addenda to

ASME/ANSI OM-1987 (Parts 1, 6, and 10). The planned STP FSAR revision will modify ABWR DCD Tier 2, Subsection 3.9.6 to describe the IST Program to be developed for STP Units 3 and 4. For example, the planned STP FSAR revision will specify that the IST Program will be based on the 2004 Edition to the ASME *Code for Operation and Maintenance of Nuclear Power Plants* (OM Code). The planned STP FSAR revision will provide a description of the IST Program for pumps and valves to be developed for STP Units 3 and 4, as required by the NRC regulations and the ASME OM Code.

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- STD DEP Admin

The applicant references Chapter 16, "Surveillance Requirement," Subsection 3.4.4.1 for performing periodic leak testing of the reactor coolant pressure isolation valves.

COL License Information Items

- COL License Information Item 3.29 Pump and Valve Testing Program

STP FSAR Subsection 3.9.7.3, "Pump and Valve Testing Program," indicates that the plant-specific environmental parameters for the Equipment Qualification Program will be available for NRC review as part of the ITAAC for the basic configuration of systems, as provided in ABWR DCD Tier 1, Section 1.2, "General Provisions."

STP FSAR Subsection 3.9.7.3 specifies that the pump and valve IST and Inspection Programs will be provided to the NRC as indicated in FSAR Section 13.4S, "Operational Program Implementation." FSAR Section 13.4S indicates that descriptions of operational programs, consistent with the definition of "fully described" in the Staff Requirements Memorandum (SRM) dated February 22, 2006, for Commission Paper SECY-05-0197, are in the FSAR sections listed in Table 13.4S-1, "Operational Programs Required by NRC Regulation and Program Implementation." FSAR Sections 3.9.6 and 5.2.4, "Preservice and Inservice Inspection and Testing of Reactor Coolant Pressure Boundary," are specified in the table for the IST Program with an implementation milestone of "after generator on line on nuclear heat." FSAR Section 3.9.6 is specified in the table for the MOV Testing Program with an implementation milestone of fuel loading.

STP FSAR Subsection 3.9.7.3 indicates that the design qualification testing, inspection, and analysis criteria in ABWR DCD Tier 2 Subsection 3.9.6.1, "Testing of Safety-Related Pumps"; Subsection 3.9.6.2.1, "Check Valves,;" Subsection 3.9.6.2.2, "Motor-Operated Valves"; and Subsection 3.9.6.2.3, "Power Operated Valves"; will be included in the respective safety-related pump and valve design specifications before fuel loading as commitment COM 3.9-3. STP FSAR Subsection 3.9.7.3 also indicates that the design, qualification, and preoperational testing for MOVs will conform to the provisions in ABWR DCD Tier 2, Subsection 3.9.6.2.2, as COM 3.9-4.

STP FSAR Subsection 3.9.7.3 indicates that ISTs to verify the operational readiness of pumps and valves—whose function is required for safety—will be conducted during the initial 120-month interval and must comply with the requirements in the latest edition and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b), on the date 12 months before the date of issuance of the operating license or the optional ASME Code cases listed in RG 1.192, "Operation and Maintenance Code Case Acceptability, ASME OM Code," which is incorporated

by reference in 10 CFR 50.55a(b), and is subject to the limitations and modifications listed in 10 CFR 50.55a(b). STP FSAR Subsection 3.9.7.3 also notes that ISTs for verifing the operational readiness of pumps and valves—whose function is required for safety—will be conducted during successive 120-month intervals and must comply with the requirements of the latest edition and addenda of the Code incorporated by reference in 10 CFR 50.55a(b) 12 months before the start of the 120-month interval or the optional ASME Code cases listed in RG 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," through Revision 14 or RG 1.192, which are incorporated by reference in 10 CFR 50.55a(b) and are subject to the limitations and modifications listed in 10 CFR 50.55a(b).

STP FSAR Subsection 3.9.7.3 indicates that the safety-relief valve (SRV) IST requirements are included in Table 3.9-8 and additional SRV testing, including Technical Specification testing, is described in Subsection 5.2.2.10, "Inspection and Testing," in ABWR DCD Tier 2 and the STP FSAR.

In Attachment 3 to the COL application, the applicant states that the milestone for COM 3.9-3 (COL License Information Item 3.29) is summarized as the Pump and Valve IST Program and will be completed and available for review before fuel loading. Attachment 3 to the STP COL application also indicates that the milestone for COM 3.9-4 (COL License Information Item 3.29) is summarized as the design, qualification, and preoperational testing of MOVs and will be completed and available for review before fuel loading.

- COL License Information Item 3.30 Audit of Design Specification and Design Reports

ABWR DCD Tier 2, Subsection 3.9.7.4, "Audit of Design Specification and Design Reports," specifies that COL applicants will make the design specifications and design reports available for NRC staff to audit. STP FSAR Subsection 3.9.7.4 of the same title notes that design specifications and design reports required by the ASME Code for vessels, pumps, valves, and piping systems will be made available for NRC review.

3.9.6.3 *Regulatory Basis*

The relevant requirements and the associated acceptance criteria for reviewing the COL license information items are listed in Section 3.9.6 of NUREG–0800.

In accordance with Section VIII, "Processes for Changes and Departures," of "Appendix A to Part 52--Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies one Tier 2 departure not requiring prior NRC approval. This departure is subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.B.5, which are similar to the requirements in 10 CFR 50.59.

The regulatory basis for NRC staff review of the STP FSAR is provided by 10 CFR Parts 50 and 52. Specifically, the NRC regulations in 10 CFR 52.79(a)(11) require that a COL application provide a description of the programs and their implementation necessary to ensure that the systems and components meet the requirements of the ASME BPV Code and the ASME OM Code in accordance with 10 CFR 50.55a. The General Design Criteria (GDC) in Appendix A to 10 CFR Part 50 establish the necessary design, fabrication, construction, testing, and performance requirements for structures, systems, and components that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public.

In RG 1.206, “Combined License Applications for Nuclear Power Plants,” the NRC staff provides guidance for a COL applicant in preparing and submitting its COL application in accordance with the NRC regulations. For example, Section C.IV.4, “Operational Programs,” in RG 1.206 discusses the requirement in 10 CFR 52.79(a) for descriptions of operational programs that need to be included in the FSAR for a COL application to allow a reasonable assurance finding of acceptability. In particular, a COL applicant should fully describe the IST, MOV Testing, and other operational programs as defined in Commission Paper SECY-05-197 to avoid the need for ITAAC for the implementation of those programs. The term “fully described” for an operational program should be understood to mean that the program is clearly and sufficiently described in terms for scope and level of detail to allow a reasonable assurance finding of acceptability. Further, operational programs should be described at a functional level and an increasing level of detail where implementation choices could materially and negatively affect the program effectiveness and acceptability. The Commission approved the use of a license condition for operational program implementation milestones that are fully described or referenced in the FSAR as discussed in the SRM for SECY-05-0197.

The NRC staff followed NUREG-0800 Standard Review Plan (SRP) Section 3.9.6, “Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints,” in its review of the STP COL application. The staff also compared the STP FSAR information with the guidance provided in RG 1.206.

3.9.6.4 *Technical Evaluation*

The staff reviewed the STP COL application and the applicable sections of the ABWR DCD incorporated by reference in the STP FSAR, for the Functional Design, Qualification, and IST Programs for safety-related pumps, valves, and dynamic restraints to determine whether the STP COL application meets the NRC regulatory requirements to provide reasonable assurance that the applicable safety-related components at STP Units 3 and 4 will be capable of performing their safety functions. The staff will not be able to reach a finding that the STP COL application with the ABWR DCD incorporated by reference contains an acceptable description of the Functional Design, Qualification, and IST Programs—including the MOV Testing Program—for STP Units 3 and 4 that provides reasonable assurance that pumps, valves, and dynamic restraints within the scope of the STP IST Program will be capable of performing their safety functions in accordance with the NRC regulations, until the resolution of the open and confirmatory items discussed in this SER section.

In ABWR DCD Tier 2, Subsection 3.9.3.2 describes the design and qualification of active ASME BPV Code Section III pumps and valves. For example, ABWR DCD Tier 2 Subsection 3.9.3.2 specifies that safety-related valves and pumps are qualified by testing, by analysis, and by satisfying the stress and deformation criteria at the critical locations within the pumps and valves. ABWR DCD Tier 2, Subsection 3.9.3.4 includes provisions for design specifications applicable to dynamic restraints. ABWR DCD Tier 2, Subsection 3.9.6 includes additional provisions for the design and qualification of pumps and valves. For example, ABWR DCD Tier 2 Subsection 3.9.6.1 specifies that the COL applicant will establish design and qualification requirements and will provide acceptance criteria for these requirements. The staff issued **RAI 03.09.06-1 (eRAI 2899–Question 11668)** requesting the applicant to describe the implementation of the functional design and qualification process specified in the ABWR DCD for pumps, valves, and dynamic restraints to be used at STP Units 3 and 4. As part of this information, the staff requested the applicant to discuss the incorporation of lessons learned from nuclear power plant operating experience in the functional design and qualification of plant components, such as in ASME Standard QME-1-2007, “Qualification of Active Mechanical

Equipment Used in Nuclear Power Plants." Furthermore, the staff requested the STP COL applicant to discuss the availability of design and procurement specifications for NRC's onsite review to demonstrate the implementation of the ABWR functional design and qualification process for pumps, valves, and dynamic restraints to be used at STP Units 3 and 4.

On August 17 and October 8, 2009, the applicant provided responses to the RAIs on the IST and MOV Testing Programs, including planned changes to the STP FSAR (ML092310488 and ML092870562, respectively). On November 10 and 11, 2009, the staff conducted an audit of documentation supporting the STP COL application at the Westinghouse office in Rockville, Maryland. The staff performed the audit according to the guidance in NRO Office Instruction NRO-REG-108, "Regulatory Audits." One objective of the audit is to review information that supports the description of the IST and MOV Operational Testing Programs to be developed for STP Units 3 and 4. During the audit, the staff also reviewed a sample of the design and procurement specifications to incorporate lessons learned from the plant operating experience. The results of the audit are summarized in an NRC letter dated December 7, 2009 (ADAMS Accession No. ML093220094).

As a follow-up to the audit, the applicant submitted a supplemental response to **RAI 03.09.06-1** in a letter dated January 5, 2010 (ML100080061), and a revision to that supplemental response in a letter dated March 31, 2010 (ML100920021), based on telephone discussions with the NRC staff. The March 31, 2010, submittal provides a planned revision to the STP Units 3 and 4 FSAR that includes modifications to specific sections in the ABWR DCD related to Functional Design, Qualification, and IST Programs for pumps, valves, and dynamic restraints. The staff reviewed the planned revision to the STP FSAR. The staff's discussion of individual provisions in the STP FSAR is in this SER section. The planned changes to the STP FSAR will be tracked as **Confirmatory Item 03.09.06-1.**

The NRC tracked the audit of the STP design and procurement specifications as **Open Item 03.09.06-1**. On August 2, 2010, the NRC staff conducted a follow-up audit of documentation supporting the STP COL application at the Westinghouse office in Rockville, Maryland. Based on this audit, the staff found that the design and procurement specifications had been revised in response to comments provided during the November 2009 audit. During the August 2010 audit, the staff provided comments on the revised specifications as discussed in the audit report dated September 1, 2010 (ADAMS Accession Number ML102230215). The staff finds that the planned changes to the design and procurement specifications will provide for qualification of plant components consistent with the ABWR DCD and STP FSAR requirements. Therefore, **RAI 03.09.06-1** is resolved and **Open Item 03.09.06-1** is closed. The planned revision of the design and procurement specifications will be tracked as part of **Confirmatory Item 03.09.06-1** until the revised specifications are made available for NRC staff audit.

ABWR DCD Tier 2 Section 3.9.6 specifies that IST of safety-related pumps and valves will be performed in accordance with the requirements of the ASME/ANSI OMa-1988 Addenda to ASME/ANSI OM-1987 (Parts 1, 6, and 10). The staff issued **RAI 03.09.06-2 (RAI 2899–Question 11669)** requesting the applicant to specify the edition and addenda of the ASME OM Code that is the basis for fully describing the IST Program in support of the COL application for STP Units 3 and 4. The staff also requested the applicant to indicate those instances where the applicable ASME OM Code will not be satisfied and to justify relief from or alternatives to those Code requirements. In addition, the staff requested the applicant to discuss the planned use of any code cases and their implementation consistent with RG 1.192. In the response to this RAI dated August 17, 2009 (ML092310488), the applicant indicates that the STP FSAR will be

revised to address these items. The applicant's letter dated March 31, 2010, describes the planned revision to FSAR Section 3.9.6 and states that the preservice testing (PST) and IST Programs are based on the ASME OM Code (2004 Edition). The planned revision to STP FSAR Subsection 3.9.6.9, "10 CFR 50.55a Relief Requests and Code Cases," describes the use of ASME OM Code Case OMN-1 (Revision 1), "Alternative Rules for the Preservice and Inservice Testing of Certain Electric Motor Operated Valve Assemblies in Light Water Reactor Power Plants," and ASME OM Code Case OMN-12, "Alternative Requirements for Inservice Testing Using Risk Insights for Pneumatically- and Hydraulically-Operated Valve Assemblies in Light-Water Reactor Power Plants."

The staff accepted the application of ASME OM Code Case OMN-1 (Revision 0) in RG 1.192 with certain conditions. In the planned STP FSAR revision, the applicant addresses those conditions as they apply to the requested use of ASME OM Code Case OMN-1 (Revision 1) at STP Units 3 and 4. In particular, the STP FSAR revision specifies that the IST Program will incorporate the provisions in RG 1.192 by providing that the adequacy of the diagnostic test interval for each MOV will be evaluated and adjusted as necessary, but not later than 5 years or three refueling outages (whichever is longer) from the initial implementation of the code case. The planned STP FSAR revision also states that the potential increase in core damage frequency (CDF) and risk associated with extending high-risk MOV test intervals beyond quarterly will be determined to be small and consistent with the intent of the Commission's Safety Goal and Policy Statement. This provision is also consistent with the conditions specified in RG 1.192 for the application of ASME OM Code Case OMN-11, "Risk-Informed Testing of Motor-Operated Valves," which is incorporated into Revision 1 to ASME OM Code Case OMN-1. The planned STP FSAR revision specifies that risk insights will be applied using MOV risk ranking methodologies accepted by the NRC on a plant-specific or industry-wide basis, consistent with the conditions in the applicable safety evaluations. The planned STP FSAR revision also indicates that the benefits for performing any particular test will be balanced against the potential adverse effects placed on the valve or system caused by this testing. The staff found that the provisions to be specified in the STP FSAR for the use of Revision 1 to ASME OM Code Case OMN-1 satisfy the conditions specified in RG 1.192 for the use of Revision 0 to ASME OM Code Case OMN-1. Revision 1 in ASME OM Code Case OMN-1 is viewed by the staff as continuing to provide an acceptable technical approach for MOV diagnostic testing as an alternative to quarterly MOV stroke-time testing, and the changes from Revision 0 to Revision 1 reflect improvements for user application and incorporation of ASME OM Code Case OMN-11. As a result, the staff authorized the use of ASME OM Code Case OMN-1 (Revision 1), which the applicant requested as an alternative to the quarterly MOV stroke-time testing provisions in the ASME OM Code, 2004 Edition, for STP Units 3 and 4. The proposed alternative satisfies the requirement in 10 CFR 50.55a(a)(3)(i) and will therefore provide an acceptable level of quality and safety.

The NRC staff accepted the application of ASME OM Code Case OMN-12 in RG 1.192 with certain conditions. In the planned STP FSAR revision, the applicant describes the application of Code Case OMN-12 as accepted in RG 1.192 for STP Units 3 and 4. Although the title of Code Case OMN-12 refers to the 1998 Edition of the ASME OM Code, the code case is attached to the 2004 Edition of the ASME OM Code. The planned STP FSAR revision specifies the application of each condition in RG 1.192 for the use of Code Case OMN-12. For example, the IST Program for high safety-significant valve assemblies will include a mix of static and dynamic testing. Furthermore, setpoints for low safety-significant power-operated valves (POVs) will be based on direct dynamic test information, test-based methodology, or dynamically tested valve groups. The planned STP FSAR revision also indicates that the benefits for performing any particular test will be balanced against the potential for adverse effects placed on the valve or

system caused by this testing. The staff found that the planned STP FSAR revision addresses the application of Code Case OMN-12, satisfies the conditions specified in RG 1.192, and is therefore acceptable.

The staff found that the application of the ASME OM Code (2004 Edition) and the use of ASME OM Code Cases OMN-1 and OMN-12 (and, as discussed below, ASME OM Code Case OMN-13) for the IST Program and MOV Testing Program satisfy the NRC regulations. Therefore, **RAI 03.09.06-2** is closed.

ABWR DCD Tier 2, Section 3.9.6 refers to numerous actions by the COL applicant related to the design and qualification of and Preservice and IST Programs for pumps and valves. The staff issued **RAI 03.09.06-3 (RAI 2899, Question 11670)**, which requested the applicant discuss implementation of the actions indicated in the ABWR DCD to fully describe the IST and MOV Testing Programs in support of the COL application for STP Units 3 and 4. As part of a full description of these programs, the staff requested the applicant to specify the categorization of pumps, valves, and dynamic restraints in STP Units 3 and 4 as Tier 1, Tier 2*, or Tier 2 components, as appropriate. In the response to this RAI dated August 17, 2009 (ML092310488), the applicant indicates that the IST Program will not depend on the categorization of components within the scope of the IST Program for STP Units 3 and 4. The staff noted that MOVs are categorized as Tier 2* components in 10 CFR Part 52, Appendix A, "Design Certification Rule for the U.S. Advanced Boiling Water Reactor." The planned STP FSAR revision submitted on March 31, 2010, supplements the ABWR DCD to provide a full description of the IST and MOV Testing Programs for STP Units 3 and 4, as discussed in RG 1.206, and removes references to the COL applicant's actions related to the IST and MOV Testing Programs where the revised STP FSAR addresses those actions. Therefore, **RAI 03.09.06-3** is closed. The planned STP FSAR changes will be tracked as part of **Confirmatory Item 03.09.06-1**.

ABWR DCD Tier 2, Subsection 3.9.6.1 refers to Table 3.9-8 for test parameters for IST of pumps with the criteria limits specified in the ASME Code. The staff issued **RAI 03.09.06-4 (RAI 2899–Question 11671)** requesting the applicant to fully describe the IST Program for pumps to be used at STP Units 3 and 4. The planned STP FSAR revision submitted on March 31, 2010, in Subsection 3.9.6.1 describes the IST Program for pumps based on the provisions specified in ASME OM Code, Subsection ISTB. For example, the planned STP FSAR revision describes the grouping of pumps per the ASME OM Code, the establishment of referenced values for testing each pump, and data trending and corrective actions. The staff found that the description of the IST Program for pumps to be used at STP Units 3 and 4 in the planned STP FSAR revision complies with Subsection ISTB in the ASME OM Code, 2004 Edition. Therefore, **RAI 03.09.06-4** is closed. The planned STP FSAR changes will be tracked as part of **Confirmatory Item 03.09.06-1.**

ABWR DCD Tier 2, Table 3.9-8 includes Note i1 for the RHR system fill pump, which is referred to as a summary justification for a "code exemption request" to exclude the flow measurement for this pump. The staff issued **RAI 03.09.06-5 (RAI2899–Question 11672)** requesting the applicant to discuss this "code exemption request" and its justification for STP Units 3 and 4. During the November 2009 audit, the applicant stated that the STP FSAR would be revised to update ABWR DCD Tier 2, Table 3.9-8. During the follow-up audit on August 2, 2010, the applicant stated that the revision to the IST table had not been completed. The staff will review the revised IST table in the STP FSAR when it is submitted. The submittal and review of the IST table revision will be tracked as **Open Item 03.09.06-5**.

ABWR DCD Tier 2 Subsection 3.9.6.2, “Testing of Safety-Related Valves,” discusses the testing program for check valves, MOVs, POVs other than MOVs, and isolation valves to be developed by the COL applicant. The staff issued **RAI 03.09.06-6 (RAI 2899–Question 11673)** requesting the applicant to provide information to fully describe the IST Program to be developed for STP Units 3 and 4. The planned STP FSAR revision in Section 3.9.6.2 submitted by the applicant in a letter dated March 31, 2010, describes the IST Program for valves to be used at STP Units 3 and 4 based on the provisions in Subsection ISTC in the ASME OM Code, 2004 Edition. For example, the planned STP FSAR revision describes the IST categorization of valves, the exercising of valves, the establishment of reference values for valve testing, and the prohibition of the preconditioning of valves or their actuators before IST activities. The planned STP FSAR revision also provides specific descriptions of IST activities for various valve types in individual subsections to STP FSAR Section 3.9.6.2. The staff found that the general description of the IST Program for valves in the planned STP FSAR revision complies with the provisions in Subsection ISTC in the ASME OM Code, 2004 Edition, with a discussion of specific valve provisions later in this SER section. Therefore, **RAI 03.09.06-6** is closed. The planned STP FSAR changes will be tracked as part of **Confirmatory Item 03.09.06-1**.

Note (e) in ABWR DCD Tier 2, Table 3.9-8 lists the valve test parameters of the ANSI/ASME OM Standard, Part 10. The staff issued **RAI 03.09.06-7 (RAI 2899–Question 11674)** requesting the applicant to update the reference to the applicable ASME OM Code to be used in fully describing the IST Program for STP Units 3 and 4. During the November 2009 audit, the applicant stated that the STP FSAR would be revised to update ABWR DCD Tier 2, Table 3.9-8. The staff will review the revised IST table in the STP FSAR when it is submitted. The submittal and review of the IST table revision will be tracked as **Open Item 03.09.06-5**.

Note (f) in ABWR DCD Tier 2, Table 3.9-8 lists pump or valve test exclusions, alternatives and frequency per the ASME OM Code or its Appendix I, “Inservice Testing of Pressure Relief Devices in Light-Water Reactor Nuclear Power Plants.” The staff issued **RAI 03.09.06-8 (RAI 2899–Question 11675)** requesting that the applicant to specify the applicable ASME OM Code sections for the components and their associated exclusions, alternatives, and frequencies covered in Note (f). The STP COL applicant was requested to provide appropriate justification for any relief from or alternatives to the applicable ASME OM Code sections. The STP COL applicant was also requested to indicate the justification for cold shutdown and refueling outage test intervals if not indicated in Table 3.9-8 for each applicable valve. The STP COL applicant was requested to discuss its implementation of Item E3, which is said to be an operability test every 6 months. The STP COL applicant was also requested to discuss its implementation of Item E11, which refers to the absence of required fluid inventory with a test once every 2 years. During the November 2009 audit, applicant stated that the STP FSAR would be revised to update ABWR DCD Tier 2, Table 3.9-8. The staff will review the revised FSAR IST table when it is submitted, and it is being tracked as part of **Open Item 03.09.06-5**.

Note (h) in ABWR DCD Tier 2, Table 3.9-8 lists reasons for code-defined testing exceptions, per the ANSI/ASME OM Standard, Part 10. The staff issued **RAI 03.09.06-9 (RAI 2899–Question 11676)** requesting the applicant to justify the basis for deferring IST for valves that rely on reasons h2 (avoids valve damage and impacts on power operations) and h3 (avoids impacts on power operations). The staff also requested the applicant to justify the basis for using of reason h9 (test connection size is insufficient for full flow test during operation) to defer testing. The staff noted that the temporary loss of system redundancy during an IST is covered by the limiting conditions for operations in the plant Technical Specifications and, therefore, the loss of system redundancy is not acceptable as a basis for deferring the IST of a refueling outage or cold shutdown interval. During the November 2009 audit, applicant stated

that the STP FSAR would be revised to update ABWR DCD Tier 2, Table 3.9-8. The staff will review the revised IST table in the STP FSAR when it is submitted. This issue is being tracked as part of **Open Item 03.09.06-5**.

ABWR DCD Tier 2, Subsection 3.9.6.2.1 on the IST Program for check valves includes (1) Design and Qualification, and (2) Pre-Operational Testing, which specifies parameters and acceptance criteria to be established by the COL applicant demonstrating that the functional performance requirements have been met. The staff issued **RAI 03.09.06-10 (RAI 2899–Question 11677)** requesting the applicant to discuss the implementation of those actions for STP Units 3 and 4. In the planned STP FSAR revision submitted on March 31, 2010, Subsection 3.9.6.2.1 describes the design and qualification and preoperational testing for check valves to be used at STP Units 3 and 4. For example, the planned STP FSAR revision discusses the design and qualification of check valves using the provisions of ASME Standard QME-1-2007, and references FSAR Subsection 3.9.3.2 for further details. The planned STP FSAR revision discusses the preoperational testing of check valves, including exercising in both flow directions regardless of their safety function, and the verification of check valve operation in both fully opened and closed positions. The staff found that this description of the design and qualification and preoperational testing of check valves complies with the NRC regulations and the provisions in the ASME OM Code, 2004 Edition. Therefore, **RAI 03.09.06-10** is closed. The planned STP FSAR changes will be tracked as part of **Confirmatory Item 03.09.06-1**.

ABWR DCD Tier 2, Subsection 3.9.6.2.1 provides general information on IST of check valves, including a reference to ANSI/ASME OM Standard Part 10. The staff issued **RAI 03.09.06-11 (RAI 2899–Question 11678)** requesting the applicant to fully describe the IST Program for the check valves, including ASME OM Code provisions for bi-directional testing. In the planned STP FSAR revision submitted on March 31, 2010, Subsections 3.9.6.2 and 3.9.6.2.1 describe the IST Program for check valves based on the provisions specified in the ASME OM Code, Subsection ISTC. For example, the planned STP FSAR revision specifies that check valves will be stroke tested in accordance with provisions in the ASME OM Code, Subsection ISTC. The planned STP FSAR revision also indicates that verification of the safety function for a check valve during IST will be accomplished by initiating the flow through the valve and verifying proper movement of the valve disk in the open and closed directions, in accordance with the ASME OM Code. The planned STP FSAR revision states that diagnostic equipment and nonintrusive techniques will be used to monitor check valve internal conditions when operating conditions, valve design or location, or other considerations prevent a direct observation of measurements using conventional methods. The planned STP FSAR revision also describes the possible use of mechanical exercisers, sample disassembly, or condition monitoring programs as part of IST activities for check valves at STP Units 3 and 4. The staff found that this description of the IST Program for check valves complies with the provisions in the ASME OM Code, 2004 Edition. Therefore, **RAI 03.09.06-11** is closed. The planned STP FSAR changes will be tracked as part of **Confirmatory Item 03.09.06-1**.

ABWR DCD Tier 2, Subsection 3.9.6.2.2 provides general information on IST of MOVs to be used in ABWR nuclear power plants. The staff issued **RAI 03.09.06-12 (RAI 2899–Question 11679)** requesting the applicant to fully describe the IST Program for MOVs and the MOV Testing Program to periodically verify the design-basis capability of safety-related MOVs. Subsection 3.9.6.2.2 in the planned STP FSAR revision submitted on March 31, 2010, specifies that the IST of MOVs will satisfy the ASME OM Code (2004 Edition) as required by 10 CFR 50.55a and as supplemented by 10 CFR 50.55a(b)(3)(ii). The planned STP FSAR revision indicates the use of the Joint Owners' Group (JOG) MOV Periodic Verification Program, with a reference to the NRC safety evaluation dated September 2006 and its supplement dated

September 2008. The planned STP FSAR revision also describes the use of ASME OM Code Case OMN-1 (Revision 1), as discussed earlier in this SER section. The planned STP FSAR revision states that IST of active MOVs will consist of both static and dynamic testing, and specific test frequencies will be based on the individual valve's risk ranking and functional margin in accordance with the JOG MOV Periodic Verification Program. The planned STP FSAR revision discusses the exercising frequency, the evaluation of required and available stem torque per OM Code Case OMN-1, and the consideration of uncertainties in the performance of tests and the evaluation of the data. The provisions specified for preoperational testing performance acceptance criteria including open and closed stroking, control switch setting margin incorporating uncertainties, motor output capability under degraded voltage conditions, maximum allowable torque and thrust limits, remote position indication, and minimum and maximum allowable stroke times are also applicable to IST activities. The staff found that this description of the IST and MOV Testing Programs complies with the NRC regulations for MOVs, including the ASME OM Code provisions and periodic verification of MOV design-basis capability. Therefore, **RAI 03.09.06-12** is closed. The planned STP FSAR changes will be tracked as part of **Confirmatory Item 03.09.06-1**.

ABWR DCD Tier 2, Subsection 3.9.6.2.3 provides general information on the IST Program for POVs to be used at ABWR nuclear power plants. The staff issued **RAI 03.09.06-13 (RAI 2899–Question 11680)** requesting the applicant to describe the functional qualification of POVs and the POV IST Program to be developed for STP Units 3 and 4. Subsection 3.9.6.2.3, "Power Operated Valves (Other Than Motor Operated Valves)," in the planned STP FSAR revision submitted by STP on March 31, 2010, describes the design and qualification, preoperational testing, and IST Programs for POVs to be used at STP Units 3 and 4. For example, the planned STP FSAR revision specifies that each prototype POV will be tested during the design and qualification process to demonstrate its capability under a range of differential pressure and flow conditions up to the design conditions, using the provisions of ASME Standard QME-1-2007. As part of preoperational testing, the planned STP FSAR revision indicates that each POV will be tested in the open and closed directions under static and maximum achievable conditions using diagnostic equipment that measures or provides information to determine total friction, stroke time, seat load, spring rate, and travel under normal and minimum pneumatic or hydraulic pressure (as applicable). The planned STP FSAR revision specifies parameters and acceptance criteria for demonstrating that the POV functional performance requirements are met. As part of the IST, the planned STP FSAR specifies that all ABWR safety-related piping systems incorporate provisions for testing to demonstrate the operability of POVs under design conditions. The planned STP FSAR states that all active POVs will be stroke tested in accordance with the ASME OM Code, and that ASME OM Code Case OMN-12 might be used in lieu of the Code stroke-testing requirements for pneumatically and hydraulically operated valves. The planned STP FSAR revision specifies parameters and acceptance criteria for testing POVs at STP Units 3 and 4. Subsection 3.9.6.8, "Non-Code Testing of Power-Operated Valves (Other Than Motor Operated Valves)," in the planned STP FSAR revision states that testing, in addition to the design and qualification process and post-installation setup, is performed as part of the Air-Operated Valve (AOV) Program that includes the key elements of the JOG AOV Program, with referenced comments provided by the NRC staff in a letter dated October 8, 1999. The planned STP FSAR revision indicates that the AOV Program incorporates the attributes of a successful POV long-term periodic verification program, as discussed in Regulatory Issue Summary (RIS) 2000-03, "Resolution of Generic Safety Issue 158: Performance of Safety-Related Power-Operated Valves Under Design Basis Conditions," by incorporating lessons learned from previous nuclear power plant operations and research programs, as they apply to the periodic testing of air-operated and other POVs included in the IST Program. For example, the planned STP FSAR revision indicates that the

key lessons learned in the AOV Program include (1) valve categorization according to safety significance and risk ranking; (2) AOV setpoints based on current vendor information or valve qualification diagnostic testing; (3) periodic static testing of high safety-significant valves to identify potential degradation and periodic dynamic testing, if required, based on valve qualification or operating experience; (4) sufficient diagnostics to collect relevant data; (5) test frequency specified and evaluated based on data trends consistent with the JOG AOV Program; (6) post-maintenance procedures with appropriate instructions and criteria; (7) lessons learned from other valve programs specified in procedures and training for the AOV Program; and (8) documentation from AOV testing with maintenance and corrective action records retained and periodically evaluated. The planned STP FSAR revision also indicates that the attributes for the AOV Program will be applied to other POVs (as applicable). The staff found that the description of the testing program for POVs other than MOVs, as described in the planned STP FSAR revision, will comply with the ASME OM Code provisions and will apply the lessons learned from nuclear power plant operating experience and valve research programs described in RIS 2000-03, for the periodic verification of design-basis capability of POVs other than MOVs. Therefore, **RAI 03.09.06-13** is closed. The planned STP FSAR changes will be tracked as part of **Confirmatory Item 03.09.06-1**.

ABWR DCD Tier 2, Subsection 3.9.6.2.4, "Isolation Valve Leak Tests," refers to pressure isolation valves, temperature isolation valves, and containment isolation valves. The staff issued **RAI 03.09.06-14 (RAI 2899–Question 11681)** requesting the applicant to indicate the classification, allowable leak rate, and test interval for POVs to be used at STP Units 3 and 4. During the November 2009 audit, STP stated that the STP FSAR would be revised to update ABWR DCD Tier 2, Table 3.9-8. The staff will review the revised IST table in the STP FSAR when it is submitted. This issue is being tracked as part of **Open Item 03.09.06-5**.

ABWR DCD Tier 2, Subsection 3.9.3.4 includes provisions to be addressed in design specifications for dynamic restraints, but does not describe the inservice examination and testing program for those components. The staff issued **RAI 03.09.06-15 (RAI 2899–Question 11682)** requesting the applicant to fully describe the IST Program for dynamic restraints to support the COL application for STP Units 3 and 4. Paragraph (3)(b) in Subsection 3.9.3.4.1, "Piping," in the planned STP FSAR revision submitted by the applicant on March 31, 2010, describes the inspection, testing, repair, and replacement of dynamic restraints (snubbers) to be used at STP Units 3 and 4. For example, the planned STP FSAR revision specifies that the inspection, testing, repair, and replacement of snubbers will be conducted in accordance with ASME OM Code, 2004 Edition (Subsection ISTD) and RG 1.192. The planned STP FSAR revision in Subsection 3.9.3.4.1(3)(c) states that the codes and standards for the functional qualification and production testing of snubbers will include ASME BPV Code Section III (Subsection NF), ASME Standard QME-1-2007 (Subsection QDR), and ASME OM Code (Subsection ISTD). The planned STP FSAR revision in Subsection 3.9.3.4.1(3)(f) describes inservice examination activities of snubbers based on the ASME OM Code, 2004 Edition (Subsection ISTD) and RG 1.192. For example, the planned STP FSAR revision describes the initial inservice examination intervals, the inservice visual examination attributes, establishment of test groups, and replacement and post-maintenance examination and testing. The planned STP FSAR revision indicates that subsequent examinations will be performed at intervals defined in the ASME OM Code (Subsection ISTD) and ASME OM Code Case OMN-13, "Requirements for Extending Snubber Inservice Visual Examination Interval at LWR Power Plants." The staff accepted the use of ASME OM Code Case OMN-13 in RG 1.192 without conditions. The staff found that the description of the IST Program for dynamic restraints, as described in the planned STP FSAR revision complies with the ASME OM Code provisions and

alternatives allowed in ASME OM Code Case OMN-13. Therefore, **RAI 03.09.06-15** is closed. The planned STP FSAR changes will be tracked as part of **Confirmatory Item 03.09.06-1**.

Tier 2 Departure Not Requiring Prior NRC Approval

- STD DEP Admin

The applicant corrects the references to Chapter 16, "Surveillance Requirement," Subsection 3.4.4.1 on performing periodic leak testing of the reactor coolant pressure isolation valves.

The applicant defines administrative departures as minor corrections, such as editorial or administrative errors in the referenced ABWR DCD (i.e., misspellings, incorrect references, table headings, etc.). Administrative departures do not affect the presentation of any design discussion or the qualification of any design margin.

The applicant's evaluation determined that this departure does not require prior NRC approval in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5. Within the review scope of this section, NRC staff found it reasonable that this departure does not require prior NRC approval.

COL License Information Items

- COL License Information Item 3.29 Pump and Valve Testing Program

STP FSAR Subsection 3.9.7.3 indicates that the plant-specific environmental parameters for the Equipment Qualification Program will be available for NRC review as part of the ITAAC for the basic configuration of plant systems, as provided in ABWR DCD Tier 1, Section 1.2. NRC staff issued **RAI 03.09.06-16 (RAI 2899–Question 11683)** requesting the applicant to discuss the availability of design and procurement specifications for pumps, valves, and dynamic restraints for NRC review. During the November 2009 audit, the staff reviewed a sample of design and procurement specifications for components to be used at STP Units 3 and 4. . The revision of the design and procurement specifications was tracked as **Open Item 03.09.06-1** in response to the November 2009 audit. As discussed above, the staff conducted a follow-up audit to review the revised design and procurement specifications on August 2, 2010. Based on that follow-up audit, **RAI 03.09.06-16** is resolved and **Open Item 03.09.06-1** is closed. The planned revision to the design and procurement specifications will be tracked as part of **Confirmatory Item 03.09.06-1**.

STP FSAR Subsection 3.9.7.3 indicates that the pump and valve IST and Inspection Programs will be provided to the NRC as specified in FSAR Section 13.4S, which indicates that descriptions of operational programs, consistent with the definition of "fully described" in the SRM for SECY-05-0197, are in the FSAR sections listed in Table 13.4S-1. The staff issued **RAI 03.09.06-17 (RAI 2899–Question 11684)** requesting the applicant to supplement the FSAR referenced sections with the information requested in RG 1.206 to provide a full description of these operational programs. STP FSAR Table 13.4S-1 specifies that the IST Program will be implemented "after generator on line on nuclear heat" and the MOV Testing Program will be implemented by fuel loading. The staff's review of the description of the IST and MOV Testing Programs is discussed in this SER section. Therefore, **RAI 03.09.06-17** is closed.

STP FSAR Subsection 3.9.7.3 indicates that the design qualification test, inspection, and analysis criteria in Subsections 3.9.6.1, 3.9.6.2.1, 3.9.6.2.2, and 3.9.6.2.3 of ABWR DCD Tier 2

will be included in the respective safety-related pump and valve design specifications before fuel loading, as COM 3.9-3. STP FSAR Subsection 3.9.7.3 also notes that the design, qualification and preoperational testing for MOVs will conform to the provisions in ABWR DCD Tier 2, Subsection 3.9.6.2.2, as COM 3.9-4. The staff issued **RAI 03.09.06-18 (RAI 2899–Question 11685)** requesting the applicant to discuss the completion of the COL applicant actions specified in the ABWR DCD, as part of the COL application for STP Units 3 and 4. In the planned STP FSAR revision, STP supplements the ABWR DCD to fully describe the IST and MOV Testing Programs in support of the STP COL application. The staff reviewed the planned STP FSAR revision (as discussed in this SER section). The staff's review of the design and procurement specifications for pumps, valves, and dynamic restraints to be used at STP Units 3 and 4 during is discussed earlier in this SER section.

STP FSAR Subsection 3.9.7.3 indicates that the SRV IST requirements are included in Table 3.9-8, and additional SRV testing (including Technical Specification testing) is described in Subsection 5.2.2.10. The staff issued **RAI 03.09.06-19 (RAI 2899–Question 11686)** requesting the applicant to fully describe the IST Program for SRVs consistent with RG 1.206 and SECY-05-0197. In the planned STP FSAR revision submitted on March 31, 2010, Subsection 3.9.6.5, "Inservice Testing Program for Safety and Relief Valves," describes the IST Program for SRVs based on the provisions specified in ASME OM Code Subsection ISTC. For example, the planned STP FSAR revision specifies that safety and relief valve tests will be conducted in accordance with Appendix I ("Inservice Testing of Pressure Relief Devices in Light-Water Reactor Nuclear Power Plants") to the ASME OM Code, 2004 Edition. The planned STP FSAR revision indicates that safety and relief valves to be used at STP Units 3 and 4 are listed in Table 3.9-8. The staff found that the description of the IST Program for safety and relief valves—as described in the planned STP FSAR revision—complies with the ASME OM Code provisions and is acceptable. **RAI 03.09.06-19** is therefore closed. The planned STP FSAR changes will be tracked as part of **Confirmatory Item 03.09.06-1**.

STP FSAR Subsection 3.9.7.3 notes that ISTs that are conducted during the initial 120-month interval to verify the operational readiness of pumps and valves, whose function is required for safety, must comply with the requirements in the latest edition and addenda of the Code incorporated by reference in 10 CFR 50.55a(b), on the date 12 months before the date of issuance of the operating license (or the optional ASME Code cases listed in RG 1.192 that is incorporated by reference in 10 CFR 50.55a(b), subject to the limitations and modifications listed in 10 CFR 50.55a(b). STP FSAR Subsection 3.9.7.3 also indicates that ISTs conducted during successive 120-month intervals to verify the operational readiness of pumps and valves, whose function is required for safety, must comply with the requirements of the latest edition and addenda of the Code incorporated by reference in 10 CFR 50.55a(b), 12 months before the start of the 120-month interval (or the optional ASME Code cases listed in RG 1.147 through Revision 14, or RG 1.192, which are incorporated by reference in 10 CFR 50.55a[b]), and are subject to the limitations and modifications listed in 10 CFR 50.55a(b). RG 1.206, Section C.IV.4.3, "Implementation of Operational Programs," states that the COL will contain a license condition that requires the licensee to submit to the NRC a schedule, 12 months after the COL issuance, which supports planning for and conducting NRC inspections of operational programs. The schedule will be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until either the operational programs in FSAR Table 13.4-201 have been fully implemented or the plant has been placed in commercial service (whichever comes first). The staff issued **RAI 03.09.06-20 (RAI 2899–Question 11687)** requesting the applicant to discuss plans to develop license conditions for operational program implementation that are consistent with the guidance in RG 1.206 and SECY-05-0197. The staff also requested the STP COL applicant to discuss updating the reference to Revision 14 of

RG 1.147, so it is consistent with the NRC regulations at the time of development of the IST Program for STP Units 3 and 4. In response to this RAI in a letter dated August 17, 2009, the applicant references Section 13.4S in the STP FSAR for the implementation schedule of the IST Program for STP Units 3 and 4. The applicant also states the intent to support planning for and conducting NRC inspections of operational programs, as indicated in RG 1.206. The applicant indicates that the applicable revision to RG 1.147 will be addressed during the development of the operational programs for STP Units 3 and 4. The staff found that the applicant has clarified the preparation for the development of the STP Units 3 and 4 operational programs. Therefore, **RAI 03.09.06-20** is closed.

In Attachment 3 to the COL application dated September 20, 2007, the applicant provides the milestone for Commitment COM 3.9-3 (COL License Information Item 3.29), which is summarized as the Pump and Valve IST Program, Commitment 3.9-4 (COL License Information Item 3.29), summarized as MOV design, qualification, and preoperational testing will be completed and available for review before fuel loading. The staff issued **RAI 03.09.06-21 (RAI 2899–Question 11688)** and **RAI 03.09.06-22 (RAI 2899–Question 11689)**, requesting the applicant to provide a schedule that allows for NRC inspections of the IST Program and MOV Testing Program during their development and implementation and before relying on pumps and valves to perform their safety functions. In response to this RAI in a letter dated August 17, 2009, the applicant indicates that a schedule for planning purposes will be provided to facilitate NRC review and confirmation activities, in accordance with the applicable license conditions. The staff found that these actions satisfy the licensing process in 10 CFR Part 52 and are therefore acceptable. **RAIs 03.09.06-21 and 22** are closed.

RG 1.206, Paragraph C.III.3.9.6.1 requests the COL applicant to provide information related to equipment not included in the referenced certified design. The staff issued **RAI 03.09.06-23 (RAI 2899–Question 11690)**, requesting the applicant to (1) confirm that STP Units 3 and 4 will not include equipment beyond what is specified in the ABWR certified design, or (2) provide information on this equipment as indicated in RG 1.206. In the response to the RAI dated August 17, 2009, the applicant states that STP Units 3 and 4 will be constructed in accordance with the ABWR certified design and will be subject to the departures specified in the COL application. During the November 2009 audit, the applicant stated that the STP FSAR would be revised to update ABWR DCD Tier 2 Table 3.9-8. The staff will review the revised IST table in the STP FSAR when it is submitted. This issue will be tracked as part of **Open Item 03.09.06-5**.

- COL License Information Item 3.30 Audit of Design Specification and Design Reports

ABWR DCD Tier 2 Subsection 3.9.7.4 specifies that COL applicants will make design specifications and design reports available for NRC staff to audit. STP FSAR Subsection 3.9.7.4 indicates that design specifications and design reports required by the ASME Code for vessels, pumps, valves, and piping systems will be made available for NRC review. The staff issued **RAI 03.09.06-24 (RAI 2899–Question 11691)**, requesting the applicant to specify the availability of design specifications and design reports related to pumps, valves, and dynamic restraints for NRC review. During the November 2009 audit, the staff reviewed a sample of design and procurement specifications for components to be used at STP Units 3 and 4. The revision of the design and procurement specifications was tracked as **Open Item 03.09.06-1** in response to the November 2009 audit. As discussed above, the staff conducted a follow-up audit to review the revised design and procurement specifications on August 2, 2010. Based on that follow-up audit, **RAI 03.09.06-24** is resolved and **Open Item 03.09.06-1** is closed. The planned revision to the design and procurement specifications will be tracked as part of **Confirmatory Item 03.09.06-1**.

STP FSAR Table 3.9-8 updates the IST table in the ABWR DCD with respect to the IST Program scope, Code category, valve function, test parameters, and test frequency. The staff issued **RAI 03.09.06-25 (RAI 2899–Question 11692)**, requesting the applicant to describe the modifications to Table 3.9-8 and the basis for the changes. In response to the audit, the applicant will update the IST table to reflect the applicable ASME OM Code edition. Therefore, this issue will be tracked as part of **Open Item OI 03.09.06-5**.

Nuclear power plant operating experience has revealed the potential for adverse flow effects from vibration caused by hydrodynamic loads and acoustic resonance on reactor coolant, steam, and feedwater systems. ABWR DCD Tier 2 Subsection 3.9.2.1.1, "Vibration and Dynamic Effects Testing," describes tests to confirm that piping, components, restraints, and supports are designed to withstand the dynamic effects of steady-state, flow-induced vibration (FIV) and anticipated operational transient conditions. ABWR DCD Tier 2 Subsection 14.2.12.1.51, "Expansion, Vibration and Dynamic Effects Preoperational Test," and Subsection 14.2.12.2.11, "System Vibration," discuss verification during plant startup tests that vibration of critical system components and piping is within acceptable limits during normal steady-state power operation and expected operational transients. The staff issued **RAI 03.09.06-26 (RAI 2899–Question 11693)** requesting the STP COL applicant to discuss the implementation of this program and identify potential adverse flow effects on pumps, valves, and dynamic restraints from hydraulic loading and acoustic resonance during plant operation. In the response to the RAI dated August 17, 2009, the applicant states that the IST Program will address the dynamic effects of steady-state FIV and anticipated transient conditions as they relate to pumps, valves, and dynamic restraints. The applicant also states that a parallel program taking advantage of nuclear power plant operating experience will be developed to assure that hydrodynamic loads and acoustic resonance are considered in the design of the reactor coolant, steam, and feedwater systems. The NRC staff found that the provisions in ABWR DCD Tier 2, Subsection 3.9.2.1.1 and DCD Tier 2, Chapter 14, with the clarification in the RAI response, provide confidence that the dynamic effects from FIV will be addressed for pumps, valves, and dynamic restraints at STP Units 3 and 4. **RAI 03.09.06-26** is therefore closed.

NUREG–1482, "Guidelines for Inservice Testing at Nuclear Power Plants," provides guidance for the preparation of IST Program documentation and tables. The NRC staff evaluated the applicant's description of the IST Program as part of the NRC review of the COL application. Following the COL issuance, the staff will evaluate the development and implementation of the IST Program as part of NRC inspection activities before and during plant operation.

In NUREG–1503, the NRC staff notes that the ABWR Standby Liquid Control System (SLCS) design includes MOVs rather than explosive-actuated (squib) injection valves. If squib valves are used at STP Units 3 and 4, the applicant will be responsible for establishing appropriate surveillance activities for squib valves. For example, the IST Program for squib valves will need to incorporate lessons learned from the design and qualification process for these valves, so that surveillance activities provide reasonable assurance of the operational readiness of squib valves to perform their safety functions.

License Conditions

In RG 1.206, Section C.IV.4.3 states that the COL will contain a license condition that requires the licensee to submit to the NRC 12 months after COL issuance, a schedule that supports planning for and conducting NRC inspections of operational programs. The schedule will be updated every 6 months until 12 months before scheduled fuel loading, and every month

thereafter until either the operational programs have been fully implemented or the plant has been placed in commercial service, whichever comes first. NRC staff will prepare this license condition as part of the completion of the staff's review of the STP COL application.

3.9.6.5 *Post Combined License Activities*

NRC regulations in 10 CFR 50.55a(f)(4)(i) state that ISTs to verify operational readiness of pumps and valves, whose function is required for safety, conducted during the initial 120-month interval must comply with the requirements in the latest edition and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b), on the date 12 months before the date scheduled for initial fuel loading under a COL issued per 10 CFR Part 52 (or the optional ASME Code cases listed in RG 1.192), subject to the limitations and modifications listed in Section 50.55a. A similar requirement is stated in 10 CFR 50.55a(g)(4)(i) for dynamic restraints. As described in Subsection 3.9.6.4, the COL licensee will provide schedules to support NRC inspections of IST and MOV Testing Operational Programs.

The applicant identifies the following commitments:

- Commitment (COM 3.9-3) – The design qualification test, inspection, and analysis criteria in Subsections 3.9.6.1, 3.9.6.2.1, 3.9.6.2.2, and 3.9.6.2.3 of Tier 2 of the referenced ABWR DCD will be included in the respective safety-related pump and valve design specifications before fuel loading.
- Commitment (COM 3.9-4) – The design, qualification, and preoperational testing for MOVs will conform to the provisions in Subsection 3.9.6.2.2 of Tier 2 of the referenced ABWR DCD.

3.9.6.6 *Conclusion*

The staff evaluated the STP COL application to determine whether it demonstrates that the Functional Design, Qualification, and IST Programs for safety-related pumps, valves, and dynamic restraints will satisfy the applicable NRC regulations and provide reasonable assurance that those components will be capable of performing their safety functions at STP Units 3 and 4. However, as a result of the **open and confirmatory items**, the staff was unable to finalize the conclusions relating to the testing of pumps and valves. The staff was unable to determine that the applicant has provided sufficient information for satisfying 10 CFR Part 50 for the Functional Design, Qualification, and IST Programs for safety-related pumps, valves, and dynamic restraints at STP Units 3 and 4.

3.10 Seismic and Dynamic Qualification of Mechanical and Electrical Equipment

3.10.1 Introduction

This section of the FSAR addresses the seismic qualification of electrical components and equipment. This section includes dynamic loads due to suppression pool dynamics associated with a LOCA and safety/relief valve (SRV) discharge as a significant vibratory effect on the RB and, hence, on the design of the structures, systems, and equipment in the reactor building. This section also discusses equipment qualification for both seismic and other reactor building vibration (RBV) dynamic loads.

The COL applicant must ensure that site-specific seismic and dynamic input response spectra are properly defined, enveloped in the methodology for that specific plant, and implemented in

its equipment qualification program. The mechanical components and equipment and the electrical components that are integral to the mechanical equipment are dynamically qualified, as described in Section 3.9 of the ABWR DCD. Principal Seismic Category I SSCs are safety-related, and they include functions that are essential to an emergency reactor shutdown, containment isolation, reactor core cooling, reactor protection, containment and reactor heat removal, and an emergency power supply or functions that are otherwise essential in preventing a significant release of radioactive material into the environment.

The criteria for the design of the SSCs include the following considerations:

- Seismic qualification criteria
- Methods and procedures for qualification using analyses, tests, or a combination of tests and analyses for mechanical and electrical equipment and instrumentation
- Methods of and procedures for analyzing or testing the supports for mechanical and electrical equipment and instrumentation
- Results of tests and analyses

3.10.2 Summary of Application

Section 3.10 of the STP Units 3 and 4 COL FSAR incorporates by reference Section 3.10 of the certified ABWR DCD, Revision 4 referenced in 10 CFR Part 52, Appendix A with no departures.

In addition, in FSAR Section 3.10.5, "COL License Information," the applicant provides supplemental information to address COL License Information Items 3.37, 3.38, and 3.39.

COL License Information Items

- COL License Information Item 3.37 Equipment Qualification

This COL license information item addresses the requirement for equipment qualification records. The applicant commits (COM 3.10-1) to prepare equipment qualification records, including reports, following the procurement of qualified equipment and before fuel loading. The applicant adds that the records will be maintained in a permanent file and readily available for audit.

- COL License Information Item 3.38 Dynamic Qualification Report

This COL license information item addresses the requirement for the dynamic qualification report (DQR). The applicant commits (COM 3.10-2) to prepare the DQR following the procurement of qualified equipment and before fuel loading.

- COL License Information Item 3.39 Qualification by Experience

This COL license information item addresses the requirement that no Seismic Category I equipment will be qualified by experience.

3.10.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG–1503. In addition, the relevant requirements of the Commission regulations for the seismic and dynamic qualification of mechanical and electrical equipment, and the associated acceptance criteria, are

in Section 3.10 of NUREG–0800. The regulatory basis for reviewing the COL license information items is in SRP Section 3.10.

3.10.4 Technical Evaluation

As documented in NUREG–1503, NRC staff reviewed and approved Section 3.10 of the certified ABWR DCD. The staff reviewed Section 3.10 of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic[1]. The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this section.

The staff reviewed the information in the COL FSAR:

COL License Information Items

- COL License Information Item 3.37 Equipment Qualification
- COL License Information Item 3.38 Dynamic Qualification Report

Specific information to be provided by the applicant to address COL License Information Item 3.37 includes plant-specific seismic and dynamic parameters for the Equipment Qualification Program. The applicant states that the plant-specific seismic and hydrodynamic spectra are bounded by spectra shown in the referenced ABWR DCD Appendix 3A and Appendix 3G, respectively. The equipment qualification reports and records in Subsections 3.10.2.1.4 and 3.10.2.2.3 of the DCD, respectively, will be prepared following the procurement of qualified equipment but before fuel loading. The records will be maintained in a permanent file readily available for audit (COM 3.10-1).

Specific information to be provided by the applicant to address COL License Information Item 3.38 includes a DQR identifying all Seismic Category I instrumentation, electrical parts and equipment therein, and their supports. The DQR shall contain the following:

1. A table or file for each system that is identified in Table 3.2-1 of the DCD to be safety related or having Seismic Category I equipment shall be included in the DQR containing the Master Parts List (MPL) item number and name, the qualification method and the input motion for all Seismic Category I equipment and the supporting structure in the system, and the corresponding qualification summary table or vendor's qualification report.

2. The mode of safety-related operation (i.e., active, manual active or passive) of the instrumentation and equipment along with the manufacturer identification and model numbers shall also be tabulated in the DQR. The operational mode identifies the instrumentation or equipment:

    a. That performs the safety related functions automatically

    b. That is used by the operators to perform the safety related functions manually

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3 for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

c. Whose failure can prevent the satisfactory accomplishment of one or more safety-related functions.

The applicant states that the DQR will be prepared following the procurement of qualified equipment but before fuel loading (COM 3.10-2).

Based on the above descriptions, the staff found that the applicant has appropriately incorporated by reference Section 3.10 of the certified ABWR DCD, Revision 4. However, in both COL License Information Items 3.37 and 3.38, the applicant indicates that the equipment qualification records and the DQR will be prepared following the procurement of qualified equipment but before fuel loading (COM 3.10-1 and COM 3.10-2, respectively). These commitments may not be in accordance with the guidance of RG 1.206 Subsection C.I.3.10.4 and would be unacceptable. Therefore, the staff issued **RAI 3.10-1 (eRAI 2927)** requesting the applicant to provide an implementation program for the seismic qualification of mechanical and electrical equipment, including milestones and completion dates for the DQR. The program should include appropriate information and be submitted with sufficient time for the staff's review and approval, before the installation of the equipment, not before fuel loading, in accordance with Subsection C.I.3.10.4 of RG 1.206. Milestones and completion dates for the DQR could be addressed as a license condition.

In a letter (U7-C-STP-NRC-090160, ML092810321) responding to **RAI 3.10-1** dated October 5, 2009, the applicant provides additional information regarding the planned method(s) of dynamic qualification for safety-related Seismic Category I equipment types listed in COL application Part 2, Tier 2, Table 3.2-1. There are also milestone dates indicating the availability of the Vendor Qualification Reports to the NRC for audit. In a letter (U7-C-STP-NRC-090088, ML092150959) dated July 30, 2009, the applicant states that FSAR Subsection 3.10.5.1, which addresses COL Information Item 3.37, "Equipment Qualification," will be revised to clarify that the equipment dynamic qualification records and reports will be available before the installation of equipment. The staff found the applicant's response acceptable and is tracking the resolution of this RAI as **Confirmatory Item 3.10-1**.

- COL License Information Item 3.39 Qualification by Experience

The applicant provides specific information to address COL License Information Item 3.39. The applicant indicates in Subsection 3.10.5.3 of the STP FSAR that no Seismic Category I instrumentation or electrical equipment will be qualified by experience. The staff found the applicant's approach acceptable. The applicant has adequately addressed COL License Information Item 3.39, which is considered closed.

3.10.5 Post Combined License Activities

The applicant identifies the following commitments:

- Commitment (COM 3.10-1) Prepare the equipment qualification records, including the reports, following the procurement of qualified equipment but before installing the equipment.

- Commitment (COM 3.10-2) Prepare the DQR prepared following the procurement of qualified equipment but before installing the equipment.

3.10.6 Conclusion

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to the seismic and dynamic qualification of mechanical and electrical equipment, as described in STP Units 3 and 4 COL FSAR Section 3.10. With the exception of **Confirmatory Item 3.10-1**, no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the seismic and dynamic qualification of mechanical and electrical equipment that were incorporated by reference have been resolved.

The staff compared the information in the application to the relevant NRC regulations, the acceptance criteria in NUREG–0800 Section 3.10, and other NRC regulatory guides. The staff's review confirmed that the applicant has adequately addressed the COL license information items.

However, as a result of **Confirmatory Item 3.10-1**, the staff was unable to finalize the conclusions relating to the seismic and dynamic qualification of mechanical and electrical equipment, in accordance with the NRC requirements.

3.11 Environmental Qualification of Safety-Related Mechanical and Electrical Equipment

3.11.1 Introduction

This section of the FSAR addresses the environmental qualification (EQ) of equipment that is important to safety (mechanical, electrical, and instrumentation and control [I&C], including digital I&C) to provide assurance that the equipment is capable of performing its design-safety functions under all normal environmental conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. During plant operation, the ABWR STP Units 3 and 4 COL applicant implements the EQ Program (EQP), which specifies the replacement frequencies of affected safety-related equipment in harsh environments and nonsafety-related equipment whose failure, under the postulated environmental conditions, could prevent the satisfactory performance of the safety functions of the safety-related equipment and certain post-accident monitoring equipment.

3.11.2 Summary of Application

Section 3.11, including Appendix 3I, of the STP Units 3 and 4 COL FSAR incorporates by reference Section 3.11 and Appendix 3I of the certified ABWR DCD, Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR, the applicant provides the following:

Tier 2 Departure Not Requiring Prior NRC Approval

- STD DEP Admin

The applicant provides information to address one administrative departure to Section 3.11 of the ABWR design certification involving section numbers for references. In the ABWR DCD Section 3.11.7 list the references, whereas in the COL FSAR, the applicant uses Section 3.11.8 for listing references.

COL License Information Items

- COL License Information Item 3.40 Environmental Qualification Document

The applicant provides additional information to address COL License Information Item 3.40 in FSAR Subsection 3.11.6.1 regarding the Environmental Qualification Document (EQD).

- COL License Information Item 3.41 Environmental Qualification Records

The applicant provides additional information to address COL License Information Item 3.41 in FSAR Subsection 3.11.6.2 regarding Environmental Qualification Records (EQR).

- COL License Information Item 3.42 Surveillance, Maintenance and Experience Information

The applicant provides additional information to address COL license Information Item 3.42 in FSAR Subsection 3.11.6.3 regarding surveillance, maintenance, and experience information.

- COL License Information Item 3.43 Radiation Environment Conditions

The applicant provides additional information to address COL License Information Item 3.43 in FSAR Section 3I.3.3 regarding radiation environmental conditions.

Supplemental Information

The applicant provides additional information in FSAR Section 3.11.6S regarding the qualification of mechanical equipment. In addition, the applicant provides site-specific supplemental information in FSAR Section 3.11.7 regarding the Operational Program description of the STP Units 3 and 4 EQP.

3.11.3 Regulatory Basis

The regulatory basis for reviewing the information incorporated by reference is in NUREG–1503. The regulatory basis for reviewing the COL license information items is in Section 3.11 of NUREG–0800.

The related acceptance criteria are as follows:

- In accordance with SECY-05-0197 as accepted in the Commission's SRM dated February 22, 2006, Equipment Qualification is an Operational Program that will be reviewed in the COL application. The NRC staff reviews this program to make a reasonable assurance finding on the program. A COL applicant should fully describe EQ and other Operational Programs as defined in SECY-05-197 to avoid the need for ITAAC to implement those programs. The term "fully described" for an operational program should be understood to mean that the program is clearly and sufficiently described in terms for scope and level of detail to allow a reasonable assurance finding of acceptability. Further, Operational Programs should be described at a functional level and an increasing level of detail where implementation choices could materially and negatively affect the program effectiveness and acceptability. The Commission approved the use of a license condition for operational

program implementation milestones that are fully described or referenced in the FSAR as discussed in the SRM for SECY-05-0197, dated February 22, 2006.

In addition, in accordance with Section VIII, "Processes for Changes and Departures," of, "Appendix A to Part 52--Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies a Tier 2 departure not requiring prior NRC approval. This departure is subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.B.5, which are similar to the requirements in 10 CFR 50.59.

3.11.4 Technical Evaluation

As documented in NUREG–1503, NRC staff reviewed and approved Section 3.11, and Appendix 3I of the certified ABWR DCD. The staff reviewed Section 3.11 and Appendix 3I of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this section.

ABWR DCD Section 3.11.2, "Qualification Tests and Analyses," indicates that safety-related mechanical equipment is qualified as described in IEEE-323 and that equipment located in a mild environment shall have a certificate of compliance certifying that the equipment has been qualified in its applicable environment. Environmental conditions and zones are described in Appendix 3I of the ABWR DCD.

In Section 3.11.2.2, "Safety-Related Mechanical Equipment in a Harsh Environment," of NUREG-1503, staff concludes that that the time-margin issue as related to safety-related mechanical equipment is resolved similarly to that for electrical equipment discussed in Section 3.11.2.1 of NUREG-1503.

STP FSAR Section 3.11.6S invokes the documentation requirements of 10 CFR Part 50, Appendix B for safety-related mechanical equipment.

On November 10, 2009 and August 2, 2010, the NRC staff conducted audits of the environmental qualification program at the Westinghouse office in Rockville, MD. The purpose of the audits was to confirm the implementation of the ABWR DCD provisions for the EQ operational program by the COL applicant. As discussed in NRC memorandums dated December 7, 2009 and September 1, 2010 (ADAMS Accession No. ML093220094 and ML102230215, respectively), the NRC staff reviewed the description of the STP Units 3 & 4 EQ program in Toshiba Project Document No. 7A10-0301-0025, "Environmental Qualification Program." In addition, NRC staff also reviewed the equivalency evaluation report (EER) developed to ensure that the requirements in NEDE-24326-1-P are properly captured in the EQP, and several pump and valve design and procurement specifications. Based on the audits, NRC staff concludes that the EQ Program for mechanical components is clearly and sufficiently described in terms of scope and level of detail to allow a reasonable assurance finding of acceptability. In the September 1, 2010 audit report , NRC staff identified that Toshiba Project Document No. 7A10-0301-0025, "Environmental Qualification Program," should be placed on

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3, for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

the docket. Furthermore, the staff also found that the EER needed clarification because the applicant did not have sufficient documentations to demonstrate how and why some of the NEDE-24326-1-P requirements are different from the EER. A follow-up audit will be scheduled when the EER is clarified. **This is confirmatory item 3.11-1.**

The staff reviewed the information in the COL FSAR:

Tier 2 Departure Not Requiring Prior NRC Approval

- STD DEP Admin

In the ABWR DCD Section 3.11.7 lists the references, whereas in the COL FSAR, the applicant uses Section 3.11.8 for listing references. The applicant defines administrative departures as minor corrections, such as editorial or administrative errors, in the referenced ABWR DCD (i.e., misspellings, incorrect references, table headings, etc.).

The applicant's evaluation determined that this departure does not require prior NRC approval, in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5. Within the review scope of this section, the staff found it reasonable that this departure does not require prior NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

COL License Information Items

- COL License Information Item 3.40 Environmental Qualification Document

NRC staff reviewed the applicant's approach to address COL License Information Item 3.40 to provide an EQD summarizing the qualification results for all safety-related mechanical and electrical equipment located in harsh environments. The EQD will include the environmental test parameters, the methodology used to qualify the equipment that is located in both harsh and mild environments, and the system component work sheets that will contain a summary of environmental conditions and qualified conditions for safety-related mechanical and electrical equipment. The EQD will be available for NRC review as part of the ITAAC for basic configuration of systems. The staff found the applicant's approach in resolving COL License Information Item 3.40 acceptable to develop the EQD and make it available for the ITAAC for basic configuration of systems.

- COL License Information Item 3.41 Environmental Qualification Records

NRC staff reviewed the applicant's approach to address COL License Information Item 3.41 to record and maintain the results of the qualification tests for safety-related electrical and I&C equipment, in accordance with the requirements of 10 CFR 50.49, and to have the records available for NRC review as part of the EQ ITAAC. The staff found the applicant's approach in resolving COL License Information Item 3.41 acceptable.

- COL License Information Item 3.42 Surveillance, Maintenance and Experience Information

NRC staff reviewed the applicant's approach to address COL License Information Item 3.42 to maintain certificates of compliance for each qualified item and to develop a surveillance and maintenance program for equipment, in accordance with the EQP. The staff reviewed the applicant's commitment to evaluate design considerations for nonsafety-related control systems

subjected to adverse environments and equipment wetting and flooding above the flood level. The applicant addresses these issues as design-related conditions and states that records of evaluation will be available for NRC review, as part of the ITAAC for basic configuration of systems and as provided in the referenced ABWR DCD, Tier 1 Section 1.2. The staff found the applicant's approach in resolving COL License Information Item 3.42 acceptable to evaluate design considerations for nonsafety-related control systems subjected to adverse environments and equipment wetting and flooding above the flood level.

- COL License Information Item 3.43 Radiation Environment Conditions

STD DEP 3I-2, "Environmental Qualification-Radiation," revises the integrated gamma radiation dose for the main steam tunnel in Table 3I-17. The increase in this value is based on current results of post-accident radiation calculations and analysis. Table 3I-17 was updated to ensure that equipment located in this area will meet their design requirements to operate in a post-accident environment.

NRC staff reviewed the applicant's approach to address COL License Information Item 3.43 to update, as necessary, the radiation environment conditions given in Tables 3I-7 through 3I-11 and Tables 3I-16 through 3I-19 based on as-designed and as-procured equipment. These FSAR tables will be updated as necessary, in accordance with 10 CFR 50.71(e). The staff found the applicant's approach in resolving COL License Information Item 3.43 acceptable to update the radiation environment conditions.

Additionally, the staff found that the applicant has revised Table 3I-13, "Thermodynamic Environment Conditions Inside Reactor Building," to eliminate thermodynamic environment conditions for the flammability control system valves including its isolation valve and electrical equipment as a result of the Tier 1 Departure STD DEP T1 2.14-1. This departure reflects the elimination of the requirements to maintain equipment needed to mitigate a design-basis LOCA hydrogen release. The amendment to 10 CFR 50.44 eliminated the requirements for hydrogen control systems to mitigate a design-basis LOCA hydrogen release. The staff found the elimination of the hydrogen recombiner requirements acceptable, as evaluated in SER Section 6.2.

Supplemental Information

- Qualification of Mechanical Equipment

NRC staff reviewed the applicant's supplemental information regarding the qualification of mechanical equipment. The process for determining the suitability of environmentally sensitive soft parts in mechanical equipment exposed to a harsh environment was established for all commodities and subcomponents of mechanical equipment that perform a safety-related function by adherence to the requirements of NEDE-24326-1-P, 1983, "General Electric Environmental Qualification Program." This topical report invokes the EQ requirement of IEEE Std 323, which will ensure that any nonmetallic (elastomer, seal, or lubricant) subcomponents used in mechanical equipment will be capable of performing the respective safety function under the environmental conditions to which it is subjected during normal, abnormal, test, and design-basis accident and post-accident conditions. As stated in FSAR Subsection 3.11.6.1, the EQD (including mechanical EQ) will be available for NRC review as part of the ITAAC for basic configuration of systems. Based on the August 2, 2010 audit, staff determined that STP FSAR needs to reference QME-1-2007, Appendix QR-B for the qualification of non-metallic subcomponents of mechanical equipment since the EQ Program references QME-1-2007 in

addition to IEEE-323-1974 for the qualification of non-metallics. **This is confirmatory item 3.11-2**.

The staff reviewed Section 3.11 and issued the following **RAIs:**

> **RAI 03.11-1 (eRAI 3328-Question 13178)**: Provide or reference the information or indicate the status of and schedule for its availability related to the environmental qualification (EQ) operational program for safety-related mechanical equipment for the STP Units 3 and 4 nuclear power plant.
>
> **RAI 03.11-2 (eRAI 3328-Question 13179)**: Discuss the plan for the implementation of the environmental qualification approach for mechanical equipment including the application of industry standards.
>
> **RAI 03.11-3 (eRAI 3328-Question 13180)**: Describe the plan for the implementation of Toshiba Replacement EQ Program Document for environmental qualification of safety-related mechanical and electrical/I&C equipment at STP Units 3 and 4.
>
> **RAI 03.11-4 (eRAI 3328-Question 13181)**: Describe the consideration of flow-induced vibration in the qualification of safety-related equipment, such as valves, actuators, and piping, resulting from acoustic resonance and hydraulic loading at STP Units 3 and 4.

The applicant responded to these RAI questions in a letter dated October 12, 2009 (ML092890084).

The applicant's response to RAI 03.11-1 states that STP is developing the EQP to address the environmental qualification of safety-related mechanical and electrical equipment. The EQP is consistent with NEDE-24326-1-P. The EQP will be used to determine the EQ requirements for the STP Units 3 and 4 safety-related mechanical and electrical equipment. These requirements will be incorporated in the equipment purchase specifications. In addition, the applicant's response to **RAI 03.10-1 (eRAI 2927)**, Supplement 1, provides a list of mechanical and electrical components that require a seismic/dynamic qualification. The EQ requirements for the mechanical and electrical items on that list will be specified in accordance with the EQP. Based on the audits performed on November 10, 2009 and August 2, 2010, the NRC staff concludes that the EQP provides an acceptable description of the environmental qualification of safety-related mechanical and electrical equipment.

The applicant's response to **RAI 3.11-2 (RAI 3328–Question 13179)** states that the EQP will be used for the qualification of mechanical equipment. The program includes the EQ approach, including the application of industry standards. The program incorporates the referenced ABWR DCD approach for the safety-related mechanical equipment that is located in a harsh or mild environment. COL application Part 2 Tier 2, Section 3.11.6S, "Qualification of Mechanical Equipment," explains the approach. Thus, DCD Tier 2 Section 3.11.2 requirements for the qualification of equipment in harsh or mild environments will be a part of the equipment purchase specifications. Based on the audits performed on November 10, 2009 and August 2, 2010, the NRC staff concludes that the EQP provides an acceptable description of STP EQ approach and application of industry standards for safety-related mechanical equipment.

The applicant's response to **RAI 03.11-3 (RAI 3328–Question 13180)** states that the EQP will be developed for STP Units 3 and 4 and will be consistent with the requirements in NEDE-24326-1-P. The process for determining the suitability of environmentally sensitive soft parts in mechanical equipment will be included in the STP Units 3 and 4 EQP. Based on the

audits performed on November 10, 2009 and August 2, 2010, the NRC staff concludes that the EQP provides an acceptable process for determining the suitability of environmentally sensitive soft parts in mechanical equipment**.**

The applicant's response to **RAI 03.11-4 (RAI 3328–Question 13181)** states that the STP Units 3 and 4 EQP will include the operational program for seismic and dynamic qualification for safety-related mechanical and electrical equipment. The EQP will address the potential vibratory effects from instabilities or rapid changes of the flow in the piping during normal and anticipated plant operation. The effect of the specified non-seismic-related vibration due to normal and transient plant operating conditions and in-plant (suppression pool hydrodynamic) vibration will be accounted for as a portion of the seismic tests. The vibration events will be specified based upon potential system operating cycles. BWR operating experience provides a basis for determining the operating events. The requirement to account for the vibratory effects will be a part of the purchase specifications via incorporation of the program requirements. Adverse piping vibration may occur due to disturbances or instabilities of the flow in the piping, depending upon the as-built piping configuration, including supports, and the operating (e.g., pumps, valves and SRVs) and non-operating (e.g., pressure reducing devices and flow restrictors) components in the system. DCD Tier 2 Subsection 3.9.2.1.1 includes requirements for preoperational and initial startup testing for piping vibrations. During this testing, piping vibration is corrected if it does not meet the acceptance criteria. In summary, the safety-related equipment is required to be qualified via purchase specifications for dynamic conditions, events, and loads, as addressed in DCD Tier 2 Sections 3.9 and 3.10. The staff found that the provisions in ABWR DCD Tier 2 Sections 3.9 and 3.10 and the clarification in the RAI response provide confidence that the effects of flow-induced vibration will be addressed during equipment qualification. **RAI 03.11-4** is therefore resolved and closed.

In Tier 1 departure T1 STD DEP T1 2.15-1, the applicant's evaluation in accordance with Section VIII.A.4 of Appendix A to 10 CFR Part 52, determined that the proposed revision in this departure of the maximum temperature limit for the reactor building safety-related diesel generator (DG) engine room—from 50 °C (122 °F) to 60 °C (140 °F) during the DG operation—does not affect the DG HVAC system or any safety-related equipment in the DG engine rooms. The applicant's process for evaluating departures and other changes to the DCD are subject to NRC inspections.

Currently, NRC staff cannot determine whether the applicant's findings are reasonable, whether the standard departure is consistent with Commission rules and regulations, and whether the departure has no adverse impact on public health and safety. In SER Section 8.3, NRC staff issued **RAI 08.03.01-14** requesting the applicant to clarify the potential impact of the proposed changes on the DG engine room equipment qualifications. The resolution of elevated temperature on equipment qualification will be addressed in Section 8.3 of this SER.

Site-Specific Supplemental Information

NRC staff reviewed the supplemental site-specific information regarding the Operational Program description of the STP Units 3 and 4. The transition of the EQ Program into an Operating Program is discussed STP COLA Section 3.11-7. Upon completion of construction and beginning with the first system startup activities, EQ document packages are turned over to STPNOC as systems are completed and accepted by STPNOC. Operational aspects for the EQ Operational Program are described in Section 3.11.7. The staff reviewed the site-specific supplemental information regarding the STP Units 3 and 4 EQP and issued the following RAIs:

RAI 03.11-5 (eRAI 3328-Question 13182): Clarify the plans for the commencement of the Environmental Qualification Program for mechanical and electrical/I&C equipment and its transition into the site-specific operating reactor program as described in Section 3.11.7 of the STP Units 3 and 4 FSAR.

RAI 03.11-6 (eRAI 3328-Question 13183): The applicant is requested to fully describe the proposed site-specific operational EQ Program for mechanical and electrical/I&C equipment (based on STP Units 1 and 2) in Subsection 3.11.7 of the STP Units 3 and 4 FSAR and note any differences with the EQ Program as approved by the NRC in NUREG-1503 and NEDE-24326-1-P, 1983. For mechanical components, also describe the qualification methods and record keeping requirements for the site-specific operational program. Also, state if this program will include equipment that is mechanical and electrical / I&C.

RAI 03.11-7 (eRAI 4668-Question 17716): Delete reference to STP Units 1&2 EQ program and fully describe the STP Units 3&4 program as discussed in RG 1.206 and SECY 05-0197.

The applicant responded in a letter dated October 12, 2009 (ML092890084).

In RAI 3.11-5, the applicant was requested to further describe the plans for the EQ Program and its transition into a site-specific operating program. By letter dated October 12, 2010, the applicant provided the following information: 1) The STP Units 3 and 4 EQ Program includes the operational program for EQ of safety-related mechanical and electrical/instrumentation and control (I&C) equipment. The procurement specifications incorporate the applicable requirements from the program; 2) A specification is attached to the purchase specifications, which provides the equipment vendors with the guidance/direction to prepare test plans, to perform the environmental qualification and submit the results of the testing in a structured EQ report for equipment. An environmental data sheet summarizing the environmental conditions that the equipment must be qualified to is also attached to the purchase specifications. These data sheets are prepared based on the equipment location in the plant, and the environmental data for that location as documented in the program. Both of these attachments to the procurement documents become a requirement for the vendors to demonstrate suitability of the supplied equipment; 3) The EQ reports will be reviewed as they become available. The review ensures that the vendor's EQ meets the procurement specification requirements, which include qualified life based on the environmental conditions, items/materials that may have a shelf life issue and items that must be replaced to maintain their qualification, when disturbed in the field or during normal maintenance/troubleshooting in the plant, such as o-ring replacement when a cover on a transmitter is removed; 4) The Environmental Qualification Document (EQD) will be prepared summarizing the qualification results for all safety-related electrical and mechanical equipment located in harsh environments. The EQD will include the following: (a) The test environmental parameters and the methodology used to qualify the equipment located in harsh environments will be identified, and (b) A summary of environmental conditions and qualified conditions for the safety-related equipment located in a harsh environment zone will be presented in the system component evaluation work sheets; 5) The approved records and reports from (3) above and the EQD will be entered into electronic searchable databases. These databases provide basis for the maintenance activities and insure that the equipment is identified that requires replacement based on shelf life, qualified life and maintenance activities; and 6) The EQ program will be implemented/utilized during construction, and will be completed for turnover to STPNOC by fuel load. NRC staff finds the information provided in RAI 3.11-5 response to further describe the plans for the EQ Program and its transition into a site-specific

operating program to be acceptable.In RAI 3.11-6, the applicant was requested to fully describe the proposed site-specific operational EQ Program. By letter dated October 12, 2010, the applicant described the program by reference to the STP Units 1 & 2 EQ Program. NRC staff identified in the Audit Report dated September 1, 2010, that the description of the STP EQ operational program should not reference the STP Units 1 & 2 EQ Program. **This is confirmatory item 3.11-3**.

In RAI 3.11-7, the applicant was requested to describe the operational aspects for the EQ Operational Program. By letter dated May 27, 2010, the applicant described operational aspects for the STP EQ Program and stated that Section 3.11-7 of the FSAR would be revised to include this information. **This is confirmatory item 3.11-4**.

The staff also reviewed the applicant's supplemental information in STP letter U7-C-STP NRC-090009 dated February 9, 2009. This supplemental information updates Tier 2 conformance tables in Section 1.9 to include RG 1.180 for I&C impact from electromagnetic interference and radio frequency interference (EMI/RFI), RG 1.209 for the EQ of computer-based I&C systems, and IEEE Std 323-1974 for general EQ requirements. The staff verified that the EQ and electromagnetic compatibility requirements for systems are included in the I&C ITAAC in FSAR Tier 1 Table 3.4. The staff thus found the requirements acceptable.

License Condition

STP Units 3 and 4 FSAR Section 13.4S indicates that FSAR Table 13.4S-1 lists each Operational Program, the regulatory source for each program, the associated implementation milestones, and the FSAR section in which the Operational Program is fully described, as discussed in RG 1.206. As listed in STP Units 3 and 4 COL FSAR Table 13.4S-1, Operational Program #3 is identified as the EQP, and it reflects a committed implementation milestone for this Operational Program as fuel loading. RG 1.206 Section C.IV.4.3 states that the COL will contain a license condition that requires the licensee to submit to the NRC a schedule, 12 months after issuance of the COL, that supports planning for and conducting NRC inspections of the operational programs. The schedule will be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until either the operational programs in FSAR Table 13.4S-1 have been fully implemented or the plant has been placed in commercial service, whichever comes first. NRC staff will prepare this license condition as part of the completion of the staff's review of the STP Units 3 and 4 COL application.

3.11.5 Post Combined License Activities

The COL licensee is responsible for defining the process and procedures for which the equipment qualification files will be accepted from the supplier, and how these files will be retained and maintained in an auditable format for the period that the equipment is installed and/or stored for future use in STP Units 3 and 4. The COL licensee is also responsible for implementing an administrative program to control revisions of EQ files when adding, modifying, or deleting equipment in the 10 CFR 50.49 EQP. Plant modifications and design-basis changes are subject to change process reviews (e.g., reviews in accordance with 10 CFR 50.59 or Section VIII of Appendix D to 10 CFR Part 52), in accordance with appropriate plant procedures.

As described in Section 3.11.4, the COL licensee will provide schedules to support NRC inspections of EQP Operational Program.

3.11.6 Conclusion

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to the EQ of mechanical and electrical equipment. With the exception of the **Confirmatory Items 03.11-1**, **03.11-2, 03.11-3, and 03.11-4**, no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the piping design review that were incorporated by reference have been resolved.

In addition, the staff compared the additional COL license information in the application to the relevant NRC regulations, the acceptance criteria defined in Section 3.11 of NUREG-0800, and other applicable NRC regulatory guides and concluded that the applicant is in compliance with the NRC regulations. COL license information items involving design specifications and as-designed reports will be adequately addressed by the applicant's ITAAC. However, as a result of the **Confirmatory Items 03.11-1**, **03.11-2, 03.11-3, and 03.11-4**, the staff was unable to finalize the conclusions relating to the piping design review, in accordance with the NRC requirement.

3.12 Piping Design Review

3.12.1 Introduction

This section of the FSAR covers the design of the piping system and piping support for Seismic Category I, Category II, and nonsafety-related systems. This section also discusses the adequacy of the structural integrity and the functional capability of the safety-related piping system, piping components, and their associated supports.

3.12.2 Summary of Application

The STP Units 3 and 4 COL FSAR differs from the format in the SRP. The title of Section 3.12 in the STP COL FSAR is "Tunnel." The evaluations of the main steam tunnel, safety-related tunnels, and nonsafety-related tunnels containing nonsafety-related equipment are in various sections of this report (Sections 3.4 and 3.8). The discussion on piping design in the STP FSAR is in Section 3.12S, "Piping Design Review," whereas the SRP review and acceptance criteria are in Section 3.12.

The design of the piping systems should ensure that they perform their safety-related functions under all postulated combinations of normal operating conditions, system operating transients, postulated pipe breaks, and seismic events. This design includes pressure-retaining piping components and their supports, buried piping, instrumentation lines, and the interaction of non-Seismic Category I piping and associated supports with Seismic Category I piping and associated supports. Also included are the design transients and resulting loads and load combinations, with appropriate and specified design and service limits for Seismic Category I piping and piping supports—including those designated as ASME Code Class 1, 2, and 3 and those not covered by the ASME Code.

In STP Units 3 and 4 COL FSAR Section 3.12S, "Piping Design Review," the applicant incorporates by reference ABWR DCD Revision 4. Table 7, "Piping Design Acceptance Criteria," of the "Introduction" of the DCD identifies the DCD subsections and the various criteria

associated with piping design for all classes of piping systems, piping components, and associated supports for the ABWR certified design. DCD Sections 3.7 and 3.9 are identified in Table 7 and address SRP Section 3.12, "ASME Code Class 1, 2, 3, Piping Systems, Piping Components and Their Associated Supports."

In addition, in various subsections of the COL FSAR, the applicant provides the following piping-related items:

COL License Information Items

- COL License Information Item 3.21 Piping Analysis, Modeling of Piping Supports

This COL license information item (described in Subsection 3.7.5.3 of the ABWR DCD and in the COL FSAR) addresses the needs described in DCD Subsection 3.7.3.3.1.6.

- COL License Information Item 3.7.5.5 Response Spectra Amplification at Support Attachment Points

This COL license information item is supplemental information provided by the applicant (described in Subsection 3.7.5.5 of the COL FSAR) to address the needs described in DCD Subsection 3.7.3.3.1.8.

- COL License Information Item 3.7.5.6 Modeling of Special Engineered Pipe Supports

This COL license information item is supplemental information provided by the applicant (described in Subsection 3.7.5.6 of the COL FSAR) to address the needs described in DCD Subsection 3.7.3.3.1.7.

- COL License Information Item 3.28 ASME Class 2 or 3 or Quality Group D Components with 60-Year Design Life

This COL license information item addresses the needs described in DCD Subsection 3.9.7.2.

- COL License Information Item 3.30 Audit of Design Specification and Design Reports

This COL license information item addresses the needs described in DCD Subsection 3.9.7.4.

3.12.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG–1503.

The regulatory basis for reviewing the COL license information items is in SRP Section 3.12.

The applicable regulatory requirements for the piping-design review are as follows:

- GDC 1, 2, 4, 14, and 15 of Appendix A to 10 CFR Part 50
- 10 CFR 50.55a
- Appendix S to 10 CFR Part 50
- 10 CFR 52.47(b)(1) and 52.80(a)

3.12.4 Technical Evaluation

As documented in NUREG–1503, NRC staff reviewed and approved Section 3.12 of the certified ABWR DCD. The staff reviewed Section 3.12S and the sections referenced in Section 3.12S of the STP Units 3 and 4 COL FSAR and checked the referenced DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the relevant information related to the piping design.

The staff reviewed the information in the COL FSAR:

COL License Information Items

- COL License Information Item 3.21 Piping Analysis, Modeling of Piping Supports

COL License Information Item 3.21, which is described in Subsection 3.7.5.3, clarifies that the method described in Subsection 3.7.3.3.1.6 of the DCD will be used to determine pipe support stiffness. Because there is no departure from the method described in the ABWR DCD, within the review scope of this section, NRC staff found this COL license information item acceptable.

- COL License Information Item 3.7.5.5 Response Spectra Amplification at Support Attachment Points

This COL license information item described in Subsection 3.7.5.5 of the STP COL FSAR is supplemental information stating that "the acceleration response spectra at piping attachment points are generated considering the drywell equipment and pipe support structure as part of the structure using the dynamic analysis methods described in Section 3.7.2." Because there is no departure from the method described in the ABWR DCD, within the review scope of this section, NRC staff found this COL license information item acceptable.

- COL License Information Item 3.7.5.6 Modeling of Special Engineered Pipe Supports

This COL license information item is described in Subsection 3.7.5.6 of the STP COL FSAR, is supplemental information, and clarifies that STP Units 3 and 4 will not be using any specially engineered pipe supports (energy absorbers and limit stops) described in Subsection 3.9.3.4.1(6) of the DCD. On the basis that the specially engineered pipe supports will not be used, the applicant does not have to address modeling methodology for these types of supports. Within the review scope of this section, NRC staff found this COL license information item acceptable.

- COL License Information Item 3.28 ASME Class 2 or 3 or Quality Group D Components with 60-Year Design Life

This COL License Information Item 3.28 is described in DCD Subsection 3.9.7.2 and identifies ASME Class 2 or 3 or Quality Group D components that will be subjected to cyclic loads, including operating vibration loads and thermal transient effects. As described in DCD

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3, for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

Subsection 3.9.3.1, the safety relief valve (SRV) discharge piping in the wetwell and the SRV quenchers are subject to severe thermal transients during SRV blowdown events. Therefore, the COL applicant will perform ASME Class 1 fatigue analyses of the ASME Class 3 SRV discharge piping in the wetwell and in the SRV quenchers.

The applicant states that the analysis will be available for review before fuel loading (COM 3.9-2). Because the applicant will address this item in a manner consistent with the ABWR DCD and through the piping design acceptance criteria, the design will not be completed until after licensing. Within the review scope of this section, NRC staff found this COL license information item acceptable.

- COL License Information Item 3.30 Audit of Design Specification and Design Reports

This COL License Information Item 3.30 is described in DCD Subsection 3.9.7.4. The applicant states that the design specification and design reports required by the ASME Code for vessels, pumps, valves, and piping systems for the purposes of audit will be made available to NRC staff for review. Because the applicant will address this item in accordance with the ABWR DCD, within the review scope of this section, the staff found this COL license information item acceptable.

For piping systems, ITAAC Item No. 1 in ABWR DCD Tier 1, Section 3.3 indicates that an ASME Code Certified Stress Report exists for the piping system and concludes that the design complies with the requirements of ASME Code Section III. The staff recognized that piping DAC were used in the ABWR design. According to RG 1.206 Section C.III.5.1, the applicant should supply the NRC with a schedule for the completion of detailed engineering information, in a manner to support a timely NRC inspection of DAC information. The staff issued **RAI 03.12-2 (eRAI 3019–Question 12231)** requesting the applicant to provide a piping DAC completion schedule. The applicant's response to **RAI 03.12-2 (eRAI 3019–Question 12231) (**letter dated August 12, 2009, [ML092260198]) indicates that design reports for all ASME Code Class 1, 2, and 3 piping systems will be completed by the end of the second quarter of 2012, and the date is subject to a potential future adjustment. Under 10 CFR 52.99(a), the licensee is required to submit a schedule for completing the analyses in the ITAAC and updates to the ITAAC schedule. On the basis of the applicant's submitted schedule and 10 CFR 52.99(a) update requirements, the staff concluded that there will be sufficient time for the staff to plan the piping DAC completion review.

The applicant also states that the piping system design is consistent with construction practices, including inspection and examination methods, of the ASME Code (1989 Edition) with no addenda. ASME Code editions and addenda, other than those listed in Table 1.8-21 and Table 3.2-3, will not be used to design ASME Code Class 1, 2, and 3 pressure-retaining components and supports. Because the applicant has addressed this item in a manner consistent with the certified ABWR DCD, the staff found this COL license information item acceptable.

The staff also reviewed piping-related items in ABWR DCD Subsection 3.8.5.4, which states that settlement of the foundations—and differential settlement between foundations for the site-specific foundation media—will be calculated and safety-related systems (e.g., piping, conduit, etc.) will be designed for the calculated settlement of the foundations.

The staff issued **RAI 03.12-1 (eRAI 2812–Question 11350)** requesting the applicant to describe the process of designing the safety-related piping systems for the calculated site-specific

settlement of the foundations. The description shall be updated in the FSAR to address pipe stress design criteria and pipe support load combinations for the site-specific settlement in piping systems.

The applicant's response to **RAI 03.12-1** (dated August 12, 2009, [ML092260198]) provides building settlement piping stress criteria that are in accordance with ASME Code Subsections NB/NC/ND-3600, which address the effects of any single non-repeated anchor movement requirements. The applicant states that the pipe support loads due to foundation (building) settlement shall be considered normal loads and shall be included in all service level load combinations. The applicant also proposes to revise Table 3.9-2 of the COL FSAR. On the basis that the building settlement piping stress criteria are addressed, are in compliance with the ASME Code, and the support load is considered, the staff found this response acceptable. Verification of the proposed revision to Table 3.9-2 of the COL FSAR is being tracked as **Confirmatory Item 03.12-1**.

3.12.5 Post Combined License Activities

There are no post COL activities related to this section.

3.12.6 Conclusion

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to the piping design review. With the exception of the **Confirmatory Item 03.12-1**, no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the piping design review that were incorporated by reference have been resolved.

In addition, the staff compared the additional COL license information in the application to the relevant NRC regulations, the acceptance criteria defined in Section 3.12 of NUREG-0800, and other applicable NRC regulatory guides and concluded that the applicant is in compliance with the NRC regulations. COL license information items involving design specifications and as-designed reports will be adequately addressed by the applicant's ITAAC. However, as a result of the **Confirmatory Item 03.12-1**, the staff was unable to finalize the conclusions relating to the piping design review, in accordance with the NRC requirement.

3.13 Secondary Containment and Divisional Separation Zones – Barrier Considerations

3.13.1 Introduction

This section of the FSAR addresses the defense-in-depth concept to the plant buildings and structures. This section also describes the fission product barriers inherent in the ABWR design; the multiple divisions; and special, physical, electrical, and environmental arrangements.

3.13.2 Summary of Application

Section 3.13 of the STP Units 3 and 4 COL FSAR incorporates by reference Section 3.13 of the certified ABWR DCD, Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 3.13, the applicant provides the following:

Tier 1 Departure

- STD DEP T1 3.4-1 Safety-Related I&C Architecture

The applicant provides editorial changes affected by this departure in Section 3.13 of the COL FSAR.

3.13.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG–1503.

In accordance with Section VIII, "Processes and Changes and Departures" of, "Appendix A to Part 52--Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies one Tier 1 departure requiring prior NRC approval. This departure is subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.A.

3.13.4 Technical Evaluation

NUREG–1503 was issued in July 1994 when NRC staff reviewed and approved the certified ABWR DCD. Section 3.13 was not in the SSAR and was not part of the FSER. However, the purpose of Section 3.13 is not to introduce new design information, but to summarize the design features that provide divisional separation zones and barriers. The staff reviewed Section 3.13 of the STP Units 3 and 4 COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this section.

The staff reviewed the information in the COL FSAR:

Tier 1 Departure

- STD DEP 3.4-1 Safety-Related I&C Architecture

The changes in Section 3.13 of the STP Units 3 and 4 COL FSAR resulting from this Tier 1 departure are nomenclature changes. The technical evaluation of this departure is in Chapter 7 of this SER.

3.13.5 Post Combined License Activities

There are no post COL activities related to this section.

3.13.6 Conclusion

NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information, and no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52 Appendix A, Section VI.B.1, all nuclear safety issues relating to

[1] See *"Finality of Referenced NRC Approvals"* in SER Section 1.1.3, for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

the “Secondary Containment and Divisional Separation Zones – Barrier Considerations” that were incorporated by reference have been resolved.

3.13S Threaded Fasteners (ASME Code Class 1, 2, and 3)

3.13S.1 Introduction

This section provides supplemental information for ASME Code Class 1, 2, and 3 threaded fasteners to address material selection, special materials fabrication processes and special controls, fracture toughness requirements for threaded fasteners made of ferritic materials, certified material test reports (quality records), and inservice inspection (ISI) requirements. The supplemental information addresses the guidance in RG 1.206, Section C.III.1, Chapter 3, C.I.3.13, “Threaded Fasteners – ASME Code Class 1, 2, and 3," for information needed in a COL application referencing a certified design.

3.13S.2 Summary of Application

Section 3.13S of the STP Units 3 and 4 COL FSAR, “Threaded Fasteners - ASME Code Class 1, 2, and 3,” provides supplemental information to comply with the guidance in RG 1.206, Section C.III.1, Chapter 3, C.I.3.13. This section of the COL FSAR includes Section 3.13S.1, “Design Considerations”; Section 3.13S.2, “Inservice Inspection Requirements”; and Section 3.13S.3, “Quality Records.” These supplemental FSAR sections address material selection, special materials fabrication processes and special controls, fracture toughness requirements for threaded fasteners made of ferritic materials, certified material test reports (quality records), and ISI requirements.

3.13S.3 Regulatory Basis

The relevant requirements of the Commission’s regulations for the threaded fasteners (ASME Codes 1, 2, and 3), and the associated acceptance criteria, are listed in Section 3.13 of NUREG–0800.

The relevant regulatory requirements for reviewing the supplemental information are as follows:

- GDC 1, 4, 14, 30, and 31 of Appendix A to 10 CFR Part 50
- 10 CFR 50.55a
- Appendix G to 10 CFR Part 50

3.13S.4 Technical Evaluation

NRC staff reviewed the conformance of the supplemental information in Section 3.13S of the STP COL FSAR to the guidance in RG 1.206, Section C.III.1, Chapter 3, C.I.3.13 for material selection, special materials fabrication processes and special controls, fracture toughness requirements for threaded fasteners made of ferritic materials, certified material test reports (quality records), and ISI requirements. The staff’s evaluation of Section 3.13S is stated below:

Material Selection:

Material selection is acceptable if the applicant (1) provides information pertaining to the selection of materials and material testing of threaded fasteners, (2) indicates the extent of conformance and justifies any exceptions to applicable codes or standards, and (3) discusses

the material testing used to establish the fracture toughness of the materials for threaded fasteners made from ferritic steels (i.e., low-alloy steel or carbon grades).

In Section 3.13S.1.1 of the STP Units 3 and 4 COL, the applicant discusses material selection for threaded fasteners. The applicant states that the material used for threaded fasteners complies with the requirements of the ASME Boiler and Pressure Vessel (B&PV) Code Section III NB-2000, NC-2000, ND-2000, or NF-2000, as appropriate. In addition, the applicant notes that fracture toughness testing is performed in accordance with ASME B&PV Code Section III NB-2300, NC-2300, or ND-2300, as appropriate. The B&PV Code sections referenced by the applicant provide requirements for material selection, material testing, and fracture toughness testing for threaded fasteners. The applicant does not address any exceptions to applicable codes or standards. Based on the above information, NRC staff found that the supplemental information for material selection meets the guidance in RG 1.206, Section C.III.1, Chapter 3, C.I.3.13 and is therefore acceptable.

Special Materials Fabrication Processes and Special Controls:

Special materials fabrication processes and special controls are acceptable if the applicant (1) provides information pertaining to the fabrication of threaded fasteners, (2) identifies particular fabrication practices or special processes used to mitigate the occurrence of stress-corrosion cracking or other forms of material degradation in the fasteners during service, (3) discusses any environmental considerations in selecting the materials used to fabricate threaded fasteners, and (4) discusses the use of lubricants and/or surface treatments in mechanical connections that are secured by threaded fasteners.

In Section 3.13S.1.2 of the STP Units 3 and 4 COL, the applicant discusses special materials fabrication processes and special controls. The applicant states that the design of threaded fasteners complies with ASME B&PV Code Section III NB-3000, NC-3000, or ND-3000, as appropriate, and the guidance in EPRI NP-6316, "Guidelines for Threaded-Fastener Application in Nuclear Power Plants." The applicant states that the fabrication of threaded fasteners complies with ASME B&PV Code Section III NB-4000, NC-4000, or ND-4000, as appropriate, and the guidance in EPRI NP-6316. Section 5.3.1 of the ABWR DCD references RG 1.65, which addresses environmental considerations for selecting the materials used to fabricate reactor pressure vessel fasteners. Lubricants with deliberately added halogens, sulfur, or lead are not to be used for any reactor coolant pressure boundary components or other components in contact with reactor water. Lubricants containing molybdenum sulfide (disulfide or polysulfide) are not to be used for any safety-related application. For ferritic steel threaded fasteners, conversion coatings such as the parkerizing process are suitable and may be used. If fasteners are plated, low melting point materials (such as zinc, tin, and cadmium, etc.) are not to be used.

Based on the above information, NRC staff found that the supplemental information for special materials fabrication processes and special controls meets the guidance in RG 1.206, Section C.III.1, Chapter 3, C.I.3.13, and is therefore acceptable.

Fracture Toughness Requirements for Threaded Fasteners Made of Ferritic Materials:

Fracture toughness requirements for threaded fasteners made of ferritic materials are acceptable for threaded fasteners in ASME Code Class 1 systems that are fabricated from ferritic steels if the applicant (1) discusses the fracture toughness tests performed on the

threaded fasteners, and (2) demonstrates compliance with the acceptance criteria in Appendix G to 10 CFR Part 50.

In Section 3.13S.1.3 of the STP Units 3 and 4 COL, the applicant discusses fracture toughness requirements for threaded fasteners made of ferritic materials. The applicant states that fracture toughness testing is performed and Certified Material Test Reports (CMTRs) are generated when ferritic material is purchased in accordance with the detail design specifications of the project. The applicant also states that fracture toughness testing is performed in accordance with NB-2300, NC-2300, or ND-2300, as appropriate.

Appendix G to 10 CFR Part 50 references the fracture toughness requirements in Appendix G of Section XI of the ASME Code, which states that tests and acceptance standards of Section III, Division 1 are considered adequate. NB-2300, NC-2300, and ND-2300 of Section III, Division 1 of the ASME Code, as referenced by the applicant, provide fracture toughness requirements for bolting.

Based on the above information, NRC staff found that the supplemental information for fracture toughness requirements for threaded fasteners made of ferritic materials (1) complies with the acceptance criteria in Appendix G to 10 CFR Part 50, and (2) meets the guidance in RG 1.206, Section C.III.1, Chapter 3, C.I.3.13 and is therefore acceptable.

Certified Material Test Reports (Quality Records):

The CMTRs are acceptable if the applicant summarizes the material fabrication results and the material property test results in the CMTRs, pursuant to Section III of the ASME Code, Division 1.

In Section 3.13S.3 of the STP Units 3 and 4 COL, the applicant discusses the CMTRs. The applicant states that the CMTRs will be retained in accordance with the requirements of the Quality Assurance Program. The applicant also states that the CMTRs will identify the material specifications and the applicable associated material properties tests and inspections.

Based on the above information, NRC staff found that the supplemental information for the CMTRs meets the guidance in RG 1.206, Section C.III.1, Chapter 3, C.I.3.13 and is therefore acceptable.

Inservice Inspection Requirements:

ISI requirements are acceptable if the applicant demonstrates compliance with the ISI requirements of 10 CFR 50.55a and Section XI of the ASME Code, Division 1.

Section 3.13S.2 of the STP Units 3 and 4 COL discusses ISI requirements. The applicant states that the ISI is performed in accordance with ASME Code Section XI and discusses specific ASME Section XI inspection criteria for threaded fasteners. The ISI program in FSAR Section 5.2.4 includes the inspection of threaded fasteners; the program complies with NRC regulations in 10 CFR 50.55a and ASME Code Section XI. Specifically for fasteners, the requirements for pressure-retaining Class 1 bolting are labeled Category B-G-1 for bolting greater than 2 inches in diameter and Category B-G-2 for bolting 2 inches and less in diameter. The Class 1 pressure-retaining bolting sample is limited to the bolting on the heat exchangers, piping, pumps, and valves that are selected for examination in the ISI program. Category B-G-1 includes volumetric and/or surface examination of the bolt or stud, depending on whether the

bolt is examined in-place or removed. Category B-G-2 requires a visual, VT-1, examination of the selected bolting. For Class 2 and 3 systems (as well as the Class 1 systems), the bolted connections are examined for leakage (VT-2) during the system pressure tests that are required by ASME Section XI. Fasteners that are part of component supports are visually examined (VT-3) as part of their inservice examination.

Based on the above information, NRC staff found that the supplemental information for ISI requirements meets the inservice inspection requirements of 10 CFR 50.55a and ASME Code Section XI and is therefore acceptable.

3.13S.5 Post Combined License Activities

There are no post COL activities related to this section.

3.13S.6 Conclusion

The staff concluded that the supplemental information pertaining to STP COL FSAR Section 3.13S appropriately provides design considerations, ISI requirements, and quality records for ASME Code Class 1, 2, and 3 fasteners and therefore satisfies GDC 1, 4, 14, 30 and 31, and the regulatory requirements described in Section 3.13S.3.

The staff's review confirmed that the applicant has addressed the relevant information and no outstanding information is expected to be addressed in the COL FSAR related to this section.