7.0 INSTRUMENTATION AND CONTROLS

Nuclear power plant instrumentation senses various plant parameters and transmits appropriate signals to the control systems during normal operation and to the reactor trip and initiate engineered safety feature (ESF) systems during abnormal and accident conditions. The information in this chapter emphasizes those instruments and associated equipment that constitute the protection and safety systems. Every chapter in the Final Safety Analysis Report (FSAR) provides relevant information concerning the instrumentation and control (I&C) systems.

Sections 7.1 through 7.8 and Appendices 7A, "Design Response to Appendix B, ABWR LRB Instrumentation and Controls," 7B, "Implementation Requirements for Hardware/Software Development," and 7C, "Defense Against Common-Mode Failure in Safety Related, Software-Based I&C Systems," of the South Texas Project (STP), Units 3 and 4, combined license (COL) FSAR Revision 12, incorporates by reference the corresponding sections in Chapter 7, "Instrumentation and Controls," of the certified Advanced Boiling-Water Reactor (ABWR) design control document (DCD), Revision 4, referenced in Title 10 of the Code of Federal Regulations (10 CFR) Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," Appendix A, "Design Certification Rule for the U.S. Advanced Boiling Water Reactor," with departures identified under each section. Tier 1 Departure STD DEP T1 3.4-1, "Safety Related I&C Architecture," requires prior U.S. Nuclear Regulatory Commission (NRC) approval and significantly impacts the content of this chapter. This departure describes the changes required to the I&C architecture and nomenclature to address obsolete data communication technology in the certified ABWR DCD. In addition, this departure addresses the changes resulting from the selection of digital I&C (DI&C) platforms. As allowed by the certified ABWR DCD, the applicant has elected to utilize the design acceptance criteria (DAC)/inspections, tests, analyses, and acceptance criteria (ITAAC) process for developing the detailed DI&C design. Accordingly, the applicant has provided the I&C system design information along with the required DAC/ITAAC for developing the I&C system design details. The following site-specific COL FSAR sections supplement the I&C design information:

- Section 7.1S "Instrumentation and Control Platforms."
- Section 7.6S "Interlock Systems Important to Safety."
- Section 7.8S "Diverse Instrumentation and Control Systems."
- Section 7.9S "Data Communication Systems."

The departures affecting the certified ABWR DCD Tier 2, Chapter 7 are evaluated under each section of this chapter. The I&C departures affecting the certified ABWR DCD Tier 1, Chapters 2 and 3 are evaluated in Safety Evaluation Report (SER) Subsections 7.1.3, "Control and Instrumentation Systems – Tier 1 Design Descriptions (Parts of STP Units 3 and 4 Tier 1 FSAR Chapters 2 and 3) (There is no related section in Regulatory Guide 1.206)," and 14.3S, "Inspections, Tests, Analyses and Acceptance Criteria (ITAAC)." Separately, STP Nuclear Operating Company (STPNOC) submitted WCAP-17119-P, Revision 2, "Methodology for South Texas Project Units 3 and 4 – ABWR Technical Specification Setpoints." This report is evaluated in Section 7.1.4, "Instrument Setpoint Methodology," of this SER.

7.1 Introduction

This section of the FSAR identifies safety-related systems and related safety criteria.

The applicant incorporates by reference, Section 7.1 of the certified ABWR DCD referenced in 10 CFR Part 52, Appendix A, including all subsections, tables, and figures. The applicant identifies the following departures from the certified design:

- STD DEP T1 2.3-1 — Deletion of MSIV Closure and Scram on High Radiation.
- STD DEP T1 2.14-1 — Hydrogen Recombiner Requirements Elimination (Table 7.1-1).
- STD DEP T1 3.4-1 — Safety-Related I&C Architecture (Figures 7.1-1 and 7.1-2).
- STD DEP 1.8-1 — Tier 2* Codes, Standards, and Regulatory Guide Edition Changes (Table 7.1-2).
- STD DEP 7.1-1 — References to Setpoints and Allowable Values.
- STD DEP 7.1-2 — ATWS DB for Startup Range Neutron Monitoring.
- STD DEP 7.4-1 — Alternate Rod Insertion (ARI) Function Description.
- STD DEP Admin — Administrative Departures (Table 7.1-1).

The acceptance criteria and regulatory basis in NUREG–0800, Chapter 7 are incorporated by reference into the DCD for the ABWR design and the FSER in NUREG–1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor." Reviews of departures from the certified design that require the NRC's review and approval are based on the current regulatory requirements, acceptance criteria, and guidelines in NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, (LWR Edition)," the Standard Review Plan (SRP), Table 7-1, "Regulatory Requirements, Acceptance Criteria, and Guidelines for Instrumentation and Control Systems Important to Safety," Revision 5 (March 2007). In accordance with 10 CFR 50.55a(h), COL applications (COLAs) filed on or after May 13, 1999, which depart from the referenced certified design material (CDM), must meet the requirements for safety systems in the Institute of Electrical and Electronics Engineers (IEEE) Standard (Std) 603–1991 and in the correction sheet dated January 30, 1995. In addition, applicable guidelines in the following DI&C Interim Staff Guidance (ISG) documents are also used to evaluate the departures from the certified ABWR design:

- DI&C-ISG-02, "Interim Staff Guidance on Digital Instrumentation and Control, Diversity and Defense-in-Depth Issues," Revision 2, dated June 5, 2009;
- DI&C-ISG-03, "Interim Staff Guidance on Review of New Reactor Digital Instrumentation and Control Probabilistic Risk Assessments," Revision 0, dated August 11, 2008;

- DI&C-ISG-04, “Interim Staff Guidance on Highly-Integrated Control Rooms - Communications Issues (HICRc),” Revision 1, dated March 6, 2009, and

- DI&C-ISG-05, “Interim Staff Guidance on Highly-Integrated Control Rooms – Human Factors Issues (HICR-HF),” Revision 1, dated November 3, 2008.

7.1.1 Identification of Safety-Related Systems

7.1.1.1 *Introduction*

This section of the FSAR addresses I&C systems that are designated as either nonsafety-related systems or safety-related systems, depending on their function. Some portions of a system may have a safety function, while other portions of the same system may be classified as nonsafety-related. The systems are classified into the following five categories: (1) reactor protection (trip) system (RPS), (2) ESF systems, (3) systems required for a safe shutdown, (4) safety-related display instrumentation, and (5) all other instrumentation systems required for safety.

7.1.1.2 *Summary of Application*

Section 7.1.1, “Identification of Safety-Related Systems,” of the STP, Units 3 and 4, COL FSAR Revision 12 incorporates by reference Section 7.1.1 of the certified ABWR DCD Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 7.1.1, the applicant provides the following:

Tier 1 Departure Requiring Prior NRC Approval

- STD DEP T1 3.4-1 — Safety-Related I&C Architecture (Figure 7.1-1)

This departure describes changes to the I&C architecture and nomenclature that are needed to address obsolete data communication technology and the selection of DI&C platforms.

Tier 2 Departures Not Requiring Prior NRC Approval

- STD DEP 7.4-1 — Alternate Rod Insertion (ARI) Function Description

This departure provides a clear and concise understanding of the ARI function.

- STD DEP Admin

The administrative departures are defined as minor corrections, such as editorial or administrative errors in the referenced ABWR DCD (e.g., misspelled words, incorrect references, table headings, etc.). The applicant identifies one administrative departure in Subsection 7.1.1.3.9, “HVAC Emergency Cooling Water System.”

7.1.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is in NUREG–1503, “Final Safety Evaluation Report Related to the Certification of the Advanced Boiling-Water Reactor Design,” (July 1994) (FSER related to the ABWR DCD). In addition, the relevant requirements

of the Commission regulations for identification of safety-related systems, and the associated acceptance criteria, are in Section 7.1 of NUREG-0800.

In accordance with Section VIII, "Processes for Changes and Departures," of Appendix A to 10 CFR 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.

Departures from the certified design are reviewed based on the current regulatory requirements, acceptance criteria, and guidelines in NUREG–0800, Section 7.1-T, (Table 7-1), Revision 5 (March 2007).

In addition, in accordance with 10 CFR 50.55a(h), COLAs filed on or after May 13, 1999, which depart from the referenced CDM, must meet the requirements for safety systems in IEEE Std 603–1991 and in the correction sheet dated January 30, 1995. In addition, applicable guidelines in DI&C-ISG-02, DI&C-ISG-03, DI&C-ISG-04, and DI&C-ISG-05 are also used to evaluate departures from the certified ABWR design.

7.1.1.4 *Technical Evaluation*

As documented in NUREG–1503, the staff reviewed and approved Section 7.1.1 of the certified ABWR DCD. The staff reviewed Section 7.1.1 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 following information in the COL FSAR:

Tier 1 Departure Requiring Prior NRC Approval

The following Tier 1 departure identified by the applicant in this section requires prior NRC approval, and the full scope of its technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0, "Tables and Indexes," for a listing of all FSAR sections affected by this Tier 1 departure.

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

This departure is divided into the following five primary changes in the I&C architecture:

- Elimination of obsolete data communication technology.
- Elimination of unnecessary inadvertent actuation prevention logic and equipment.
- Clarifications of digital controls nomenclature and systems.
- Final selection of platforms that changed the implementation architecture.

[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.

- Identification of testing and surveillance changes.

In COLA Part 7, "Departures Report," Section 2.1, "Tier 1 and Tier 2* Departures from the DCD," the applicant describes and evaluates this departure per the requirements in Section VIII.A.4 of Appendix A to 10 CFR Part 52. Categories 1 and 3 of this departure are relevant to the changes in FSAR Subsection 7.1.1.1 and Figure 7.1-2, "Assignment of Interfacing Safety System Logic to SSLC Controllers." Changes in FSAR, Subsection 7.1.1.1 are based on Departure STD DEP T1 3.4-1, which includes the elimination of obsolete data communication technology. As described in the Departures Report for STD DEP T1 3.4-1, proposed data communication functions are inherent in the proposed digital platforms (ESF logic and control system (ELCS), neutron monitoring system (NMS), reactor trip and isolation system (RTIS), plant information and control system (PICS), etc.) and therefore, they are separate and independent from each DI&C system and division within the systems. Also, as depicted in FSAR Figure 7C-1, "Implementation of Additional Diversity in SSLC to Mitigate Effects of Common-Mode Failures," communication between the various safety system logic and control (SSLC) units follows a point-to-point configuration. Whereas the certified ABWR design is based on a common data communication (multiplexer) system that is to be used by multiple DI&C systems, the staff found that minimal changes made to the text (i.e., from the essential multiplexing system (EMS) to the essential communication function (ECF)) in this section failed to clearly communicate the description of significantly different data communication features and technology. For instance, the stated description referred to data highways for sensor input to the logic units (and other such units, etc.), which contradicts the point-to-point configuration setup of the proposed SSLC communication functions and features. With such significant changes to the data communication system, the applicant was requested in Request for Additional Information (RAI) 07.01-5 to provide a relevant and applicable description that is consistent with the proposed DI&C platforms.

In its response to the staffRAI 07.01-5 dated September 15, 2009 (ML092600154), and RAI 07.01-9 dated August 27, 2009 (ML092430132), and in the revised response to RAI 07-6 dated December 30, 2009 (ML100050181), the applicant updated FSAR Sections 7.1.1 and 7.1.1.1 and provides a new site-specific FSAR Section, 7.1S, which describes the safety-related DI&C platforms, including their data communications capabilities. The staff reviewed these responses and found that the proposed FSAR changes adequately capture the design information of the safety-related I&C platforms and associated ECFs. The responses are therefore acceptable. For technical and regulatory compliance evaluations of the RTIS, ELCS, and ECF designs described in the COLA, including the new site-specific FSAR Section 7.1S, refer to Sections 7.2, "Reactor Protection (Trip) System (RPS) – Instrumentation and Controls, (Related to Regulatory Guide 1.206, Section C.I.7.2, "Reactor Trip System")," 7.3, "Engineered Safety Feature Systems, Instrumentation, and Control," and 7.9S, "Data Communications System," of this SER. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.01-5 is closed.

Based on Departure STD DEP T1 3.4-1, the applicant significantly modifies ABWR DCD Tier 2, Figure 7.1-2, "Assignment of Interfacing Safety System Logic to SSLC Controllers." However, the applicant did not provide any explanations for the changes in the FSAR or in the Departures Report. In its response to RAI 07.01-6 dated August 27, 2009 (ML092430132), the applicant revised FSAR Tier 2, Figure 7.1-2, which is included in COLA Revision 3. The applicant also explains the changes in FSAR Figure 7.1-2. In addition, in its revised response to RAI 07-6 dated December 30, 2009 (ML100050181), the applicant provides a supplemental design description of the SSLC platforms that corresponds to revised FSAR Figure 7.1-2. Except for

editorial errors in the revised figure, the staff found the applicant's response acceptable. The staff noted that the assignment of the interfacing safety system logic to SSLC controllers remains unchanged and is the same as in the ABWR DCD. Other than the nomenclature changes, one significant change in FSAR Figure 7.1-2 eliminates the redundant safety logic functions (SLFs) within a division. For the technical evaluation of the RTIS, ELCS (specifically, elimination of unnecessary inadvertent actuation prevention logic and equipment), and ECF, see SER Sections 7.2, 7.3, and 7.9S. As per above discussion, the staff found RAI 07-6 response acceptable. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5 and Revision 6 including editorial corrections in FSAR Figure 7.1-2. Therefore, RAI 07-6 is closed. The evaluation of the RAI 07.01-9 response is provided in Section 7.1.2, "Identification of Safety Criteria," of this SER.

Tier 2 Departures Not Requiring Prior NRC Approval

The following Tier 2 Departures Not Requiring Prior NRC Approval identified by the applicant in this section may also be evaluated in other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these departures.

- STD DEP 7.4-1 Alternate Rod Insertion (ARI) Function Descriptions

The applicant revises FSAR Tier 2, Subsection 7.1.1.4.1, "Alternate Rod Insertion Function (ARI)," based on Tier 2 Departure STD DEP 7.4-1, which does not require prior NRC approval. This FSAR change clarifies the ARI features and functions.

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. The staff evaluated the changes to FSAR Subsection 7.1.1.4.1 and found that the applicant has adequately addressed this departure. Within the review scope of this section, the staff found it reasonable that this departure does not require prior NRC approval. For additional discussions of this departure, see SER Section 7.4, "Systems Required for Safe Shutdown."

- STD DEP Admin

In FSAR Subsection 7.1.1.3.9, the applicant changes the supply of heating ventilation and air conditioning (HVAC) emergency cooling water from "diesel generator cooling coils" to "reactor building essential electrical equipment rooms," based on an administrative departure (STD DEP Admin). In the COLA Departure Report (Part 7 of COLA), administrative departures are defined as minor corrections, such as editorial or administrative errors in the referenced ABWR DCD (e.g., misspelled words, 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.

The staff reviewed the information and concluded that the changes to Subsection 7.1.1.3.9 are beyond administrative in nature and issued RAI 07.01-7. In its response to RAI 07.01-7 dated August 27, 2009 (ML092430132), the applicant justifies this administrative change on the bases of consistency with the design basis for the HVAC emergency cooling water described in FSAR Tier 2, Subsection 9.2.13.1.2(1) and Figure 9.4-4, "R/B Safety-Related Electrical Equipment HVAC System." Because diesel generators are located in the reactor building, this administrative departure ensures consistency with other parts of the FSAR. Therefore, the staff found the applicant's response acceptable, and this RAI is closed. Within the review scope of

this section, the staff found it reasonable that this departure does not require prior NRC approval.

7.1.1.5 *Post Combined License Activities*

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

7.1.1.6 *Conclusion*

The 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 identification of safety-related systems, 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 10 CFR Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the identification of safety-related systems that were incorporated by reference have been resolved.

In addition, the staff compared the additional information in the COLA to the relevant NRC regulations and the guidance in Section 7.1 of NUREG–0800. The staff's review concluded that the applicant has adequately addressed the Tier 1 departure in accordance with Section 7.1 of NUREG–0800, and 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. The staff concludes that the applicant has provided sufficient information to satisfy NRC requirements.

7.1.2 Identification of Safety Criteria

7.1.2.1 *Introduction*

This section of the FSAR addresses design bases and criteria for the I&C equipment design based on the need for each system to perform its intended function, while meeting the requirements of applicable general design criteria (GDC), RGs, industry standards, and other documents.

The safety-design basis for a safety system states, in functional terms, the unique design requirements that establish the limits within which the safety objectives shall be met. The general functional requirement portion of the safety-design basis presents those requirements determined to be sufficient for ensuring the adequacy and reliability of the system from a safety perspective. Many of these requirements have been incorporated into various codes, criteria, and regulatory requirements.

7.1.2.2 *Summary of Application*

Section 7.1.2 of the STP, Units 3 and 4, COL FSAR Revision 12 incorporates by reference Section 7.1.2 of the certified ABWR DCD Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 7.1.2, 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 deletes the scram and the main steam isolation valve (MSIV) automatic closure on high main steamline radiation.

- STD DEP T1 2.14-1 — Hydrogen Recombiner Requirements Elimination (Table 7.1-1)

This departure eliminates the requirements for hydrogen control systems to mitigate a design-basis loss-of-coolant accident (LOCA) hydrogen release.

- STD DEP T1 3.4-1 — Safety-Related I&C Architecture (Figures 7.1-1, 7.1-2)

This departure describes changes to the I&C architecture and nomenclature that are needed to address obsolete data communication technology and the selection of DI&C platforms.

Tier 2 Departure*

- STD DEP 1.8-1 — Tier 2* Codes, Standards, and Regulatory Guide Edition Changes (Table 7.1-2)

This departure identifies Tier 2* items in FSAR Tier 2, Tables 1.8-20, "NRC Regulatory Guides Applicable to ABWR," and 1.8-21, "Industrial Codes and Standards Applicable to ABWR," which are being updated to current revisions/editions.

Tier 2 Departures Not Requiring Prior NRC Approval

- STD DEP 7.1-1 — References to Setpoints and Allowable Values

The purpose of this departure is to clarify in the FSAR that wherever the technical specifications (TS) are referenced for setpoints or margins, the correct reference is to the methods for calculating setpoints and margins as described in the TS.

- STD DEP 7.1-2 — ATWS DB for Startup Range Neutron Monitoring

This departure clarifies the understanding of the ARI functional requirements and safety-design basis for the startup range neutron monitoring (SRNM) and the average power range monitor (APRM), which provide anticipated transient without scram (ATWS) permissive signals to the ELCS.

- STD DEP Admin — Administrative Departures (Table 7.1-1)

Administrative departures are defined as minor corrections, such as editorial or administrative errors, in the referenced ABWR DCD (e.g., misspelled words, incorrect references, table headings, etc.). The applicant identifies one administrative departure in Subsection 7.1.2.8, "Independence of Safety-Related Systems," which corrects a referenced subsection number.

7.1.2.3 *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 identification of safety criteria, and the associated acceptance criteria, are in Section 7.1 of NUREG–0800.

In accordance with Section VIII, "Processes for Changes and Departures," of Appendix A to 10 CFR Part 52, "Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies Tier 1, Tier 2*, 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 require prior NRC approval and are subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.B.6. 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 design departures are satisfied based on meeting the current regulatory requirements, acceptance criteria, and guidelines in NUREG–0800, Table 7-1, Revision 5 (March 2007).

In accordance with 10 CFR 50.55a(h), COLAs filed on or after May 13, 1999, which depart from the referenced CDM, must meet the requirements for safety systems in IEEE Std 603–1991 and in the correction sheet dated January 30, 1995. In addition, applicable guidelines in Digital I&C-ISG Documents DI&C-ISG-02, DI&C-ISG-03, DI&C-ISG-04, and DI&C-ISG-05 are also used to evaluate the departures from the certified ABWR design.

7.1.2.4 *Technical Evaluation*

As documented in NUREG–1503, the staff reviewed and approved Section 7.1.2 of the certified ABWR DCD. The staff reviewed Section 7.1.2 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 required information relating to this section.

The staff reviewed the following information in the COL FSAR:

Tier 1 Departures

The following Tier 1 departures identified by the applicant in this section require prior NRC approval, and the full scope of their technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these Tier 1 departures.

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

This departure is divided into the following five primary changes in the I&C architecture:

[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.

- Elimination of obsolete data communication technology.
- Elimination of unnecessary inadvertent actuation prevention logic and equipment.
- Clarifications of digital controls nomenclature and systems.
- Final selection of platforms changed the implementation architecture.
- Testing and surveillance changes.

The applicant revises FSAR Subsection 7.1.2.1.6, "Protection System Inservice Testability," based on Tier 1 Departure STD DEP T1 3.4-1. This departure requires prior NRC approval. Also per Section 7.1.1.2 of the ABWR DCD, any changes to Subsection 7.1.2.1.6, which is Tier 2*, require prior NRC approval.

In the first paragraph of FSAR Subsection 7.1.2.1.6, the applicant changes "ESF" to "ELCS." This minor change raises a number of questions (see below), and the staff issued RAI 07.01-9:

- What is ELCS?

- Is it ESF Logic and Control System? (This term has not been defined in previous subsections of FSAR Section 7.1.)

- What about NMS (also a part of the SSLC)? The applicant should describe the various digital I&C platforms (ELCS, NMS, RTIS, etc.) that comprise the SSLC in FSAR Section 7.1.1.1, which would allow the use of these DI&C platforms in subsequent FSAR sections.

In its response to RAI 07.01-9 dated August 27, 2009 (ML092430132), the applicant updated FSAR Tier 2, Section 7.1.1, which refers to Section 7.1S for terminology related to the RTIS, NMS, and ELCS. In its revised response to RAI 07-6, dated December 30, 2009 (ML100050181), the applicant provided a new FSAR Section 7.1S that describes the safety-related DI&C platforms. The staff found that these FSAR updates are acceptable and provide an adequate description of the SSLC platforms and related terminology. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.01-9 is closed.

In FSAR Subsection 7.1.2.1.6(4), the applicant deleted a sentence that states, "The test signals are adjustable manually from the control room and also are capable of performing an automatic sequence of events." This deleted sentence is a part of the fourth test that checks calibration of analog sensor inputs. This change is based on Tier 1 Departure STD DEP T1 3.4-1. However, the "Departures Report" in Part 7 of the COLA failed to provide any justification for removing this testing capability. In its response to RAI 07.01-10 dated August 27, 2009 (ML092430132), the applicant provided an acceptable alternate method for accomplishing the calibration checks. Due to final selections of the SSLC platforms, the test signal injection and adjustments will occur at the cabinet that contains the analog to digital conversion equipment. The staff found the proposed alternate method of accomplishing the calibration checks of analog sensor inputs acceptable, because the objectives of the fourth test described in the ABWR DCD are fully met. Therefore, RAI 07.01-10 is closed.

In Subsection 7.1.2.1.6(6)(a), "Online Continuous Testing," the applicant deletes the automatic system self-testing features that comply with the criteria for periodic surveillance testing, in accordance with IEEE Std 338-1987, "IEEE Standard Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems." It was not clear to the staff why

this deletion of the automatic system self-testing feature is acceptable. This change is based on Tier 1 Departure STD DEP T1 3.4-1. However, the "Departures Report" (in Part 7) failed to provide any justification for removing this self-testing feature. In its response to RAI 07.01-11 dated August 27, 2009 (ML092430132), the applicant provides an adequate explanation for the changes to Subsection 7.1.2.1.6(6)(a), which resulted from the final selections of the SSLC platforms. Online continuous testing and self-diagnostic features described in the ABWR DCD are being employed in the STP, Units 3 and 4, SSLC design, with slight variations to suit the selected SSLC platforms. The referenced ABWR DCD Tier 2 Subsection 7.1.2.1.6(6), states the following regarding the self-test features:

> The primary purpose of the self-test is to improve the availability of the SSLC by optimizing the time to detect and determine the location of a failure in the functional system. It is not intended that the self-test eliminate the need for the other five manual tests. However, most faults are detected more quickly than with manual testing alone.

The proposed methods for performing online continuous testing meet the IEEE Std 338–1987 testing requirements and the applicable acceptance criteria in (Branch Technical Position (BTP) 7-17, "Guidance on Self-Test and Surveillance Test Provisions," of NUREG–0800. Table 1.8-21, "Industrial Codes and Standards Applicable to ABWR," in COL FSAR Revision 7 lists IEEE Std 388-1977, but includes a note that the DI&C systems will comply with IEEE Std 388-1987. Therefore, the staff found the proposed methods for performing online continuous testing acceptable, and RAI 07.01-11 is closed.

Subsection 7.1.2.1.6(6)(b) introduces a new term, "maintenance and test processor (MTP)," which is intended to test the functional logic of the ELCS. The proposed MTP replaces the surveillance test controller (STC) that is a part of the certified ABWR design. The STC was intended to test the SSLC functional logic that includes the NMS and RTIS platforms. This proposed change under Tier 1 Departure STD DEP T1 3.4-1 raised various questions. It was not clear to the staff, if the MTP was integral to the ELCS platform. In addition, it was not clear if it was permanently connected to the ELCS platform. The staff noted that the MTP was only intended to test the ELCS functional logic, and it was not clear how the functional logic in the NMS and RTIS would be tested. The COLA Departures Report failed to address these proposed changes. All of these questions were asked of the applicant in RAI 07.01-12. In its response to RAI 07.01-12 dated August 27, 2009, the applicant provides an adequate explanation for the changes to Subsection 7.1.2.1.6(6)(b) that are consistent with the characteristics of the chosen SSLC platforms. The ELCS MTP is permanently connected and is integral to the ELCS platform. There is one MTP for each division. The NMS and RTIS are implemented using platforms based on the non-rewriteable field programmable array (FPGA). Each FPGA-based system includes self-diagnostic features, such as watchdog timers and power supply monitoring, to continuously verify proper FPGA and communications performance and alerts the operator to any detected faults. Additional information on the self-diagnostic features of the MTP and FPGA-based system is in a new FSAR Section 7.1S, "Instrumentation and Control Systems and Platforms," which was added to the FSAR Tier 2 in the revised response to RAI 07-6 dated December 30, 2009 (ML100060181). The proposed methods for performing offline end-to-end (sensor input to trip actuator) testing included in FSAR Section 7.1S meet the IEEE Std 338–1987 test requirements and the applicable acceptance criteria in BTP 7-17 of NUREG–0800. Therefore, the staff found the proposed methods for performing offline end-to-end testing acceptable. Therefore, RAI 07.01-12 is closed.

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

SER Chapter 11, "Radioactive Waste Management," documents the staff's evaluation of Tier 1 Departure T1 2.3-1 for the deletion of the MSIV closure and scram on high radiation. In summary, the main steamline radiation monitor (MSLRM) high trip is not specifically credited in any ABWR safety analysis. This trip was originally designed to mitigate effects in the event of a control rod drop accident for boiling-water reactors (BWRs). The ABWR has no basis for the control rod drop accident event to occur, as described in DCD FSAR Tier 2, Section 15.4.10. Furthermore, the U.S. BWRs have experienced spurious trips due to this MSLRM high trip. The trip setpoint must be set high enough to accommodate the normal high-radiation level during operation from the activated oxygen-16 in the reactor producing radioactive nitrogen-16 (N-16) that is carried in the main steamline flow, but low enough to provide adequate protection. The MSLRM trip setpoints can be overwhelmed by minor variations in the N-16 flow and cause spurious trips. The BWR Owner's Group (BWROG) submitted a topical safety analysis report on this subject in early 1990s, which was reviewed and approved by the NRC. Based on this BWROG topical report, most of the BWR plants in the U.S. have already removed this MSLRM trip feature. Per this departure, the applicant also revised the applicable areas of FSAR Subsection 7.1.2.6.2 (1)(d), "Process Radiation Monitoring System Safety Design Bases," which removes 'reactor scram' and 'MSIV Closure' due to high radiation in the main steamline (MSL) tunnel area from the safety-design bases. Therefore, the staff found the changes to FSAR Tier 2, Subsection 7.1.2.6.2(1)(d) acceptable.

- STD DEP T1 2.14-1 — Hydrogen Recombiner Requirements Elimination

SER Chapter 6, "Engineered Safety Features," documents the staff's evaluation of Tier 1 Departure T1 2.14-1, which eliminates hydrogen recombiner requirements. Per this departure, the applicant also revised the applicable areas in FSAR Subsection 7.1.2.6.6, "Containment Atmospheric Monitoring (CAM) Systems." The staff found this change from safety to nonsafety design bases for containment hydrogen and oxygen monitoring systems acceptable. However, the first deleted paragraph under "Safety Design Bases" also applies to the containment radiation monitoring systems. The staff issued RAI 07.01-13 requesting the applicant to retain the deleted paragraph from the safety design bases, which is applicable to the containment radiation monitoring systems such as, "Monitoring shall be provided by two independent safety related divisional subsystems." In its response to RAI 07.01-13, dated August 27, 2009 (ML092430132), the applicant updated FSAR Tier 2, Subsection 7.1.2.6.6 to correctly identify the safety-related and nonsafety-related design bases for the containment radiation monitoring system. Hence, the design bases for the containment radiation monitoring system remain unchanged and are the same as those in the ABWR DCD. The changes to the design bases for the containment hydrogen and oxygen monitoring systems are consistent with those identified in STP, Units 3 and 4, FSAR Tier 2, Chapter 6. The staff found the response acceptable and the RAI is resolved. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.01-13 is closed.

Tier 2 Departure Requiring Prior NRC Approval*

The following Tier 2* departure identified by the applicant in this section requires prior NRC approval, and the full scope of its technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by this Tier 2* departure.

- STD DEP 1.8-1 — Tier 2* Codes, Standards, and Regulatory Guide Edition Changes

Based on Tier 2* Departure STD DEP 1.8-1, the applicant revised FSAR Subsections 7.1.2.9.1 and 7.1.2.11.1 and Table 7.1-2, "Regulatory Requirements Applicability Matrix for I&C Systems." The applicant submitted additional changes to FSAR Sections 1.8, "Conformance with Standard Review Plan and Applicability of Codes and Standards," 1.9S, "Conformance with Regulatory Criteria," and 7.1, resulting from this departure in a letter dated February 9, 2009 (ML090430154), and in response to RAI 07.01-14 dated September 24, 2009 (ML092710226). In general, the applicant updated the conformance to regulatory requirements, RGs, and industry standards to current revisions and editions. Specific to the safety-related I&C systems (e.g., ELCS, NMS, and RTIS), the applicant is committed to apply IEEE Std 603–1991 as required by 10 CFR 50.55a(h), current revisions of applicable RGs, industry standards, and NUREG–0800, and the BTPs. The staff evaluated the changes to FSAR Subsections 7.1.2.9.1 and 7.1.2.11.1 and Table 7.1-2. The staff found that the applicant adequately addressed parts of this departure that are applicable to the I&C systems. Subsequently, the applicant submitted a revised response to RAI 07.01-14, dated April 19, 2010 (ML101120084), which relocated information regarding the conformance to the RGs and industry codes and standards that are applicable to I&C platform departures. Information that was previously proposed to be included in FSAR Tables 1.9S-1, "Site-Specific Conformance with Regulatory Guides," and 1.9S-1a is now being appropriately included in FSAR Tables 1.8-20 and 1.8-21. In its revised response to RAI 07.01-14, dated April 19, 2010 (ML101120084), the applicant states that for ELCS the requirements that the Common Qualified (Q) platform were licensed to are submitted as an alternative to current revisions and editions of RGs and industry standards based on the original NRC review of the Common Q platform and resulting SERs. Note that the Common Q topical report was evaluated and accepted (*not licensed*) by the NRC for use in safety-related applications within the limitations stated in the SER. Also note that the NRC letter (to Mr. Philip Richardson of Westinghouse, dated August 11, 2000 [ML003740165]) transmitting the Common Q SER (SER on, "Common Qualified Platform," Topical Report, WCAP-16097-NP-A, Revision 0, [ML031820484] and WCAP-16097-P-A, Revision 0, [ML031830959]) states, "Should our criteria or regulations change so that our conclusions as to the acceptability of the report are invalidated, CE Nuclear Power and/or the applicants referencing the topical report will be expected to revise and resubmit their respective documentation, or submit justification for the continued applicability of the topical report without revision of their respective documentation." The applicant was asked to evaluate the impact of current RGs and IEEE standards on the Common Q topical report. The applicant provided another revised response to RAI 07.01-14 dated September 23, 2010 (ML102700189), which replaces previous responses on the subject in their entirety. In this RAI response, the applicant commits to current revisions of applicable RGs, and industry standards for all of the STP, Units 3 and 4, I&C systems, including ELCS. Accordingly, the applicant provides the revised FSAR Tables 1.8-20, 1.8-21, 1.8-21a, "Codes and Standards for Site-Specific Systems," and the description of Departure STD DEP 1.8-1 in COLA Part 7. The staff found this RAI response and the proposed FSAR changes acceptable. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 6. Therefore, RAI 07.01-14 is closed.

Tier 2 Departures Not Requiring Prior NRC Approval

The following Tier 2 departures identified by the applicant in this section as not requiring prior NRC approval, may also be evaluated in other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these departures.

- STD DEP 7.1-1 References to Setpoints and Allowable Values

Based on Tier 2 Departure STD DEP 7.1-1, the applicant revised FSAR Subsections 7.1.2.1.4, 7.1.2.1.4.1, and 7.1.2.10.9, which all reference Chapter 16, "Technical Specifications," TS and Bases for the instrument setpoint-related parameters. Subsequently, the applicant's response to RAI 16-1 proposes to use the Setpoint Control Program to document the setpoint-related parameters. The staff issued RAI 07.01-8, requesting the applicant to reevaluate the impact on revisions to these FSAR subsections based on the applicant's response to RAI 16-1. In its response to RAI 07.01-8 dated August 27, 2009 (ML092430132), the applicant updated FSAR Tier 2, Subsections 7.1.2.1.4, 7.1.2.1.4.1, and 7.1.2.10.9, which now reference the instrument setpoint methodology document described in Subsection 16.5.5.2.11, "Setpoint Control Program." The technical evaluation of the instrument setpoint methodology document WCAP-17119-P, "Methodology for STP 3 and 4 ABWR Technical Specifications Setpoints," is in Section 7.1.5 of this SER. The staff found that the changes to FSAR Tier 2, Subsections 7.1.2.1.4, 7.1.2.1.4.1, and 7.1.2.10.9 are consistent with FSAR Chapter 16 and are therefore acceptable. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.01-8 is closed.

In FSAR Subsection 7.1.2.6.2 (2)(e), the applicant changed the methods for determining setpoints for high radiation levels from the TS to the Offsite Dose Calculation Manual, based on Tier 2 Departure STD DEP 7.1-1. Within the review scope of this section, the staff found it reasonable that this departure does not require prior NRC approval.

- STD DEP 7.1-2 ATWS DB for Startup Range Neutron Monitoring

- STD DEP 7.4-1 Alternate Rod Insertion Function Description

The applicant revised FSAR Subsection 7.1.2.6, "Other Safety-Related Systems," based on Tier 2 Departures STD DEP 7.1-2 and 7.4-1, which are identified as not requiring prior NRC approval. These FSAR changes clarify the ARI functional requirements and safety design basis for the SRNM and APRM, which provide ATWS permissive signals to the ELCS, as described in ABWR DCD Subsections 7.6.1.1.1(6) and 7.6.1.1.2.2(5). Within the review scope of this section, the staff found it reasonable that these departures do not require prior NRC approval because these FSAR changes provide clarification for the SRNM and APRM and are consistent with other sections of the FSAR.

7.1.2.5 *Post Combined License Activities*

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

7.1.2.6 *Conclusion*

The 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 identification of safety criteria, 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 10 CFR Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the identification of safety criteria that were incorporated by reference have been resolved.

In addition, the staff compared the additional information in the COLA to the relevant NRC regulations and the guidance in Section 7.1 of NUREG–0800. The staff's review concluded that the applicant has adequately addressed the Tier 1 and Tier 2* departures in accordance with Section 7.1 of NUREG–0800, and 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. The staff concludes that the applicant has provided sufficient information to satisfy NRC requirements.

7.1.3 Control and Instrumentation Systems – Tier 1 Design Descriptions (Parts of STP Units 3 and 4 Tier 1 FSAR Chapters 2 and 3) (There is no related section in Regulatory Guide 1.206)

7.1.3.1 *Introduction*

FSAR Tier 1, Chapters 2 and 3 of the STP, Units 3 and 4, COLA discuss inspections, tests, and analyses, including those applicable to controls and instrumentation systems that the applicant proposes to perform, as well as the acceptance criteria that are necessary and sufficient to provide reasonable assurance that if the proposed inspections, tests, and analyses are performed and the acceptance criteria are met, the facility has been constructed and will operate in conformance with the COL, the provisions of the *Atomic Energy Act of 1954*, and NRC regulations. The COL applicant provides the proposed selection methodology and criteria for establishing the ITAAC that are necessary and sufficient to provide that reasonable assurance. Each FSAR Tier 1 subsection consists of two parts, namely the "Design Description" and the "Inspections, Tests, Analyses and Acceptance Criteria." This SER section evaluates the control and instrumentation systems related the design descriptions in the STP, Units 3 and 4, COLA, FSAR Tier 1, Chapters 2 and 3. The evaluation of the ITAAC applicable to the control and instrumentation systems is in SER Section 14.3S, "Inspections, Tests, Analyses and Acceptance Criteria (ITAAC)."

7.1.3.2 *Summary of Application*

Tier 1, Chapters 2 and 3 of the STP, Units 3 and 4, COL FSAR Revision 12 incorporate by reference Tier 1 Chapters 2 and 3 of the certified ABWR DCD Revision 4, referenced in 10 CFR Part 52, Appendix A. In Chapters 2 and 3 of Tier 1 in Part 2 of the COLA, the applicant provides the following departures that are applicable to the control and instrumentation systems related to the design descriptions:

Tier 1 Departures

- STD DEP T1 2.2-1 — Control Systems Changes to Inputs, Tests, and Hardware

This departure modifies the ITAAC acceptance criteria based on the final rod control and information system (RCIS) design implementation, where the power supply associated with the one non-Class 1E uninterruptible power supply being tested will become inoperable, and both dual-redundant controller channels will remain operational when conducting this test.

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

This departure describes changes to the I&C architecture and nomenclature that are needed to address obsolete data communication technology and the selection of DI&C platforms.

7.1.3.3 *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 "Control and Instrumentation Systems – Tier 1 Design Descriptions," and the associated acceptance criteria, are in Section 14.3.5 of NUREG–0800.

In accordance with Section VIII, "Processes for Changes and Departures," of Appendix A to 10 CFR Part 52, "Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies Tier 1 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.

7.1.3.4 *Technical Evaluation*

As documented in NUREG–1503, the staff reviewed and approved Tier 1, Chapters 2 and 3 information of the certified ABWR DCD. The staff reviewed Chapters 2 and 3 of the STP, Units 3 and 4, COL FSAR Tier 1 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 control and instrumentation systems – Tier 1 design descriptions.

The staff reviewed the following information in the COL FSAR:

Tier 1 Departures

The following Tier 1 departures identified by the applicant in this section require prior NRC approval, and the full scope of their technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these Tier 1 departures.

- STD DEP T1 2.2-1 Control Systems Changes to Inputs, Tests, and Hardware
- STD DEP T1 3.4-1 Safety-Related I&C Architecture

The staff reviewed the proposed changes to the I&C systems as summarized below:

Tier 1 Section 2.2, "Control and Instrument Systems"

The applicant annotated Tier 1, Section 2.2.7, "Reactor Protection System," with Departure STD DEP T1 2.2-1. However, the staff was unable to find any changes in this section resulting from

[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.

this departure. In its response to RAI 07-1, dated September 22, 2009 (ML092680017), the applicant states that Departure STD DEP T1 2.2-1 does not change COLA Tier 1, Section 2.2.7, and the departure number referenced in Section 2.2.7 will be deleted. This action represents no change to this Tier 1 section; the staff found that the action incorporates by reference relevant subsections of the certified ABWR DCD, and the RAI is resolved. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07-1 is closed.

The applicant revises Sections 2.2.3, "Feedwater Control System;" 2.2.5, "Neutron Monitoring System;" 2.2.7, "Reactor Protection System;" 2.2.9, "Automatic Power Regulator System;" 2.2.11, "Plant Computer Functions (PCFs);" and Figures 2.2.1, "Rod Control and Information System Control Interface Diagram;" 2.2.5, "Neutron Monitoring System;" and 2.2.7b, "Reactor Protection System," based on Tier 1 Departure STD DEP T1 3.4-1.

As stated above, Departure STD DEP T1 3.4-1 changes the ABWR control and instrument systems architecture. The evaluation of specific changes in Tier 1, Section 2.2 is discussed below:

(1) Section 2.2.5, "Neutron Monitoring System."
(2) Section 2.2.11, "Process Computer System."
(3) Figure 2.2.1, "Rod Control and Information System Control Interface Diagram."
(4) Figure 2.2.5, "Neutron Monitoring System."

- In the above stated sections and figures, the applicant replaces "Process Computer System" (PCS) with "Plant Computer Function" (PCF) and modifies related text. As described in COLA Tier 1, Section 2.2.11 in the proposed I&C architecture, all of the process computer system functions are now performed within the PICS, thereby eliminating the need for a dedicated PCS. Similar to the PCS, the PCF are classified as nonsafety-related. The staff concluded that the proposed change, which replaces PCS with PCF, does not change the PCS design bases in the ABWR DCD and will not decrease the level of safety. Therefore, the staff found these changes acceptable.

- However, the PCF design description in Tier 1, Section 2.2.11 is inconsistent with the system description in Tier 2, Section 7.7.1.5. According to 10 CFR Part 52, Appendix A, Tier 1 information such as design descriptions, interface requirements, and site parameters are derived from Tier 2. In its response to RAI 07-2 dated September 22, 2009 (ML092680017), the applicant states that details will be added to COLA Tier 2, Section 7.7.1.5, "Plant Computer Functions (PCF) – Instrumentation and Controls," to resolve the inconsistencies between this section and COLA FSAR Tier 1, Section 2.2.11. The following paragraphs will be added to COLA Tier 2, Subsection 7.7.1.5(1), "System Identification":

  > The Plant Computer Functions (PCF) are a set of control, monitoring, and data calculation functions that are implemented on digital central processing units and associated peripheral equipment provided by the Plant Information and Control System (PICS). Redundant processors are used for functions that are important to plant operation. The PCF are classified as nonsafety related.

> The PCF perform local power range monitor (LPRM) calibrations and calculations of fuel operating thermal limits data, which is provided to the automated thermal limit monitor (ATLM) function of the Rod Control & Information System (RCIS) for the purpose of updating rod block setpoints.
>
> The PCF also include top-level controller functions that monitor the overall plant conditions, issue control commands and adjust setpoints of lower level controllers to support automation of normal plant startup, shutdown, and power range operations. In the event that abnormal conditions develop in the plant during operations in the automatic mode, these functions automatically revert to the manual mode of operation.

The above stated change to FSAR Tier 2, Subsection 7.7.1.5, addresses the staff's concerns of inconsistencies between Tier 1 and Tier 2 content. The suggested FSAR revision does not change the PCS design bases in the ABWR DCD and does not decrease the level of safety. Therefore, the staff found the proposed FSAR change acceptable, and the RAI is resolved. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07-2 is closed.

Tier 1 Section 2.2.3, "Feedwater Control System" and Tier 1 Section 2.2.9, "Automatic Power Regulator System"

In the sections identified above, the applicant removes or replaces "Non Essential Multiplexing System (NEMS)" with "Non Essential Data Communication Function (NECF)" and modifies related text. As described in Tier 1, Section 2.7.5 , "Data Communication," in the proposed I&C architecture, all of the non-essential communication functions are now performed through a plant-wide distributed network identified as the plant data network (PDN) system, which supports the communication functions of the nonsafety-related I&C systems and other plant data and information systems. Similar to the NEMS, the equipment implementing the NECF is classified as nonsafety-related. The staff concluded that the proposed change, which replaces 'NEMS' with 'NECF,' does not decrease the level of safety. Therefore, the staff found these changes acceptable. Refer to Subsection 7.9S, "Data Communication Systems," of this SER for an in-depth safety evaluation of the data communication system.

Tier 1 Section 2.2.7, "Reactor Protection System"

In Section 2.2.7 and Figure 2.2.7b, "Reactor Protection System," the applicant revises the RPS description in accordance with the proposed I&C architecture. Most of the changes are associated with the nomenclature consistent with the proposed I&C architecture and do not adversely impact the RPS design bases in the ABWR DCD. These nomenclature changes do not decrease the level of safety. The staff issued RAI 07-3, requesting the applicant to provide additional information in the following two areas: a description of interfaces between (1) the RPS and MSIV closure signals and (2) the RPS and suppression pool temperature trip was deleted from Tier 1, Section 2.2.7, with no justification provided in the Departure Report. In its response to RAI 07-3, dated September 22, 2009 (ML092680017), the applicant provides the following explanation for the stated changes in the DCD:

> Changes in the Design Description provided in STP Units 3 and 4 COL application Tier 1 Section 2.2.7 reflect the new Non-Rewriteable Field Programmable Gate Array (FPGA)-based platforms. The interfaces between 1) the Reactor Protection System (RPS) and Main Steam Isolation Valve (MSIV) closure signals; and 2) RPS and Suppression Pool Temperature trip were not deleted in STD DEP T1 3.4-1, although some text dealing with those interfaces was deleted from paragraph 4 for clarity. Both of those interfaces are shown on Figure 2.2.7a as noted in paragraph 1 and further detailed below.
>
> The interface between the RPS and MSIV closure signals is listed as "(7) Main Steamline Isolation [NBS]" in the text.
>
> The interface between the RPS and Suppression Pool Temperature trip is listed as "(9) High Suppression Pool Average Temperature [SPTM]" in the text.

Because these proposed changes in the COL FSAR application to the DCD do not change the RPS logic described in the ABWR DCD, the staff found them acceptable. Therefore, RAI 07-3 is closed.

The staff noted that a new paragraph that is added to the design description for the RPS is inconsistent with the changes described in the Departure Report: "The OLU and LDs are implemented with non-microprocessor-based equipment. The remaining RPS functions are primarily implemented with microprocessor-based equipment configurable logic devices." The staff issued RAI 07-4, requesting the applicant to address this inconsistency. In its response to RAI 07-4, dated September 22, 2009 (ML092680017), the applicant provides the following corrections to FSAR Tier 1, Section 2.2.7:

> The OLU and LDs are implemented with non-microprocessor-based equipment. The remaining RPS functions are primarily implemented with ~~microprocessor-based equipment~~ configurable logic devices.

The staff found that these FSAR corrections, resolve the inconsistencies in the COLA. Therefore, these changes are acceptable. Refer to Section 7.2 of this SER for a detailed safety evaluation of the RPS platform. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07-4 is closed.

Tier 1 Section 2.7, "Control Panels"

The applicant has revised Section 2.7.5 based on Departure STD DEP T1 3.4-1. As stated above, Departure STD DEP T1 3.4-1 addresses changes to the ABWR control and instrument systems architecture. The evaluation of specific changes in Tier 1, Section 2.7.5 is discussed below.

Based on the proposed I&C system architecture, the applicant renames Section 2.7.5 from "Multiplexing System" to "Data Communication." The data communication design description is replaced in its entirety to explain the significantly different ways of essential and non-essential data communication associated with the proposed I&C architecture. The design description for the ECF states, "The ECFs are implemented through the use of divisionally dedicated networks and/or data links provided with the safety-related digital system platforms. Some of the platforms use data links only or networks only and some of the platforms use a combination of both data links and networks." The staff issued RAI 07-5, requesting the applicant to address

the following concerns. Whereas in the subsequent paragraph, it is stated, “Data communication is provided between redundant safety-related divisions to support coincident logic functions. The data communication is implemented through fiber optic based data links to ensure interdivisional isolation.” It was not clear to the staff how the interdivisional communication takes place for the platforms that do not use data links. The staff asked the applicant to define the terms “data link” and “network” and explain the differences.

In its response to RAI 07-5, dated September 24, 2009 (ML092710226), the applicant provides the following explanation for the stated changes in the DCD:

> Both the RTIS and ESF Logic and Control System (ELCS) utilize data links for interdivision communication. The ELCS utilizes a network within a division, but that network does not cross division boundaries.
>
> The RTIS utilizes only data links. A data link is defined as having a point to point communication connection between the sending unit and the receiving unit.
>
> A network is defined as a communication method that connects multiple devices together to allow communication between the devices.
>
> The ELCS utilizes an intra-division network to communicate between multiple processors and human-machine interfaces within a single division. The intra-division network communication is buffered from the ELCS controller by a communication module contained in the same rack that houses the ELCS controller. The intra-division communication module also performs communication diagnostics. The ELCS intra-division network is a deterministic network that utilizes a bus master. Each ELCS division includes an independent intra-division network. The intra-division network does not communicate outside the ELCS division. Each controller will send and receive periodic messages from the intra-division network communication modules. It allows communication between the control room safety displays, the Maintenance and Test Panel (MTP), and ELCS controllers for one division. This bus is used to communicate status and diagnostic data from the ELCS controllers for display on the safety displays and MTP. It is also used to communicate test signals and data from the MTP and control room safety displays to the ELCS controllers. Each ELCS division includes an independent intra-division network. The intra-division network does not communicate outside the ELCS division.
>
> High Speed Serial Link Communication
>
> Each ELCS controller contains two processors. One processor is dedicated to performing the safety functions. The second processor is responsible for performing the unidirectional high speed serial link communications. The safety function processor shares a dual ported memory with the communications processor to allow data exchange. The ELCS communication processor has two independent receive communication ports and one independent transmit port.
>
> The ELCS utilizes a high speed serial link (HSL) to communicate Class 1E safety function actuation information. The HSL is a true broadcast link that meets the communication isolation requirements of IEEE Std 7.4.3-2. The HSL is utilized in a multi-drop communication method. In this method the transmission source is

sent to multiple fiber optic modems which convert the HSL signal to utilize fiber optic communication media. The identical unidirectional signals are then connected to multiple receivers. An example of multi-drop communication is the transmission of a single division's Digital Trip Function (DTF) output actuation status signals to the other three divisions of Safety Logic Functions (SLFs).

For STP 3&4, the HSL communication is utilized for the following ELCS communication paths:

- DTF remote I/O to DTF
- DTF to SLF
- SLF safety function actuation to SLF remote I/O

Based on the above RAI response, both the RTIS and ELCS platforms utilize data links for intra-division communication. In its revised response to RAI 07-5, dated January 21, 2010 (ML100250136), the applicant clarifies that none of the DI&C platforms use networks only. ELCS utilizes a network within a division, but the network does not cross division boundaries. Accordingly, the applicant proposes to revise FSAR Tier 1, Section 2.7.5 as follows:

"Some of the platforms use data links only ~~or networks only~~ and some of the platforms use a combination of both data links and networks."

The staff found these proposed FSAR changes acceptable, and the RAI is resolved. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07-5 is closed.

Tier 1 Section 3.4, "Instrumentation and Control"

The applicant revises Section 3.4, including subsections and figures, based on Departure STD DEP T1 3.4-1. In its response dated February 9, 2009 (ML090430154), to items identified in a NRC staff regulatory audit summary, the applicant provides additional changes to Tier 1, Section 3.4, Subsections A and C, and Figure 3.4b, "Safety System Logic & Control Block Diagram." A significant number of changes in this section reflect all categories of changes included within the scope of Departure STD DEP T1 3.4-1. In general, the changes reflect the proposed I&C architecture, which the staff found acceptable with the following concerns/issues that required additional information from the applicant:

(1) Section A, Safety System Logic and Control

Based on Departure STD DEP T1 3.4-1, the applicant has revised Tier 1 Subsection A of Section 3.4 that provides the design description of the proposed SSLC. According to 10 CFR Part 52, Appendix A, Tier 1 information, such as, design descriptions, interface requirements, and site parameters are derived from Tier 2. The staff was unable to locate the SSLC design details in Tier 2 of the COLA that would form the basis for the SSLC design description provided in Tier 1. The staff requested the applicant to resolve these inconsistencies.

In its revised response to RAI 07-6, dated December 30, 2009 (ML100050181), the applicant provides a new site-specific FSAR Tier 2 Section 7.1S, "Instrumentation and Control Platforms." This section provides an overview of the RTIS, NMS, and ELCS platforms, which is consistent with and envelops the SSLC design description in FSAR Tier 1, Subsection A of Section 3.4. These FSAR additions resolve the inconsistencies in the COLA. Therefore, the staff found

these changes acceptable. Refer to Sections 7.2 and 7.3 of this SER for in depth safety evaluation of the SSLC platforms. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07-6 is closed.

Based on Departure STD DEP T1 3.4-1, the applicant adds a sentence in Tier 1, Subsection A(3) of Section 3.4 stating, "The TLF also receives input directly from the Neutron Monitoring System and manual control switches." Whereas, according to the FSAR, Figure 7.2-2, "Reactor Protection System Equipment Arrangement (From Sensors Through Trip Actuators)," the Trip Logic Function (TLF) also receives direct input from the sensor channel(s) of the corresponding division. The staff requested the applicant to provide the design description of the sensor channel(s) with direct input to the TLF, and evaluate the impact on Figure 3.4b in the FSAR.

In its response to RAI 07-7, dated September 22, 2009 (ML092680017), the applicant points to an error in FSAR Tier 2, Figure 7.2-2 that erroneously shows the TLF receiving direct input from the sensor channel. The correction to Figure 7.2-2 resolves the inconsistencies in the COLA. Therefore, the staff found the correction acceptable, and the RAI is resolved. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07-7 is closed.

Based on Departure STD DEP T1 3.4-1, the applicant deletes from Tier 1, Subsection A(5) of Section 3.4, the design concept of each division containing two ESFs processing channels each containing a pair of safety system logic units (SLUs). The Departure Report failed to provide any justification for making this significant change in the design concept. The staff requested the applicant to provide adequate justification for this change in the design concept and to demonstrate how the proposed ELCS conforms to the current regulations. In its response to RAI 07-8, dated September 22, 2009 (ML092680017), the applicant provides the following explanation:

> STP 3&4 COLA Part 7, departure STD DEP T1 3.4-1 Description, Item (2) "Elimination of unnecessary inadvertent actuation prevention logic and equipment" was previously addressed in the RAI 07.03-1 response. This response provided expanded bases for limiting the application of the dual redundant Safety System Logic Functions (SLFs), which replace the Safety System Logic Units (SLUs). It also provided bases for retention of two forms of dual redundancy in certain cases along with an expanded justification for item (2) of this departure. In addition, this response identified which functions did not require this logic feature and the justification bases for each function.
>
> STP 3&4 COLA Part 2, Tier 1 Subsection 3.4.1 (changed back to Subsection 3.4.A) under "The ELCS portion of SSLC …" Item (3) has a paragraph that captures the related Tier 1 requirements as:
>
> > "The SLF logic for ECCS functions (i.e. initiation of Reactor Core Isolation Cooling, High Pressure Core Flooder, Low Pressure Core Flooder or Automatic Depressurization) is implemented using redundant processing channels. The redundant channels receive the same input data from the DTF, manual control switch inputs and contact closures and perform the same trip decision logic. A majority of the redundant processors must agree for initiation of the function to occur, in order to assure that failure

> of a single electronic module will not result in inadvertent coolant injection into the core or inadvertent depressurization. The final majority vote of the system initiation signals is accomplished with non-microprocessor based equipment in the logic or with a separate actuation of system valves and pumps, where both are required to initiate coolant injection."

Also, STP 3&4 COLA Part 2, Tier 2 will be updated with a new Section 7.1S.2 as described in STPNOC's RAI 07-6 response. The related and supporting Tier 2 requirements are in new Subsection 7.1S.2.1 as:

> "As shown in Figure 3.4B, each of the three ESF component actuation divisions contains a minimum of two SLFs. One of the two SLFs processes initiation logic for functions that service the reactor vessel at low pressure (e.g., RHR), while a second SLF provides the same support for the vessel at high pressure (e.g., Reactor Core Isolation Cooling (RCIC) system and High Pressure Core Flooder (HPCF) system).
>
> The SLF logic for ECCS functions (i.e., initiation of Reactor Core Isolation Cooling, High Pressure Core Flooder or Automatic Depressurization) is implemented using two redundant SLF processing channels per division. The two redundant channels receive the data from the four redundant divisional DTFs, manual control switch inputs and contact closures. The two redundant SLF processing channels perform the same ESF safety function action logic."

And later it states:

> "The two-out-of-two voting of the two SLF processing channels is performed on a component basis with non-microprocessor based equipment or with a separate actuation for a valve from one SLF processing channel and a related pump actuation from the second SLF processing channel, where both are required to initiate coolant injection."

In its response to RAI 07-8, dated August 27, 2009, (ML092430132), the applicant provides the requested information related to Tier 1 content and the proposed Tier 2 additional content. The staff therefore found the applicant's response to RAI 07-8 acceptable and the RAI is closed. For a detailed technical evaluation of this ESF design concept and its regulatory compliance, refer to Section 7.3 of this SER.

Based on Departure STD DEP T1 3.4-1, the applicant has added a design description for the ELCS portion of the SSLC in Tier 1, Subsection A(3) of Section 3.4. Some of the added statements are vague (e.g., "A majority of redundant processors must agree…," "logic for some isolation functions …," "Other ELCS functions are implemented using redundancy …," etc.). In RAI 07-9, the staff requested the applicant to provide specific design details that outline the ESF functions and their need for redundant or non-redundant processing channels. Criteria for selecting the ESF functions that do not require redundant processing channels should also be provided demonstrating compliance with the current regulations. In its response to RAI 07-9, dated September 22, 2009 (ML092680017), the applicant provides the following clarification:

> In STPNOC's response to RAI 07-6, an addition to the COL application Part 2, Tier 2, Section 7.1S.2 was presented. In that COL application addition, the

redundant SLF processing channels and the two-out-of-two voting of the channels was described. Also in response to RAI 07.03-1, a list of Functions for which there was a modification of the 2-out-of-2 voting was provided. This response also provided the Bases for limiting the application of dual redundant SLFs.

Additional information is provided below regarding design criteria for ESF functions.

SLF redundancy is categorized into the following four cases. The concept for categorization is described in COL application Part 2 Tier 1, Section 3.4.1, Item (3) under ELCS discussion as follows.

(1) A majority of the redundant processors must agree for initiation of the function to occur, in order to assure that failure of a single electronic module will not result in inadvertent coolant injection into the core or inadvertent depressurization. The final majority vote of the system initiation signals is accomplished with non-microprocessor based equipment in the logic or with a separate actuation of system valves and pumps, where both are required to initiate coolant injection.

(2) The SLF logic for some isolation and supporting ESF functions are also implemented using redundant channels where such implementation increases the operator response time to avoid plant operational impact following postulated failure in the control equipment. In these cases, an operator bypass that reduces the logic to a single channel may be utilized where such logic reduces the risk of unnecessary adverse plant operational impact.

(3) Other ELCS functions are implemented using redundancy where such logic provides overall plant operating or maintenance benefits.

(4) Non-redundancy in processing channels.

Case 1 is applied to ECCS (i.e., RCIC, HPCF, LPFL, or ADS). This structure is described in COLA Part 2, Tier 2, Chapter 16, Figures B 3.3.1.4-2, B 3.3.1.4-3 or B 3.3.1.4-4.

Case 2 is mainly applied to equipment that is normally in operation and does not have redundancy of equipment (example: RCW isolation valve of non-safety loads). This structure is described in COLA Part 2, Tier 2, Chapter 16, Figure B 3.3.1.4-5.

Case 3 is applied when equipment malfunction does not impact plant operation. However, the logic redundancy benefits plant operation or maintenance. Applicable equipment for case (3) is determined during detailed design. COLA Part 2, Tier 2, Chapter 16, Figure B 3.3.1.4-2 or Figure B 3.3.1.4-5 is applied to the structures.

Case 4 is applied when equipment malfunction does not impact plant operation as in case 3, and failure to take action does not affect system functions. The major equipment applied is shown in the response to RAI 07.03-1. This structure is described in COLA Part 2, Tier 2, Chapter 16, Figure B 3.3.1.4-1.

The staff found the applicant's response to RAI 07-9 acceptable and RAI 07-9 is closed. For a detailed technical evaluation of this ESF design concept and its regulatory compliance, refer to Section 7.3 of this SER. Verification of the implementation of these ESF design concepts described above will be performed via Tier 1, Section 3.4 DAC/ITAAC inspections.

Based on Departure STD DEP T1 3.4-1, the applicant revised the design description for the ELCS portion of the SSLC in Tier 1, Subsection A(4) of Section 3.4. The first sentence in the subsection appeared to be incomplete, which simply stated "local inputs." Also the applicant added the following statement: "ELCS logic and controls are implemented through three divisions corresponding to the three divisions of controlled equipment." This statement was in contradiction with design details provided in various other parts of the COLA, which imply that there are four divisions of ELCS. The staff requested the applicant to complete the missing information and resolve the stated conflicting information. In its response to RAI 07-10, dated September 22, 2009 (ML092680017), the applicant proposed the following changes to the FSAR:

~~(7)For ESF functions, the trip signals in three divisions are transmitted by the Essential Multiplexing System to the RMUs local inputs. where a final 2-outof-2 logic comparison is made prior to distribution of the control signals to the final actuators. ESF outputs do not exist in Division IV.~~ As described above, the ELCS contains four redundant divisions of DTFs. The four divisions of DTF safety function actuation status are communicated to three divisions of SLFs, which correspond to the three divisions of ESF actuated equipment. No ESF actuated equipment exists in Division IV. The final SLF actuation outputs are distributed to the final system actuated equipment ~~control elements~~ through the RDLC remote I/O devices. ~~ELCS logic and controls are implemented through three divisions corresponding to the three divisions of controlled equipment.~~

The staff found the proposed changes to FSAR Tier 1, Section 3.4.A consistent with the COLA and is therefore acceptable. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07-10 is closed.

(2) Section B, I&C Development and Qualification Process

Based on Departure STD DEP T1 3.4-1, the applicant re-numbers the subsections of Tier 1 Section 3.4 (i.e., Subsection A to 3.4.1; Subsection B to 3.4.2; and Subsection C to 3.4.3). In STPNOC letter dated February 9, 2009 (ML090430154), the applicant reverts back the subsection numbering from 3.4.1 to A and from 3.4.3 to C. However, the applicant does not revert back to numbering Section 3.4.2 to B. Parts of the Tier 1 document still make references to Subsection B. The staff issued RAI 07-11 requesting the applicant to resolve this conflict. In its response to RAI 07-11, dated September 22, 2009 (ML092680017), the applicant proposes the following FSAR changes:

To be consistent with the ABWR DCD, Section 3.4 subsections were changed back to alpha designations, as shown below:

~~3.4.1~~ A, Safety System Logic and Control
~~3.4.2~~ B, I & C Development and Qualification Processes
~~3.4.3~~ C, Diversity and Defense-in-Depth Considerations

The staff found these proposed FSAR changes acceptable, and the RAI is resolved. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07-11 is closed.

7.1.3.5 *Post Combined License Activities*

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

7.1.3.6 *Conclusion*

The 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 "Controls and Instrumentation Systems - Tier 1 Design Description," 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 10 CFR Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the controls and instrumentation system that were incorporated by reference, have been resolved.

In addition, the staff compared the additional information in the COLA to the relevant NRC regulations and the guidance in Chapter 7 and Section 14.3 of NUREG–0800. The staff's review concluded that the applicant has provided sufficient information such that Tier 1 design descriptions can be verified by the ITAAC and the ITAAC are necessary and sufficient to verify conformance of the as-built STP, Units 3 and 4, I&C system to the design described in FSAR Tier 1 and Tier 2. Therefore, the staff finds that the proposed Tier 1 departures are acceptable and concludes that the applicant has provided sufficient information to satisfy in accordance with Chapter 7 and Section 14.3 of NUREG–0800.

7.1.4 Instrument Setpoint Methodology

7.1.4.1 *Introduction*

In the certified ABWR DCD, development of the setpoint methodology is a part of Item 13 ITAAC listed in Tier 1, Table 3.4, "Instrumentation and Control." As stated earlier, the applicant elects to utilize the DAC/ITAAC process for developing the detailed DI&C design. Likewise, the applicant's original intent was also to develop the setpoint methodology after issuance of the COL. The applicant chooses to resolve the bracketed items in the generic TS using the Setpoint Control Program. Therefore, in support of the Setpoint Control Program, the setpoint methodology technical report was submitted as part of the COLA. An evaluation of the Setpoint Control Program is in Chapter 16 of this SER. The setpoint methodology report is evaluated in this section of the SER.

7.1.4.2 *Summary of Application*

In a letter dated October 30, 2009 (ML093130113), the applicant submitted WCAP-17119-P Revision 0, "Methodology for South Texas Project Units 3 and 4 – ABWR Technical Specification Setpoint." Subsequently, in response to the RAI 07.01-15 and RAI 16-65 dated March 29, 2010 (ML100900137), the applicant submitted WCAP-17119-P, Revision 1, "Methodology for South Texas Project Units 3&4 ABWR Technical Specifications Setpoints." This technical report is prepared by Westinghouse for the applicant to document the instrument uncertainty calculations for the RPS and ESF functions for the ABWR plant. This document has been submitted as a part of the COLA and includes typical industry uncertainty values and assumptions that reflect the ABWR I&C design, to the extent required to support a COLA. This document identifies the general algorithm used as a basis for determining the overall instrument uncertainty and provides typical setpoints for each of the RPS and ESF functions. Reconciliation of this final setpoint study for the plant cannot be performed until the design for the plant is finalized. Before initial fuel loading, a reconciliation of this setpoint study against the final design for the plant will be performed, as required by the ABWR ITAAC (Section 3.4, Item 13 of Table 3.4, ABWR DCD, Revision 4).

7.1.4.3 *Regulatory Basis*

The relevant requirements of the Commission regulations for the instrument setpoint methodology and the associated acceptance criteria are in BTP 7-12, "Guidance on Establishing and Maintaining Instrument Setpoints," in Chapter 7 of NUREG–0800. The following regulatory requirements and guidance documents are applicable to the staff's review of the STP setpoint methodology:

GDC 13, "Instrumentation and control," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," requires, in part, that instrumentation be provided to monitor variables and systems and controls be provided to maintain these variables and systems within prescribed operating ranges.

GDC 20, "Protection system functions," of Appendix A to 10 CFR Part 50 requires, in part, that the protection system be designed to initiate automatically the operation of appropriate systems, including the reactivity control systems, to assure that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences.

Paragraph (c)(1)(ii)(A) of 10 CFR 50.36, requires the TS to include limiting safety systems settings. This paragraph specifies, in part, that "where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting must be so chosen that automatic protective action will correct that abnormal situation before a safety limit is exceeded." Accordingly, the setpoint for instrument channels that initiate protective functions must be properly established in the setpoint methodology.

Paragraph (c)(3) of 10 CFR 50.36, states that surveillance requirements relate to tests, calibrations, or inspections to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met.

Regulation 10 CFR 50.55a(h), requires compliance with IEEE Std 603–1991 and the correction sheet dated January 30, 1995. Section 4.4 of IEEE Std 603–1991 requires the identification of the analytical limit associated with each variable. Section 6.8.1 requires the allowances for

uncertainties between the analytical limit and device setpoint to be determined using a documented methodology.

RG 1.105, Revision 3, "Setpoints for Safety-Related Instrumentation," describes a method acceptable to the staff for complying with the NRC's regulation for ensuring that setpoints for safety-related instrumentation are initially within and remain within the TS. This RG endorses Instrument Society of America (ISA-S67.4–1994, Part 1, "Setpoints for Nuclear Safety-Related Instrumentation Used in Nuclear Power Plants.") Although not endorsed by the RG, ISA S67.04–1994 Part II, "Methodology for the Determination of Setpoints for Nuclear Safety-Related Instrumentation," provides additional guidance.

7.1.4.4 *Technical Evaluation*

The staff reviewed WCAP-17119-P, "Methodology for STP 3 & 4 ABWR Technical Specifications Setpoints," Revision 1 to ensure that the information provided in the WCAP appropriately represents the complete scope of information relating to this review topic. The objective of the WCAP-17119-P review is to confirm that the STP, Units 3 and 4, setpoint methodology satisfies regulatory acceptance criteria, guidelines, and performance requirements. The outcome of the review is shown in the paragraphs below.

The establishment of setpoints and the relationships between trip setpoints, allowable value (AV), as-left tolerance, as-found tolerance, analytical limit, and safety limit are discussed in this report. A thorough understanding of these terms is important in order to properly utilize the method for establishing trip setpoints to protect the safety limits.

The safety limits are chosen to protect the integrity of physical barriers that guard against the uncontrolled release of radioactivity. The safety limits are typically provided in the plant safety analyses. The analytical limit is established to ensure that the safety limit is not exceeded. The analytical limit is developed from event analyses models that consider parameters such as process delays, rod insertion times, reactivity changes, and instrument response times.

The STP setpoint methodology combines the uncertainty components to determine the overall allowance for the functions of the safety-related systems. All appropriate and applicable uncertainties have been considered for each safety-related function. The methodology used to combine the uncertainty components for a channel is an appropriate combination of those groups that are statistically and functionally independent. The independent and random uncertainty components are combined using the square root of the sum of the squares (SRSS) technique. The uncertainties that are not independent, are conservatively treated by arithmetic summation and then systematically combined with the independent terms. The latter includes instrument (sensor and process rack) uncertainties and non-instrument-related effects (e.g., process measurement accuracy, etc.). This methodology uses the SRSS technique, which is acceptable to the NRC. Also, the American National Standard Institute (ANSI), the American Nuclear Society, and the ISA endorse the use of the same probabilistic and statistical techniques for the various standards in determining safety-related setpoints.

The STP setpoint methodology combines the uncertainty components to determine the overall Channel Statistical Allowance (CSA) for the RPS/ESF functions listed in Tables 3-1, "Startup Range Neutron Monitors - SRNM Neutron Flux - High," through 79, "Constant Voltage Constant Frequency Power Supply - Overfrequency," of WCAP-17119-P, Revision 1. The CSA calculation is based on the following:

1. The sensor and rack measurement and test equipment uncertainties are treated as dependent parameters, with their respective drift and calibration accuracy allowances.

2. Although the environmental allowances are not considered statically dependent on all other parameters, the equipment testing generally results in large magnitude, non-random terms conservatively treated as limits of error that are added to the statistical summation. Westinghouse generally considers a term to be a limit of error if the term is a bias with an unknown sign. The term is added to the SRSS in the direction of conservatism.

3. Bias terms are one directional with known magnitudes that may result from several sources (e.g., drift or calibration data evaluations), which are also added to the statistical summation.

4. The calibration terms are treated in the same radical with the other terms based on the assumption that general trending data (i.e., drift and calibration data) are evaluated on a periodic and timely basis.

This STP setpoint methodology should confirm, as part of the treatment of the terms, that the assumed distribution function characteristics are still applicable. This approach results in a higher net reduction of the CSA magnitude than would be determined if trending was not performed. Also, in calculating the uncertainties for determining the CSA value, trip setpoints, and allowable value, the applicant uses a 95/95 tolerance limit as an acceptable criterion (i.e., a 95 percent probability and a 95 percent confidence level, which are consistent with the criterion of RG 1.105). This CSA value is compared with the total allowance (TA) for determining the instrument channel margin. The TA is established by adding the margin to the CSA. The TA defines a maximum acceptable value for the calculated instrument channel uncertainty referred to the CSA. Having determined the safety analytical limit and the TA, the nominal trip setpoint (NTS) can be calculated by subtracting (adding) from (to) the safety analysis limit (SAL), depending on the direction of the process variable change when approaching the SAL. Because there are two unknowns—the margin and the NTS—the staff was unable to identify the method used for determining the margin and/or the NTS. In its response to the staff's RAI 07.01-15, dated March 29, 2010 (ML100910300), the applicant clarifies the methods used in determining margin criteria and establishing NTS. In Section 3.3, "Conservatism of Algorithm," of WCAP-17119-P, an acceptable criterion for the magnitude for margin has been defined as greater than or equal to rack calibration accuracy. In the RAI response, the applicant describes three different approaches used in determining the acceptable ABWR nominal trip setpoints. The staff found these methods and approaches for determining the margin and NTS to be in accordance with the WCAP-17119-P setpoint methodology, and therefore acceptable.

The "As-Left Tolerance" is established by the required accuracy band (calibration accuracy) that a device or an instrument channel must be calibrated to the NTS during surveillance. The as-left condition is where the instrument channel setpoint is left within the as-left tolerance after verifying the calibration or trip setpoint. Additionally, if the as-found value is within the "As Left Tolerance," then recalibration is not required. The AV is derived from the NTS by subtracting (adding) the "As Found Tolerance" depending on the direction of the process variable change when approaching the SAL. The AV is what the instrument channel should be evaluated at for operability and to protect the safety limit when the test is performed. In its response to the staff's RAI 07.01-15, dated March 29, 2010 (ML100910300), the applicant clarifies the definitions for "As Left Value"; "As Found Value"; "As Left Tolerance"; and "As Found Tolerance"

in accordance with their applicability to sensors/transmitter or process racks. These clarified definitions, and the definition of "Allowable Value" are included in Revision 1 of WCAP-17119-P. An allowable value column is added to Table 3-80, "Summary of Typical Setpoints and Allowances" of WCAP-17119-P. The staff found that Revision 1 of WCAP-17119-P, addresses all of the concerns identified in RAI 07.01-15, and therefore this RAI is considered closed.

WCAP-17119-P, Revision 1 makes a reference to WCAP-17137-P, "Westinghouse Stability Methodology for the ABWR" for determining the oscillation power range monitor (OPRM) setpoints (Table 3-80, Note 7). Since WCAP-17137-P is a part of the fuel related topical reports that form the basis for post-COL fuel amendment application, making a reference to a post-COL document in the COLA is not acceptable. In its response to the staff's RAI 07.01-16, dated June 17, 2010 (ML101720574), the applicant states that reference to WCAP-17137-P will be removed from WCAP-17119-P, and it will revise WCAP-17119-P to include typical setpoint values and associated uncertainties for the OPRM (NOTE: the actual setpoint values will be calculated in accordance with the setpoint control program). Reference to WCAP-17137-P will also be removed from TS 5.5.2.11, "Setpoint Control Program" and from Departure STD DEP 16.3-100, "Setpoint Control Program Implementation." The staff found this RAI response acceptable, and the RAI is resolved. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 8 and WCAP-17119-P, Revision 2. Therefore, RAI 07.01-16 is closed.

7.1.4.5 *Post Combined License Activities*

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

7.1.4.6 *Conclusion*

The staff reviewed the application and WCAP-17119-P Revision 2, "Methodology for South Texas Project Units 3 and 4 – ABWR Technical Specification Setpoint," and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to instrument setpoint methodology associated with TS 5.5.2.11, "Setpoint Control Program (SCP)," 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 10 CFR Part 52, Appendix A ,Section VI.B.1, all nuclear safety issues relating to the controls and instrumentation system that were incorporated by reference have been resolved.

In addition, the staff compared the additional information in the COLA to the relevant NRC regulations and the guidance in Chapter 7 of NUREG–0800. The staff's review concluded that the instrument setpoint methodology describes in WCAP-17119-P, Revision 2, satisfies regulatory acceptance criteria, guidelines, and performance requirements. As stated in TS 5.5.2.11.b, the NTS, AV, As-Found Tolerance, and As-Left Tolerance for each TS required automatic protection instrumentation function shall be calculated in conformance with the NRC approved WCAP-17119-P, Revision 2. The staff concludes that the applicant has provided sufficient information to satisfy NRC requirements.

7.1S Instrumentation and Control Systems Platforms

The staff issued RAI 07-6, requesting the applicant to provide additional clarifications and descriptions. In its revised response to RAI 07-6, dated December 30, 2009 (ML100050181), the applicant provides a new supplement, FSAR Section 7.1S, which addresses the DI&C platforms for safety-related I&C systems, including their data communications capabilities. In

Section 7.1S.1, “Field Programmable Gate Array Based Platforms,” the applicant describes the RTIS, which is based on the non-rewritable field programmable gate array, and the NMS. In Section 7.1S.2, “Microprocessor Based Platforms,” the applicant describes the implementation of the ELCS using a microprocessor-based platform. For technical and regulatory compliance evaluations of the departures related to the RTIS, NMS, and ELCS platforms and associated data communication features described in the COLA, including this new site-specific Section 7.1S, see Sections 7.2, 7.3, and 7.9S of this SER.

7.2 Reactor Protection (Trip) System (RPS) – Instrumentation and Controls, (Related to Regulatory Guide 1.206, Section C.I.7.2, “Reactor Trip System”)

7.2.1 Introduction

This section of the FSAR outlines the RPS or the RTIS as they are used in the COLA. The RTIS is the overall complex of instrument channels, trip logics, trip actuators, and scram logic circuitry that initiates a rapid insertion of control rods (scram) to shut down the reactor. There is also manual initiation. In addition, the RTIS establishes reactor-operating modes and provides status and control signals to other systems and annunciators.

To accomplish its overall function, the RTIS interfaces with the NMS, control rod drive system (CRDS), RCIS, reactor recirculation control system, PCF, nuclear boiler system (NBS), and other plant systems and equipment.

7.2.2 Summary of Application

Section 7.2 of the STP, Units 3 and 4, COL FSAR Revision 12 incorporates by reference Section 7.2 of the certified ABWR DCD, Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 7.2, 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 describes the removal of the MSIV automatic closure and scram based on the high main steam radiation monitor (MSLRM).

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

This departure describes changes to the I&C architecture and nomenclature that are needed to address obsolete data communication technology and the selection of DI&C platforms.

Tier 2 Departure*

- STD DEP 1.8-1 — Tier 2* Codes, Standards, and Regulatory Guide Edition Changes

This departure updated some codes, standards, and RGs to more current revisions/editions.

Tier 2 Departure Requiring Prior NRC Approval

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

This departure identifies a change in the medium voltage distribution system that affects the certified ABWR DCD, Revision 4, for the offsite electrical power system, the onsite alternating current (ac) power distribution system, and safety loads. The departure specifically changes the medium-voltage electrical distribution system to a dual-voltage system consisting of 13.8 kilovolts (kV) and 4.16 kV.

Tier 2 Departure Not Requiring Prior NRC Approval

- STD DEP 7.1-1 References to Setpoints and Allowable Values

This departure clarifies in the FSAR that wherever the TS are referenced for setpoints or margins, the correct reference is to the methods for calculating the setpoints and margins, as described in the TS Bases.

- STD DEP 7.2-2 Description of Scram Actuating Relays

This departure revises the wording of the relay logic contact status from “normally closed” to “normally open” and clarifies that the tripped state is when the coil is “energized.”

- STD DEP 7.2-4 Manual Scram Monitoring

This departure deletes the statement about monitoring initiating variables because it is misplaced in the “Manual Scram” subsection.

- STD DEP 7.2-6 RPS Instrumentation Ranges (Table 7.2-1)

This departure updated RPS instrumentation ranges to reflect a range of values appropriate for optimal performance.

- STD DEP Admin

This departure describes minor corrections such as editorial or administrative errors in the certified ABWR DCD, Revision 4 (e.g., misspelled words, incorrect references, table headings, etc.).

7.2.3 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 RPS I&C, and the associated acceptance criteria, are in Section 7.2 of NUREG–0800. In accordance with Section VIII, “Processes for Changes and Departures,” of Appendix A to 10 CFR Part 52, “Design Certification Rule for the U.S. Advanced Boiling Water Reactor,” the applicant identifies three Tier 1 and Tier 2* departures requiring prior NRC approval. 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.6. Tier 2 departures that affect TS or TS Bases require prior NRC approval and are subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.C.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 of 10 CFR 50.59.

Reviews of the departures are based on meeting the current regulatory requirements, acceptance criteria, and guidelines in NUREG–0800, Table 7-1, Revision 5 (March 2007). In accordance with 10 CFR 50.55a(h), COLAs filed on or after May 13, 1999, which depart from the certified ABWR DCD Revision 4, must meet the requirements for safety systems in IEEE Std 603-1991 and in the correction sheet dated January 30, 1995. In addition, applicable guidelines in Digital I&C-ISG documents are also used to evaluate the departures from the certified ABWR design.

7.2.4 Technical Evaluation

As documented in NUREG–1503, the staff reviewed and approved Section 7.2 of the certified ABWR DCD. The staff reviewed Section 7.2 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:

Tier 1 Departures

The following Tier 1 departures identified by the applicant in this section require prior NRC approval, and the full scope of their technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these Tier 1 departures.

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

This departure is classified as requiring prior NRC approval. In Part 7 of the COLA, "Departures Report," Section 2.1, the applicant describes and evaluates this departure per the requirements of Section VIII.A.4 of Appendix A to 10 CFR Part 52.

The staff reviewed this departure and found that it deletes the MSIV automatic closure and scram based on the high MSLRM. Refer to Section 7.1.2 of this SER for the discussion of this change. The staff noticed that the impacts of this departure on the RTIS I&C include the elimination of the automatic trip function and its associated initiating circuits from the high MSLRM. However, the main steamline radiation indication and alarm is still available in the main control room (MCR). The staff found the associated I&C changes acceptable.

With respect to COLA FSAR instrument block diagram (IBD) Figure 7.2-9, "Reactor Protection System IED (Sheet 3 of 11)," Revision 2, still includes the MSL radiation trip signal. The staff issued RAI 07.01-4 requesting the applicant to delete the MSL radiation trip signal from the IBD.

[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.

In its response to RAI 07.01-4, dated June 15, 2009 (ML091690066), the applicant commits to revising IBD Figure 7.2-9. The staff found the applicant's response acceptable, and the RAI is resolved. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.01-4 is closed.

SER Chapter 11 documents the staff's evaluation of Departure STD DEP T1 2.3-1 for the deletion of the MSIV closure and scram on high radiation. This departure does not impact its conformance to the 10 CFR 50.55a(h) (IEEE Std 603–1991) regulation for the RTIS safety system in the certified ABWR DCD. Hence, the staff determined that this departure is acceptable from the I&C perspective.

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

The staff reviewed this departure and found that it includes the following five primary changes to the I&C architecture of the certified ABWR DCD, Revision 4:

1. Elimination of obsolete data communication technology.
2. Elimination of unnecessary inadvertent actuation prevention logic and equipment.
3. Clarification of digital controls nomenclature and systems.
4. Final selection of platforms that changed the implementation architecture.
5. Identification of testing and surveillance changes for the SSLC.

The staff found that only Items 1, 3, 4, and 5 above, are changes that are relevant to the certified ABWR DCD FSAR Section 7.2, Revision 4. Item 2 is related to the ESF systems and will be addressed in Section 7.3 of this SER. The first change to the plant safety-related I&C architecture in the certified ABWR DCD replaces the EMS and the NEMS included as the communication protocol in the certified ABWR DCD, with separate and independent system level communication capabilities. It has been more than twelve years since the certification of the ABWR DCD, Revision 4. The staff agreed that the data communication standard ANSI-X3 series and fiber-distributed data interface (FDDI) used in the certified ABWR DCD have become an obsolete technology and are no longer appropriate for use with the ABWR safety-related I&C systems. The staff also found that the certified ABWR DCD used a centralized, common EMS that is subject to a common cause failure (CCF) potential of greater consequence. This CCF problem within the EMS could disable both the RTIS and the ELCS. The departure proposes to use different and diverse platforms for the RTIS and ELCS. The staff determined that this proposed change will allow the overall SSLC safety systems to be more resistant to CCFs; will provide a more robust communication design because a credible single failure will minimize degradation to independent communication functions; will not be subject to the CCF scenario of disabling both the RTIS and ELCS; and will provide the flexibility to utilize communication technologies that could generate benefits through simplicity of function and improved independence, such as the use of point-to-point unidirectional data links. The staff also found that the RTIS uses direct hardwired inputs to the system instead of using remote multiplexers, as described in the certified ABWR DCD, Revision 4. The staff also determined that this change will significantly reduce the complexity of data communication requirements for this RTIS, while continuing to meet the certified ABWR DCD functional requirements.

The third change to the safety-related I&C architecture noted above in the certified ABWR DCD clarifies the use of digital controls nomenclature and systems associated with the above new data communication technology and selected platform. This change replaces all references to

the previous EMS- and NEMS-related terminology and their primary components with a data communication reference.

The fourth and fifth changes are related to the platform change for the RTIS I&C safety system and its associated testing and surveillance requirements. The staff reviewed this platform change and found it necessary for incorporating currently available platforms and also for meeting both the regulatory and functional requirements. The staff reviewed the revised testing and surveillance descriptions for the SSLC (NMS, RTIS, and ELCS) and found them consistent with the characteristics of the proposed design platforms.

The staff's review of the above changes to the RTIS I&C system found that the relevant changes from this departure do not alter the certified ABWR design concepts and functional requirements for the RTIS safety system. The staff also found that this departure meets the regulatory requirements of 10 CFR 50.55a(h) (IEEE Std 603–1991); GDC 13; GDC 19, "Control room"; GDC 20; GDC 21, "Protection system reliability and testability"; GDC 22, "Protection system independence"; GDC 23, "Protection system failure modes"; GDC 24, "Separation of protection and control systems"; and the guidelines in RG 1.152, Revision 2, "Criteria for Use of Computers in Safety Systems of Nuclear Power Plants"; DI&C-ISG-04; and other guidelines.

The proposed high-level changes for the RTIS and its associated functions in this departure are captured in the COLA FSAR, Tier 1, Section 3.4. However, there were no design details in the COLA FSAR Tier 2, Chapter 7, which could be used to form the bases for the high-level RTIS design description. The staff issued RAI 07-6 requesting the applicant to provide enough details of the RTIS design information. In its response to RAI 07-6, dated December 30, 2009 (ML100050181), the applicant committed to providing a new Tier 2 supplemental section, FSAR Tier 2, Section 7.1S, to meet the requirements of the regulations in 10 CFR Part 52. The proposed supplemental section, "Site Specific Instrumentation and Control Platforms," includes the description of the FPGA-based platform for the RTIS and NMS. In this supplemental section, the FPGA-based RTIS and NMS are presented in more detailed design. The staff found that this supplemental section includes adequate details of the platform design information. The staff also found that the design information for the RTIS, meets the requirements of 10 CFR 50.55a(h). The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07-6 is closed.

The staff found that the fourth change item noted above is not reflected in all related places of this and other sections. The staff issued RAI 07.01-4 requesting the applicant to correct the inconsistencies. In its response to RAI 07.01-4, dated June 15, 2009 (ML091690066), the applicant committed to correcting all inconsistencies. The staff found the applicant's response acceptable and therefore the RAI is resolved. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.01-4 is closed.

COLA FSAR Tier 2, Subsection 7.2.1.1.6.1(3), Revision 2 refers to Departure STD DEP T1 3.4-1, which proposed to change the time resolution of all sequences of events from 5 milliseconds (ms) or less to 25 ms or less for the safety-related nuclear steam supply (NSS) systems. In Revision 2 of the COL FSAR, the applicant had not provided any reasons for this change or any of the resultant impacts. The staff issued RAI 07.02-3 requesting the applicant to provide sufficient information and analysis to support this departure. In its response to RAI 07.02-3, dated September 24, 2009 (ML092710226), the applicant committed to reverting to the certified ABWR DCD Revision 4 value of 5 ms for the sequential events interval. The staff found this response acceptable, and the RAI is resolved. The staff confirmed that the

applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.02-3 is closed.

In the safety-related RTIS, the bypass unit with inputs and outputs to and from each division (shown in the original Figure 7.2-2 in the certified ABWR DCD, Revision 4) was deleted without any explanation in the COL FSAR. In addition, some interlocks (such as "reset permissive," "from one ACT [reset permissive]," "trips from NMS Div X," etc.) were included in the original figure but are circled as changes in this figure in the COLA FSAR. The staff issued RAI 07.02-2 requesting the applicant to explain the above changes in Figure 7.2-2 and to clarify why the original interlocks are circled as changes. In its response to RAI 07.02-2, dated December 30, 2009, the applicant provides a markup of Figure 7.2-2 and the related FSAR text, which incorporates all changes and will be included in a future COLA revision. The staff's review of the markups found them consistent with the proposed changes in the departure, which the staff found acceptable, and the RAI is resolved. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.02-2 is closed.

Refer to Sections 7.1, 7.3, and 7.9S of this SER for detailed evaluations of this departure.

Tier 2 Departure*

The following Tier 2* departure identified by the applicant in this section requires prior NRC approval, and the full scope of its technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by this Tier 2* departure.

- STD DEP 1.8-1 — Tier 2* Codes, Standards, and Regulatory Guide Edition Changes

COLA FSAR Tier 2, Table 1.8-20 lists NRC RGs applicable to the ABWR. Table 1.8-21 lists industry codes and standards applicable to the ABWR. This departure identifies Tier 2* items in these two tables that are being updated to more current revisions/editions. The staff reviewed this departure and found that the following Tier 2* items included in this departure are related to the DI&C systems:

- RG 1.75, "Physical Independence of Electric Systems," Revision 3, dated February 2005; and RG 1.153, "Criteria for Safety Systems," Revision 1, dated June 1996 are adopted to ensure that more recent industry design and construction practices are used.

- The staff also found that the IEEE Std 384–1992, "IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits," was adopted. This edition of the standard is currently endorsed by the NRC. IEEE Std 603 was updated to the 1991 version because this edition is required by the NRC regulation 10 CFR 50.55a(h).

- Because the electromagnetic interference (EMI) field has advanced considerably since the certification of the ABWR DCD, the applicant has updated the Mil-Specs for EMI analysis and control to more current versions that comply with requirements in RG 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems."

The staff found that some RGs have been updated to the current ones in force. The NRC has either approved or endorsed the revisions to the industrial codes and standards. The applicant

submitted two supplemental tables (Tables 1.9S-1 and 1.9S-1a) that list the RGs, codes, and standards that are applicable to the safety-related I&C platform departures and that are considered acceptable. These updates to more current revisions or editions in the tables will increase plant reliability and performance by capturing selected advancements in engineering theory and practice since the issuance of the ABWR design certification.

From the above review, the staff concluded that this departure meets the requirements in regulations 10 CFR 50.55a(a)(1), 10 CFR 50.55a(h), and GDC 1, "Quality standards and records." Hence, the staff determined that this departure is acceptable from the I&C perspective.

Refer to Section 7.1 of this SER for the detailed evaluation of this departure.

Tier 2 Departure Requiring Prior NRC Approval

The following Tier 2 departure identified by the applicant in this section requires prior NRC approval, and the full scope of its technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by this Tier 2 departure.

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

The staff reviewed this departure and found it includes the following changes:

- Medium voltage rating of the power generation (PG) buses increased to 13.8 kV.
- Medium voltage rating of the plant investment protection (PIP) buses decreased to 4.16 kV.
- Medium voltage rating of the Class 1E buses decreased to 4.16 kV.
- Emergency diesel generator (EDG) ratings increased to 7200 kW and 4.16 kV.
- Combustion turbine generator (CTG) ratings increased to 13.8 kV and at least 20 megawatts electrical (MWe).
- Time required for CTG to start and achieve steady state voltage and frequency increased from two minutes to "less than 10 minutes" as provided by RG 1.155, "Station Blackout," for a station blackout (SBO) alternate ac source

The staff found that the above proposed changes improve reliability with divisional and safety/nonsafety isolation and independence; provide greater flexibility for maintenance, surveillance, and inspection via the dual voltage design; and increase the availability of multiple sources of power to the various buses in the revised design and the ability to isolate the buses individually, if needed. This departure changes the voltage of the EDGs from 6.9 kV to 4.16 kV, which is used to power the transformers and then provides 120 volts of alternating current (VAC) alternate power sources for each SSLC bus. The staff found that the change in this departure to Section 7.2 of the certified ABWR DCD is the revised rating as indicated above. The staff therefore found the change acceptable.

The staff's review indicates that the changes in this departure still meet the requirements of Clause 8.1 of IEEE Std 603–1991. Therefore, the staff determines that this departure is acceptable from the I&C perspective.

Refer to Section 8.3, “Onsite Power Systems,” of this SER for the detailed evaluation of this departure.

Tier 2 Departure Not Requiring Prior NRC Approval

The following Tier 2 departures not requiring prior NRC approval identified by the applicant in this section may also be evaluated in other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these departures.

- STD DEP 7.1-1 References to Setpoints and Allowable Values

The staff reviewed this departure and found that it clarifies, in the COLA FSAR wherever the TS are referenced for setpoints or margins, that the correct reference is to the methods for calculating the setpoints and margins, as described in the TS Bases. Setpoints for high radiation levels are in accordance with the offsite dose calculation manual. The changes to this section from this departure reflect the above mentioned reference to TS for methods of calculating setpoints and margins.

In COLA Part 7, “Departures Report,” Section 3.0, “Departures Not Requiring Prior NRC Approval,” the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant’s evaluation determines 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 NRC approval. The applicant’s process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 7.2-2 Description of Scram Actuating Relays

The staff reviewed this departure and found that the change from this departure revises the wording of the relay logic contact status from “normally closed” to “normally open,” and clarifies that the tripped state is when the coil is “energized.” The change in this departure makes the description in DCD Subsection 7.2.1.1.4.1(3) match with Figure 7.2-8, “SCRAM Solenoids and Air Header Dump Valves Power Distribution,” in the certified ABWR DCD, Revision 4, which is not changed in the COLA FSAR.

In COLA Part 7, “Departures Report,” Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant’s evaluation 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 NRC approval. The applicant’s process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 7.2-4 Manual Scram Monitoring

The staff reviewed this departure, which deletes the statement about monitoring initiating variables, because it is misplaced in the “Manual Scram” subsection and could be misleading in light of the manual scram not being bypassed.

In COLA Part 7, “Departures Report,” Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant’s evaluation 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 NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 7.2-6 RPS Instrumentation Ranges

The staff reviewed this departure and found that the change in this departure is reflected as new ranges in Table 7.2-1, "Reactor Protection System Instrumentation Specifications," for RPS instrumentation specifications, which are derived from the continuing design effort. The staff reviewed the updated ranges and found them appropriate for optimal performance.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation determined that this departure does not require prior NRC approval. The staff conducted an audit on this Tier 2 departure and its evaluation process and found it reasonable that the departure does not require NRC approval. For additional information on this audit, see NRC Audit Report dated January 25, 2010 (ML093360537).

- STD DEP Admin

The staff reviewed this departure, which is administrative and makes minor corrections, such as editorial or administrative errors in the certified ABWR DCD, Revision 4 (e.g., misspelled words, incorrect references, table headings, etc.). Administrative departures do not affect the presentation of any design discussion or qualification of design margin. The changes in this departure to this section reflect clarifications of digital controls nomenclature and systems, as mentioned in Departure STD DEP T1 3.4-1.

In COLA Part 7, "Departures Report," Section 4.0, the applicant conducts screenings using an evaluation methodology derived from 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation determined that administrative departures do not require prior NRC approval. The staff reviewed the Departures Report regarding this departure, and could not determine whether it is reasonable for this departure not to require prior NRC approval. The staff's review of Revision 2 of the COL FSAR found many editorial or administrative errors. The staff issued RAI 07.01-4 requesting the applicant to correct those errors. In its response to RAI 07.01-4, dated June 15, 2009 (ML091690066), the applicant committed to incorporating the corrections in the new revision of the COLA. The staff found the response acceptable, and the RAI is resolved. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.01-4 is closed.

7.2.5 Post Combined License Activities

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

7.2.6 Conclusion

The 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 RPS I&C, 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 10 CFR Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the RPS I&C that were incorporated by reference have been resolved.

The applicant elects to develop the detailed design for the RTIS using the ITAAC/DAC items in the certified ABWR DCD Tier 1, Table 3.4. The staff found that the COLA provides adequate RTIS design information and acceptance criteria, so that verification of the implementation of the ITAAC/DAC items will demonstrate that the as-built RTIS conforms to the COL design.

The staff compared the additional information referred to in the COLA to the relevant NRC regulations and the guidance in Section 7.2 of NUREG–0800. The staff's review concluded that the applicant has adequately addressed the identified Tier 1 and Tier 2* departures in accordance with Section 7.2 of NUREG–0800, and 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. The staff concludes that the applicant has provided sufficient information to satisfy NRC requirements.

7.3 Engineered Safety Feature Systems, Instrumentation, and Control

7.3.1 Introduction

This section of the FSAR describes the I&C for equipment in the various ESF systems. Descriptions of the ESF systems are in Chapter 6 and Chapter 9, "Auxiliary Systems," of the certified ABWR DCD, Revision 4. The ESF systems for the ABWR utilize the ELCS, which is a part of the SSLC system. The following ESF systems are evaluated:

- Emergency core cooling systems (ECCS).
- Leak detection and isolation system (LDS).
- Wetwell and drywell spray mode of the residual heat removal system (RHR).
- Suppression pool cooling mode of the RHR.
- Standby gas treatment system.
- EDG support systems.
- Reactor building cooling water (RCW) system and reactor service water (RSW) system.
- Essential HVAC systems.
- HVAC emergency cooling water system.
- High-pressure nitrogen gas supply system.

7.3.2 Summary of Application

Section 7.3 of the STP, Units 3 and 4, COL FSAR Revision 12 incorporates by reference Section 7.3 of the certified ABWR DCD, Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 7.3, 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 describes the removal of the MSIV automatic closure and scram based on high MSLRM.

- STD DEP T1 2.4-1 RHR System and Spent Fuel Pool Cooling

This departure describes the changes that provide the ability to supply fuel pool cooling or makeup from any of the three RHR loops in the augmented fuel pool cooling or fuel pool makeup modes.

- STD DEP T1 2.4-2 Feedwater Line Break Mitigation

This departure reduces challenges to the containment pressure design value following a feedwater line break (FWLB).

- STD DEP T1 2.4-3 RCIC Turbine/Pump

This departure describes an improved new design for the reactor core isolation and cooling (RCIC) turbine/pump system, which meets or exceeds all safety-related system performance criteria including start time, flow rate, and low steam pressure operation.

- STD DEP T1 2.14-1 Hydrogen Recombiner Requirements Elimination

This departure eliminates the hydrogen recombiner requirement to maintain equipment needed to mitigate a design-basis LOCA hydrogen release.

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

This departure describes changes to the I&C architecture and nomenclature that are needed to address obsolete data communication technology and selection of DI&C platforms.

Tier 2 Departure*

- STD DEP 1.8-1 Tier 2* Codes, Standards, and Regulatory Guide Edition Changes

This departure updated codes, standards, and RGs to more current revisions/editions.

Tier 2 Departures Requiring Prior NRC Approval

- STD DEP 7.3-12 Leak Detection and Isolation System Sump Monitoring

This departure revises alarm setpoints (nominal values) to support TS limits for reactor coolant pressure boundary leakage.

- STD DEP 7.3-17 Automatic Depressurization Subsystem (ADS) Electrical Interface

This departure provides a more complete description of the ECCS compliance with RG 1.75, “Physical Independence of Electric Systems.” This departure changes TS 3.3.1.4 Bases but does not change the intent of the generic TS.

Tier 2 Departures Not Requiring Prior NRC Approval

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

The certified ABWR DCD, Revision 4, is based on a single-unit site. STP, Units 3 and 4, is a dual-unit project. This departure describes the common support systems shared by STP, Units 3 and 4, and the existing STP, Units 1 and 2.

- STD DEP 7.1-1 References to Setpoints and Allowable Values

This departure clarifies that, in the FSAR, wherever the TS is referenced for setpoints or margins the correct reference is to the methods for calculating the setpoints and margins, as described in the TS Bases.

- STD DEP 7.3-1 Time Intervals for Licensing Analysis

This departure deletes the specific values of the licensing analysis and provides a new reference in COLA FSAR Chapter 7 to ensure that the information is consistent.

- STD DEP 7.3-2 Automatic Depressurization System (ADS) Operator

This departure revises actuation of the automatic safety/relief valves (SRVs) as pneumatic action to clearly describe the automatic depressurization system (ADS) function of the SRV.

- STD DEP 7.3-4 ADS Logic

This departure provides a clearer description of the conditions under which the ADS could be initiated.

- STD DEP 7.3-5 Water Level Monitoring

This departure describes the use of standard ABWR nomenclature of various water levels for initiating signals.

- STD DEP 7.3-6 SRV Position Indication

This departure incorporates limit switches on the SRVs that provide a direct, positive indication of the SRV position and is more reliable than the original described linear variable differential transformers (LVDT).

- STD DEP 7.3-7 Automatic Depressurization System (ADS) Manual Operation

This departure changes the ADS inhibit switches from a keylock type to a normal manual switch.

- STD DEP 7.3-9 Shutdown Cooling Operation

This departure clarifies the description of the RHR shutdown cooling mode valve alignment in the certified ABWR DCD, Revision 4, after a low-pressure core flooder (LPFL) actuation signal.

This clarification deletes the reference to automatic closure of the RHR suction valves for the shutdown cooling system (SCS) mode, upon receipt of an LPFL initiation signal on water level 1.

- STD DEP 7.3-10 — ESF Logic and Control System (ELCS) Mode Automation

This departure provides an expanded description of the mode switches in the MCR. In order to support the displays and reduce operator burden, the RHR has specific mode operation capability. This change eliminates the possibility of operator error and supports the display requirements.

- STD DEP 7.3-11 — Leak Detection and Isolation System Valve Leakage Monitoring

This departure describes the use of one set of expanded graphite packing to seal the valve stem penetration in order to resolve the valve stem leakage issue.

- STD DEP 7.3-13 — Containment Spray Logic

This departure clarifies the operation of the containment spray system, removes the manual override logic, and provides a more complete description of the operation of this mode of RHR.

- STD DEP 7.3-14 — Residual Heat Removal Suppression Pool Cooling Logic

This departure describes changes to the logic and sequencing of the RHR suppression pool cooling mode.

- STD DEP 7.3-15 — Reactor Service Water Logic Interfaces

This departure describes the modified information about the safety interfaces for the reactor cooling water system controls.

- STD DEP 7.3-16 — Testing Safety Relief Valve Solenoid Valves

This departure describes improved testing capabilities for SRV solenoid valves. These improvements allow the testing of the safety/relief valve pilot solenoid valves to be performed at any pressure.

- STD DEP 7.7-2 — SRV Discharge Pipe Temperature Data Recording

This departure describes a design upgrade of the SRV discharge pipe temperature data recording and alarm to replace the multipoint recorders with a historian function digital system, because there have been significant technological advances in data recording since the certified ABWR DCD, Revision 4, was written.

- STD DEP Admin

This departure describes minor corrections such as editorial or administrative errors in the certified ABWR DCD, Revision 4, (e.g., misspelled words, incorrect references, table headings, etc.).

COL License Information Item

- COL License Information Item 7.1 Cooling Temperature Profiles For Class 1E Digital Equipment

The applicant provides supplemental information to address COL License Information Item 7.1 regarding cooling temperature profiles for Class 1E digital equipment.

7.3.3 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 ESF systems I&C, and the associated acceptance criteria, are in Section 7.3 of NUREG–0800. In accordance with Section VIII, "Processes for Changes and Departures," of Appendix A to 10 CFR Part 52, "Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies Tier 1, Tier 2*, 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 require prior NRC approval and are subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.B.6. Tier 2 departures that affect TS or TS Bases require prior NRC approval and are subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.C.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 of 10 CFR 50.59.

Reviews of the departures are based on meeting the current regulatory requirements, acceptance criteria, and guidelines in NUREG–0800, Table 7-1, Revision 5 (March 2007). In accordance with 10 CFR 50.55a(h), COLAs filed on or after May 13, 1999, which depart from the certified ABWR DCD, Revision 4, must meet the requirements for safety systems in IEEE Std 603–1991, and in the correction sheet dated January 30, 1995. In addition, applicable guidelines in DI&C ISG documents are also used to evaluate the departures from the certified ABWR design.

7.3.4 Technical Evaluation

As documented in NUREG–1503, the staff reviewed and approved Section 7.3 of the certified ABWR DCD. The staff reviewed Section 7.3 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 ESF systems I&C.

[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 reviewed the following information in the COL FSAR:

Tier 1 Departures

The following Tier 1 departures identified by the applicant in this section require prior NRC approval, and the full scope of their technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these Tier 1 departures.

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

The staff reviewed this departure, which deletes the logic of the scram and MSIV automatic closure on high MSLRM trip in DCD FSAR Subsection 7.3.1.1.2. The staff found that this safety function was deleted because the MSLR-high trip is not specifically credited in any ABWR safety analysis. This trip was originally designed for BWRs to mitigate the effects of a control rod drop accident (CRDA). However, the ABWR has no basis for the CRDA event to occur. Thus, the staff found that the deletion of the automatic scram and MSL isolation results in no changes in associated risks or safety margins. In addition, the staff found that there are spurious trips due to this function. The radiation trip setpoints can be overwhelmed by minor variations during normal operation and cause spurious trips. Elimination of this safety-related function reduces the potential for unnecessary reactor shutdown and increases plant operation flexibility. Operators in the MCR are alerted to potential offsite releases by the MSLRM, the condenser steam jet air ejector monitor, and/or the ventilation stack monitor. Furthermore, the NRC has already reviewed and approved this change for U.S. BWRs based on analyses demonstrating that safety margins are not impacted. Based on the above review, the staff found this change acceptable.

Chapter 11 of this SER, documents the staff's evaluation of Departure STD DEP T1 2.3-1. This departure does not impact its conformance to the 10 CFR 50.55a(h) (IEEE Std 603–1991) regulation for the LDS I&C system in the certified ABWR DCD. Hence, the staff determined that this departure is acceptable from the I&C perspective.

- STD DEP T1 2.4-1 — RHR System and Spent Fuel Pool Cooling

The staff reviewed this departure and found that the relevant change in this departure adds the capability to allow the choice of a third loop, RHR division A, in the augmented fuel pool cooling and fuel pool makeup modes. The staff also found that this change provides the added flexibility of the capability to perform divisional outages in any order. This departure modifies Figure 7.3-4, "RHR System IBD" in the certified ABWR DCD Section 7.3. The staff found the changes from this departure acceptable from the I&C perspective since the added RHR system capability and augmented fuel pool cooling system meets regulatory requirements in 10 CFR 50.55a(h) (IEEE Std 603–1991), 10 CFR 50.34(f)(2), GDC 13, GDC 20 through 24, and GDC 34, "Residual heat removal," for the ESF system.

This departure is evaluated in Chapter 5 of this SER.

- STD DEP T1 2.4-2 — Feedwater Line Break Mitigation

The staff reviewed this departure and found the changes included in this departure decrease the risk associated with the feedwater line break inside containment by ensuring that the

containment pressure margins are maintained during the limiting containment pressurization accident. The staff found that the applicant has included the changes in FSAR Subsection 7.3.1.1.2 associated with this departure. However, the staff also found that more design information was needed to make a reasonable assurance evaluation. The staff issued RAI 07.03-3 requesting the applicant to provide more information. In its response to RAI 07.03-3, dated September 22, 2009 (ML092680017), the applicant provides adequate design information and identified other sections where this clarifying information is located, specifically FSAR Tier 2, Subsection 8.3.1.1.1 and Figure 8.3-1, "Electrical Power Distribution System SLD (Sheets 1 – 4)." From the applicant's response, the staff found that this departure adds feedwater line differential pressure instruments to detect a line break in the piping and provide signals to the LDS logic systems. During normal plant operation, the differential pressure between the two feedwater lines is expected to be small. During a postulated break of one feedwater line inside the drywell, the differential pressure is expected to be large, because the broken line would be discharging into the low pressure of the drywell, and the intact line would be discharging into the high-pressure of the Reactor Pressure Vessel (RPV). Each feedwater line differential pressure signal is compared to a set value, and its trip signal goes to a two-out-of-four voter logic. The output of this logic goes to an 'AND' gate, into which the other input is the output of a two-out-of-four voter logic of high drywell-pressure trip signals that indicates a LOCA has occurred. This trip function is performed by the LDS. The postulated condition of a FWLB and a high drywell pressure will cause the operating condensate pumps to trip, which terminates feedwater flow into the drywell. The feedwater line differential pressure instrumentation and drywell pressure instrumentation are classified as safety-related for the mitigation of a postulated FWLB inside the drywell. The staff found that the changes in this departure will maintain the same level of plant reliability and performance as described in the certified ABWR DCD, Revision 4. The changes will also provide a better level of plant protection and a net benefit to public health and safety. The staff's evaluation discussed above determined that this departure satisfies 10 CFR 50.55a(h) (IEEE Std 603-1991); GDC 13 and 20–24; and the guidance in RG 1.97, Revision 4, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants." Therefore, the staff found a reasonable assurance that this departure is acceptable from the I&C perspective, and RAI 07.03-3 is closed.

This departure is also evaluated in Chapter 6, "Engineered Safety Features," of this SER.

- STD DEP T1 2.4-3 RCIC Turbine/Pump

The NRC staff reviewed the changes that the applicant made in FSAR Subsections 7.3.1.1.1.3 and 7.3.1.1.2 related to this departure. The staff noted that the applicant also made corresponding changes to IBD 7.3-3, "Reactor Core Isolation Cooling System IBD," and IBD 7.3-4, "Residual Heat Removal System IBD." The staff found that the changes in this departure include an improved new design for the RCIC turbine/pump system, which meets or exceeds all safety-related system performance criteria including start time, flow rate, and low steam pressure operation. In this proposed new design, the operating speed of the pump is governed by the turbine control subsystem that regulates the quantity of steam to the turbine based on discharge pressure. The main elements of the control gear are the steam stop valve, the throttle valve, and the pressure governor. FSAR Subsections 7.3.1.1.1.3 and 7.3.1.1.2, reflect this departure and modify the RCIC I&C description. The staff found that the related impact from this departure on the ESF I&C system is the updated I&C system for this new design of RCIC turbine/pump system. The staff found that this departure is acceptable from the I&C perspective because the staff determined that this departure meets the requirements in regulations 10 CFR 50.55a(h) (IEEE Std 603–1991) and GDC 13 and GDC 20 through 24.

This departure is also evaluated in Chapter 5 of this SER.

- STD DEP T1 2.14-1 Hydrogen Recombiner Requirements Elimination

The staff found that the applicant deletes FSAR Subsection 7.3.1.1.11 associated with the flammability control system (FCS), which is not used for the COLA. Accordingly the applicant makes changes to IBD 7.3-4, "Residual Heat Removal System IBD," and IBD 7.3-5, "Leak Detection and Isolation System IBD," for the deletion of the FCS. The staff reviewed this departure and found that the change in this departure includes the elimination of the requirement to maintain equipment needed to mitigate a design-basis LOCA hydrogen release. The ABWR FCS, which consists of two redundant hydrogen recombiners, is no longer required in the response to a design basis accident and is eliminated. The containment hydrogen and oxygen monitoring functions of the containment monitoring system are no longer required to function for the mitigation of a design-basis LOCA. This proposed design modification incorporates changes to regulations that occurred after the issuance of the design certification for the ABWR.

The staff reviewed the related impacts from this departure on the ESF I&C system and found the departure acceptable from the I&C perspective, because after incorporating these design changes, the ABWR design features and requirements for controlling combustible gases still satisfy regulations in 10 CFR 50.44(c) and are consistent with the guidance in RG 1.7, Revision 3, "Control of Combustible Gas Concentrations in Containment."

This departure is also evaluated in Chapter 6 of this SER.

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

The staff reviewed this departure and found that this departure includes the following five primary changes to the I&C architecture of the certified ABWR DCD, Revision 4:

1. Elimination of obsolete data communication technology.
2. Elimination of unnecessary inadvertent actuation prevention logic and equipment.
3. Clarifications of digital controls nomenclature and systems.
4. Final selection of platforms that changed the implementation architecture.
5. Identification of testing and surveillance changes for the SSLC.

Only Items 1, 2, 3, and 5, above, are changes that are relevant to the certified ABWR DCD, FSAR Section 7.3, Revision 4. Item 4 is related to the RTIS that is evaluated in Section 7.2 of this SER. The first change to the I&C architecture in the certified ABWR DCD is to replace the EMS and NEMS included as the communication protocol in the certified ABWR DCD, with separate and independent system level communication capabilities. It has been more than twelve years since the ABWR DCD, Revision 4, was certified. The staff found that the data communication standard, ANSI-X3 series, and the FDDI used in the certified ABWR DCD had become obsolete technologies and were no longer appropriate for use. The staff also found that the certified ABWR DCD used a centralized, common EMS that is subject to a higher potential for a CCF with a greater consequence than the separate systems of data communication described in this departure. In the unlikely event, both rings of the dual ring FDDI are disabled or there is a some other CCF within the EMS for that division, then both the RTIS and the ELCS could be disabled for that division. The departure proposes to use different and diverse platforms for the RTIS and ELCS. The staff determined that these proposed changes (a) allow the overall SSLC to be more resistant to a CCF; (b) provide a more robust

communication design; (c) are not subject to a single CCF disabling both the RTIS and ELCS; and (d) provide the flexibility to utilize communication technologies that have benefits in the areas of simplicity of function and improved independence, such as the use of point-to-point unidirectional data links. The staff also found that the ELCS addressed in this section will use serial, unidirectional, fiber optical-based data links to replace the FDDI protocol, as described in the certified ABWR DCD, Revision 4. The staff has already reviewed and approved the platform selected for the ELCS in the COLA as documented in the staff's SER dated August 11, 2000 (ML003740165). Therefore, the staff determined that the method of communication for the ELCS meets the regulatory and functional requirements specified in the certified ABWR DCD, Revision 4.

The staff found that the purpose of the second change stated above is relevant to the ELCS I&C system and will minimize the potential for the false actuation of ESF components. The certified ABWR DCD includes a design for the ESF actuation system that is fully redundant within each division of the ESF control system. This second change eliminates unnecessary and inadvertent actuation logic and equipment and implements the redundant actuation prevention logics only for the required ESF components, which may impact the safety or operation of the plant. But the COLA FSAR did not provide a list of logic and equipment in the ESF system selected for deletion or the bases for the deletion of each individual equipment or logic. The staff issued RAI 07.03-1, requesting the applicant to address these concerns. In its response to RAI 07.03-1, dated June 29, 2009 (ML091830340), the applicant provides a list of deleted logic functions and their bases for modifications. The staff reviewed the responses and found this change acceptable and therefore, RAI 07.03-1 is closed. The changed ELCS logics still meet the safety functional requirements in the certified ABWR DCD.

The third change to the I&C architecture stated above is relevant to the ELCS in the certified ABWR DCD. This change clarifies the use of the digital controls nomenclature and systems associated with the above new data communication technology and approved platform selected for the ELCS. This change just replaces all references to the previous EMS- and non-NEMS-related terminology and primary components with a generic data communication reference.

The fifth change stated above is relevant to the ELCS and is related to the approved platform selected for the ELCS safety system and its associated testing and surveillance requirements. The staff has reviewed and approved this platform. The staff found that it meets both the regulatory and technical requirements in the certified ABWR DCD for the ELCS safety system.

After reviewing the changes to the ELCS I&C system, the staff found that the relevant changes in this departure do not depart from the concepts and functional requirements in the certified ABWR DCD for the ELCS safety system. The staff also found that Departure STD DEP T1 3.4-1 meets the regulatory requirements of 10 CFR 50.55a(h) (IEEE Std 603–1991), GDC 13 and GDC 19 through 24; and the guidelines in RG 1.152, Revision 1, DI&C-ISG-04, and other guidelines. Therefore, the staff found a reasonable assurance that this departure is acceptable from the I&C perspective with the confirmation items discussed below.

The proposed high-level changes for the ELCS and its associated functions in departure STD DEP T1 3.4-1 are captured in the COLA FSAR Tier 1, Section 3.4. However, there were no design details in the COLA FSAR Tier 2, Chapter 7 that could be used to form the basis for the high-level ELCS design description. The staff issued RAI 07-6 requesting the applicant to provide enough details of the ELCS design. In its revised response to RAI 07-6, dated December 30, 2009 (ML100050181), the applicant committed to providing a new Tier 2

supplemental Section 7.1S to meet the requirements of the regulations in 10 CFR Part 52. The proposed supplemental section titled "Site-Specific Instrumentation and Control Platforms" includes the description and appropriate details of the microprocessor-based platform for the ELCS, which the staff has reviewed and approved. The staff found the supplemental section acceptable. The staff confirmed that the applicant has included the proposed new Section 7.1S in FSAR Revision 5. Therefore, RAI 07-6 is closed.

The staff found that the change in Item 4 stated above is not reflected in all of the related sections, including this one. The staff issued RAI 07.01-4 requesting the applicant to correct the inconsistencies. In its response to RAI 07.01-4, dated June 15, 2009 (ML091690066), the applicant committed to correct all inconsistencies. The staff found the response acceptable, and the RAI is resolved. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.01-4 is closed.

Refer to Sections 7.1, 7.2, and 7.9S of this SER for additional evaluations of this departure.

Tier 2 Departure*

The following Tier 2* departure identified by the applicant in this section requires prior NRC approval, and the full scope of its technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by this Tier 2* departure.

- STD DEP 1.8-1 — Tier 2* Codes, Standards, and Regulatory Guide Edition Changes

The staff found that the applicant's change in FSAR Section 7.3, which replaces IEEE Std 279 with IEEE Std 603–1991, meets the requirement of 10 CFR 50.55a(h) and is therefore acceptable. Refer to Section 7.2 of this SER for an additional evaluation of the impacts from this departure on the DI&C system.

Tier 2 Departures Requiring Prior NRC Approval

The following Tier 2 departures identified by the applicant in this section require prior NRC approval, and the full scope of their technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these Tier 2 departures.

- STD DEP 7.3-12 — Leak Detection and Isolation System Sump Monitoring

The staff found that this departure changes FSAR Subsection 7.3.1.1.2, "Leak Detection and Isolation System (LDS) – Instrumentation and Controls." The staff reviewed this departure and found that the changes include new leakage setpoint values and the addition of an increase in unidentified leakage parameters for the leak detection and isolation system. However, the staff determined that this departure does not change the intent of the generic TS. This departure therefore meets the requirements of 10 CFR 50.55a(h) (IEEE Std 603–1991); 10 CFR 50.34(f)(2); and GDC 13, 19, and 20. The staff found reasonable assurance that this departure is acceptable from the I&C perspective.

This departure is also evaluated in Chapters 5 and 16 of this SER.

- STD DEP 7.3-17 Automatic Depressurization System (ADS) Electrical Interface

The staff found that the applicant's changes in FSAR Subsection 7.3.2.1.2 relate to this departure. The staff reviewed this departure and found that the changes include a more complete description of ECCS compliance with RG 1.75 than the description in the certified ABWR DCD. The staff found that the departure clarifies that while sensor signals input come from all four electrical divisions, the control logic that is only in Divisions I, II, and III is needed to actuate and conform to the three divisions of the actual ECCS equipment. Those changes are reflected in the revised FSAR Subsection 7.3.2.1.2. The staff found that this departure does not change the intent of the generic TS in the certified ABWR DCD and meets the requirements in 10 CFR 50.55a(h) and conforms to the guidance in RG 1.75. Hence, the staff found this departure acceptable from the I&C perspective.

This departure is also evaluated in Chapter 16 of this SER.

Tier 2 Departures Not Requiring Prior NRC Approval

The following Tier 2 departures not requiring prior NRC approval identified by the applicant in this section may also be evaluated in other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these departures.

- STD DEP 1.1-2 Dual Units at STP, Units 3 and 4

The NRC staff reviewed the Departures Report regarding this departure and found that this departure only clarifies that the certified ABWR DCD Revision 4, is based on a single unit and the STP COLA is a dual-unit project. There are a few common balance-of-plant systems to be shared by STP, Units 3 and 4, and the existing STP, Units 1 and 2. The staff was initially unable to determine whether it is reasonable for this departure not to require NRC prior approval. The staff issued RAI 07.07-1 requesting the applicant to address whether there is any common I&C failure that can cause multiple unit transients or shutdowns. In its response to RAI 07.07-1, dated June 15, 2009 (ML091690066), the applicant clarifies that there are no shared I&C systems between STP, Units 3 and 4, and the existing STP, Units 1 and 2, that are capable of bringing down multiple units. The safety-related ESF systems for each unit are not shared.

The staff reviewed the applicant's response to RAI 07.07-1 and found it satisfactory; this RAI is closed. Therefore, within the review scope of this section, the staff found it reasonable that the departure does not require NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 7.1-1 References to Setpoints and Allowable Values

This departure modifies DCD Subsections 7.3.1.1.1.1, 7.3.1.1.1.2, 7.3.1.1.3, 7.3.1.1.7, and 7.3.1.2 in the FSAR by referring to the bases in COLA Chapter 16 for methods of calculating setpoints and margins. The staff found this change 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 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.

Refer to Section 7.2 of this SER for an additional evaluation of this departure from the I&C perspective.

- STD DEP 7.3-1 Time Intervals for Licensing Analysis

The staff reviewed this departure and found that the change to this section from this departure only replaces specific values with a reference to Table 6.3-1, "Significant Input Variables Used in the Loss-of-Coolant Accident Analysis," in the ABWR DCD, thus ensuring that the information is consistent.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation 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 NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 7.3-2 Automatic Depressurization System (ADS Operator

The staff reviewed this departure and found that it only rewords and clarifies the actuation of the automatic safety/relief valves without changing the meaning or intent of and with no adverse impact on the ADS design or function.

In COLA Part 7, "Departures Report," Section 3.0, "Departures Not Requiring Prior NRC Approval," the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation 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 NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 7.3-4 ADS Logic

The staff reviewed this departure and found that it only clarifies the initiating signals and logic for the ADS. The departure does not change the TS, setpoints for the parameters, or other operational requirements. It does not change the ADS design, any plant physical features, structures, systems, or components (SSCs) important to safety, or fission product barriers.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation determined that this departure does not require prior NRC approval. The staff conducted an audit on this Tier 2 departure and its evaluation process and found it reasonable that the departure does not require NRC approval. For additional information on this audit, see the NRC Audit Report dated January 25, 2010 (ML093360537).

- STD DEP 7.3-5 Water Level Monitoring

The staff reviewed the Departure Report regarding this departure and found that it includes the use of standard ABWR nomenclature for the reactor vessel level initiating instrumentation. This departure does not change the meaning or intent of and has no adverse impact on the ESF system design or function. However, the standard ABWR nomenclature for the reactor vessel level should be used in all other parts and sections of the COLA to maintain consistency. The

staff was unable to determine whether it is reasonable for this departure not to require NRC prior approval. Therefore, the staff issued RAI 07.02-5 requesting the applicant to address this concern. In its response to RAI 07.02-5, dated September 24, 2009 (ML092710226), the applicant provides a markup of the impacted FSAR sections that corrects all inconsistencies.

The staff found the response to this RAI acceptable. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.02-5 is closed.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation determined that this departure does not require prior NRC approval. Within the review scope of this section and with these inconsistencies addressed, the staff finds 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.

- STD DEP 7.3-6 SRV Position Indication

The staff reviewed this departure and found that it includes the use of limit switches mounted on the ADS SRVs to provide the position indication in the MCR for the SRVs, instead of the originally described LVDTs in the ABWR DCD. The changes in this departure are reflected in FSAR Subsection 7.3.1.1.1.2 and IBD 7.3-2. The use of the limit switch on the valves provides a direct and positive indication of the SRV position that is more reliable than that of the LVDT.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation 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 NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

This departure is also evaluated in Chapter 5 of this SER.

- STD DEP 7.3-7 Automatic Depressurization System (ADS) Manual Operation

The staff reviewed this departure and found that it replaces the ADS key-locked inhibit switch in the ABWR DCD with a normal manual switch to facilitate operator operation. This change does not affect the overall function of the ADS inhibit switches. The ADS inhibit switch is used to allow one ADS division to be taken out of service. This switch is ineffective once the ADS timers have timed out and thus cannot be used to abort and reclose the valves once they are signaled to open. The inhibit mode is continuously annunciated in the MCR. This departure only changes the type of switch and does not change the functionality of the ADS.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation determined that this departure does not require prior NRC approval. The staff conducted an audit on this Tier 2 departure and its evaluation process and determined that it is reasonable that the departure does not require NRC approval. For additional information on this audit, see the NRC Audit Report dated January 25, 2010 (ML093360537).

- STD DEP 7.3-9 Shutdown Cooling Operation

The staff reviewed this departure, which deletes references to the automatic closure of the RHR suction valves for the shutdown cooling system mode upon receipt of an LPFL initiation signal on Level 1. These valves are already automatically closed on a Level 3 signal. This departure further clarifies that the shutdown cooling isolation valves must be closed to permit suction from the suppression pool.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation determined that this departure does not require prior NRC approval. The staff conducted an audit on this Tier 2 departure and its evaluation process and found that it is reasonable that the departure does not require NRC approval. For additional information on this audit, see NRC Audit Report dated January 25, 2010 (ML093360537).

- STD DEP 7.3-10 ESF Logic and Control System (ELCS) Mode Automation

The staff reviewed this departure, which provides an expanded description of the mode switches in the MCR. In order to support the displays and reduce operator burden, the RHR has a specific mode operation capability that eliminates the possibility of operator error and supports the display requirements. The logic changes to the ELCS are implemented to assure that the diverse, hard-wired manual initiation function of HPCF loop "C" has priority over the normal automatic initiation logic for HPCF loop "C." These changes assure the proper implementation of the diverse, hard-wired HPCF loop "C" manual initiation capability.

For the safety-related RHR system, COLA FSAR Tier 2, Subsection 7.3.1.1.1.4(i), "Operational Considerations," states that "this action must occur within a limited interval." The applicant needed to provide a specific time requirement for this action and to include what could happen, in addition to any mitigation that would be needed, if the operator does not act within that limited time interval.

The staff issued RAI 07.03-2, requesting the applicant to address this concern. In its response to RAI 07.03-2, dated September 22, 2009 (ML0926800017), the applicant provides a markup of the impacted FSAR sections that delete the specific time requirement. The staff found this response acceptable. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.03-2 is closed.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation determined that this departure does not require prior NRC approval. The staff conducted an audit on this Tier 2 departure and its evaluation process and determined that it is reasonable that the departure does not require NRC approval. For additional information on this audit, see NRC Audit Report dated January 25, 2010 (ML093360537).

- STD DEP 7.3-11 Leak Detection and Isolation System Valve Leakage Monitoring

The staff reviewed this departure, which eliminates the reactor coolant pressure boundary isolation valve stem/gland leakage monitoring system. In the ABWR DCD, the valve stem packing rings were mostly made of asbestos material, which was prone to shrinkage during

service. The shrinkage could cause voids in the packing chamber, which lead to leakage. To resolve the stem leakage issue, valves of one set of expanded graphite packing to seal the valve stem penetration were specified in the COLA FSAR. Expanded graphite has superior sealing properties, is less likely to induce corrosion and damage to the valve stem from the trace material, retains its form longer, and avoids the formation of voids that could lead to leakage. Due to the valve packing changes, the valve stem leak-off lines are eliminated for the valves and the described instrumentation is no longer applicable.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation 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 NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

This departure is also evaluated in Chapter 5 of this SER.

- STD DEP 7.3-13 Containment Spray Logic

The staff reviewed this departure, which removes the manual override logic for the wetwell spray valves and suppression pool return valves. The annunciator status lights for these functions are removed from the table of status lights and annunciators. The departure to remove the manual override logic indicates that the spray system will continue to operate until manually terminated by the operator, or the spray system will automatically terminate and realign with the LPFL injection mode upon receipt of an RPV water Level 1 signal, because core cooling has priority.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation determined that this departure does not require prior NRC approval. The staff conducted an audit on this Tier 2 departure and its evaluation process and determined that it is reasonable that the departure does not require NRC approval. For additional information on this audit, see NRC Audit Report dated January 25, 2010 (ML093360537).

- STD DEP 7.3-14 Residual Heat Removal Suppression Pool Cooling Logic

The staff reviewed this departure, which provides a more complete and consistent description of the suppression pool cooling (SPC) automatic and manual modes of operation. The design change to an Arm and Initiate switch provides additional assurance that the operator will not inadvertently switch to the SPC mode from the LPFL mode while performing the critical operation of maintaining the water level in the RPV. This change does not impact the automatic initiation of the SPC mode on high-suppression pool temperature. Consequently, this change will not impact the frequency or consequences of accidents or the malfunction of an SSC important to safety. There is no impact on any fission product barrier, nor is there any impact on the likelihood or consequences of an ex-vessel severe accident.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation determined that this departure does not require prior NRC approval. The staff conducted an audit on this Tier 2 departure and its evaluation process and found it

reasonable that the departure does not require NRC approval. For additional information on this audit, see NRC Audit Report dated January 25, 2010 (ML093360537).

- STD DEP 7.3-15 Reactor Service Water Logic Interfaces

The staff reviewed this departure, which provides additional and more complete information regarding RCW flow. This information is considered an improvement for the control room operator. This departure also changes the annunciator alarm on high differential pressure from the RCW heat exchangers to the RSW A or D strainers. The departure does not change any control room indications concerning these systems (e.g., flow rate, differential pressure, or temperature) or any SSC important to safety. Because fouling the strainers is more likely to restrict cooling flow in the RSW than would fouling the heat exchangers, differential pressure monitoring of the strainers more effectively monitors conditions that could impede flow in the RSW.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation 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 NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 7.3-16 Testing Safety Relief Valve Solenoid Valves

The staff reviewed this departure, which improves testing capabilities of SRV solenoid valves. The staff found that these improvements allow the testing of the SRV pilot solenoid valves to be performed at any pressure instead of only when the reactor is not pressurized, thus enhancing the flexibility for testing these valves. Consequently, this departure has no adverse effects on the frequency or consequences of accidents or on functions of an SSC important to safety.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation 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 NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 7.7-2 SRV Discharge Pipe Temperature Data Recording

The staff reviewed this departure, which changes the SRV discharge pipe temperature data recording device using significant technological advances in data recording since the referenced ABWR DCD was written. The discharge temperatures of all SRVs will be shown on a historian function in the MCR. Recording SRV discharge temperature data will thus be performed in a more accurate manner that is easily retrievable. The recorded data rate meets all design criteria. The recorded data and the parameters remain the same.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in Part 52 Appendix A, Section VIII.B.5. The applicant's evaluation determined that this departure did not require prior NRC approval. Within the review scope of this section, the staff found it reasonable that the departure does not require NRC

approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

Refer to Section 7.7 of this SER for additional evaluations of this departure.

- STD DEP Admin

The applicant has changed FSAR Subsections 7.3.1.1.1.1, 7.3.1.1.1.3, 7.3.1.1.1.4, 7.3.1.1.3, 7.3.1.1.10, 7.3.1.2, 7.3.2.8.2, and Figure 7.3-5, "Leak Detection and Isolation System IBD (Sheet 1-8,11-12,15-16, 19-20, 23-24, 35, 36, 39-56, 58-61, 72, 74-77)." The changes are administrative and provide consistency in the COLA. The departure also clarifies descriptions and terminology.

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. Administrative departures do not affect the presentation of any design discussion or the qualification of any design margin. Therefore, the staff found it reasonable that this departure does not require prior NRC approval.

COL License Information Item

- COL License Information Item 7.1 Cooling Temperature Profiles for Class 1E Digital Equipment

The room cooling temperature profiles for equipment qualifications that are included in Appendix 3I of the certified ABWR DCD will be confirmed as part of the preoperational testing. ITAAC Item 14(b) in DCD Tier 1, Table 3.4 is specifically designed with acceptance criteria to track the implementation of this COL license information item. The staff reviewed this ITAAC item and determined that it covers COL License Information Item 7.1, which is therefore closed because it is redundant to existing ITAAC Item 14(b) in Tier 1, Table 3.4.

7.3.5 Post Combined License Activities

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

7.3.6 Conclusion

The 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 ESF systems I&C, 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 10 CFR Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the ESF systems I&C that were incorporated by reference have been resolved.

In addition, the staff compared the additional information in the COLA to the relevant NRC regulations and guidance in Section 7.3 of NUREG–0800. The staff's review concluded that the applicant has adequately addressed COL license information item and the Tier 1 and Tier 2* departures in accordance with Section 7.3 of NUREG–-0800, and 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.

The applicant elects to develop the detailed design for the ELCS using the ITAAC/DAC items in the certified ABWR DCD Tier 1, Table 3.4. The staff found that the COLA provides adequate ELCS design information and acceptance criteria; verification of the implementation of the ITAAC/DAC items will demonstrate that the as-built ELCS conforms to the COL design.

The applicant will address COL License Information Item 7.1 as part of the preoperational testing, which is covered by ITAAC item 14(b) in DCD Tier 1, Table 3.4. The staff found that the applicant has adequately addressed the identified departures. The staff concludes that the applicant has provided sufficient information to satisfy NRC requirements.

7.4 Systems Required for Safe Shutdown

7.4.1 Introduction

This section of the FSAR examines and discusses the I&C aspects of the following plant systems and functions designed to assure the safe and orderly shutdown of the ABWR:

- ARI function.
- Standby liquid control system (SLCS).
- Reactor shutdown cooling mode.
- Remote shutdown system (RSS).

7.4.2 Summary of Application

Section 7.4, "Systems Required for Safe Shutdown," of the STP, Units 3 and 4, COL FSAR Revision 12 incorporates by reference Section 7.4 of the certified ABWR DCD, Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 7.4, the applicant provides the following:

Tier 1 Departures

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

This departure provides the ability to supply fuel pool cooling or makeup from any of the three RHR loops in the augmented fuel pool cooling or fuel pool makeup modes.

- STD DEP T1 2.14-1 — Hydrogen Recombiner Requirements Elimination

This departure eliminates the hydrogen recombiner requirement to maintain equipment needed to mitigate a design-basis LOCA hydrogen release.

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

This departure describes changes to the I&C architecture and nomenclature that are needed to address obsolete data communication technology and the selection of DI&C platforms.

Tier 2 Departure*

- STD DEP 1.8-1 — Tier 2* Codes, Standards, and Regulatory Guide Edition Changes

This departure updated some codes, standards, and RGs to more current revisions/editions.

Tier 2 Departure Requiring Prior NRC Approval

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

This departure identifies a change in the medium voltage distribution system that affects the certified ABWR DCD, Revision 4, for the offsite electrical power system, the onsite ac power distribution system, and safety loads. The departure specifically changes the medium-voltage electrical distribution system to a dual-voltage system consisting of 13.8 kV and 4.16 kV.

Tier 2 Departures Not Requiring Prior NRC Approval

- STD DEP 1.1-2 Dual Units at STP, Units 3 and 4

The certified ABWR DCD Revision 4, is based on a single-unit site; STP, Units 3 and 4, is a dual-unit project. This departure describes the common supporting systems shared by STP, Units 3 and 4, and the existing STP, Units 1 and 2.

- STD DEP 7.4-1 Alternate Rod Insertion (ARI) Function Description

This departure provides a clear and concise description of the ARI functions. The ARI is not required for safety, nor are its components considered Class 1E.

- STD DEP 7.4-2 Residual Heat Removal (RHR) Alarm

This departure replaces the alarm for the "RHR Logic Power Failure" with the alarm "ELCS out of Service." The departure also clarifies that the only time the "Manual Initiation Armed" alarm is activated is when the RHR system is in the LPFL mode of operation.

- STD DEP Admin

This departure describes minor corrections in the certified ABWR DCD, Revision 4, such as editorial or administrative errors (e.g., misspelled words, incorrect references, table headings, etc.).

7.4.3 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 systems required for a safe shutdown, and the associated acceptance criteria, are in Section 7.4 of NUREG–0800.

In accordance with Section VIII, "Processes for Changes and Departures," of Appendix A to 10 CFR Part 52, "Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies Tier 1, Tier 2*, and Tier 2 departures. Tier 1 and Tier 2* departures require prior NRC approval and are subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.A.4, and Section VIII.B.6, respectively. Tier 2 departures that affect TS or TS Bases require prior NRC approval and are subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.C.4. Tier 2 departures that do not require 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 of 10 CFR 50.59.

Reviews of the departures are based on meeting the current regulatory requirements, acceptance criteria, and guidelines in NUREG–0800, Table 7-1, Revision 5 (March 2007). In accordance with 10 CFR 50.55a(h), COLAs filed on or after May 13, 1999, which depart from the certified ABWR DCD, Revision 4, must meet the requirements for safety systems in IEEE Std 603–1991 and in the correction sheet dated January 30, 1995. In addition, applicable guidelines in DI&C ISG documents are also used to evaluate the departures from the certified ABWR design.

7.4.4 Technical Evaluation

As documented in NUREG–1503, the staff reviewed and approved Section 7.4 of the certified ABWR DCD. The staff reviewed Section 7.4 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 systems required for safe shutdown.

The staff reviewed the following information in the COL FSAR:

Tier 1 Departures

The following Tier 1 departures identified by the applicant in this section require prior NRC approval, and the full scope of their technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these Tier 1 departures.

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

The staff found that the applicant has changed FSAR Subsection 7.4.1.3. The applicant also has made corresponding changes to Figure 7.4-2, "Remote Shutdown System IED," [instrument and electrical diagram] and Figure 7.4-3, "Remote Shutdown System IBD" [interlock block diagram]. The staff reviewed this departure, which adds an additional third loop for the RHR system in the augmented fuel pool cooling and fuel pool makeup modes. This change provides additional flexibility for the capability to perform divisional outages in any order. The change in this departure from Section 7.4 of the ABWR DCD includes the I&C function for this new third loop and its testability. The I&C-related changes are about testability during normal operation for all valves, except for those isolated by the reactor pressure interlock in the system.

For the DI&C system to be used for STP, Units 3 and 4, the applicant should have provided sufficient information on how to prevent the remote transfer devices from adversely impacting both the safety-related DI&C system and the RSS. Because no information was provided for this transferring device, the staff issued RAI 07.04-1 requesting the applicant to explain how the remote transfer devices function between the two systems.

In its response to RAI 07.04-1, dated August 27, 2009 (ML092430132), the applicant explains

[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.

that the remote transfer devices are not used for DI&C communications. The remote transfer devices are mechanically reliable Class 1E switches and are utilized for selected hardwired input and output control signals. The method of using remote transfer devices assures that the remote shutdown system has the required control capability independent of the state of the DI&C system. The staff found the applicant's response acceptable, and this RAI 07.04-1 is closed.

The staff reviewed the I&C-related changes resulting from this departure and found it acceptable from the I&C perspective.

This departure is also evaluated in Chapter 5 of this SER.

- STD DEP T1 2.14-1 Hydrogen Recombiner Requirements Elimination

The staff found that the applicant has changed FSAR Subsections 7.4.1.4.4 and 7.4.2.4.2. The applicant also has made changes to Figure 7.4-2, "Remote Shutdown System IED," and Figure 7.4-3, "Remote Shutdown System IBD." The staff reviewed this departure and found that it eliminates the requirement to maintain equipment needed to mitigate a design-basis LOCA hydrogen release. The ABWR FCS, which consists of two redundant hydrogen recombiners, is no longer required in the response to a design-basis LOCA and is therefore eliminated from this section. The containment hydrogen and oxygen monitoring functions of the containment monitoring system are no longer required to function for the mitigation of a design-basis LOCA. This proposed design change incorporates changes to regulations that occurred after the issuance of the design certification for the ABWR. After incorporating the above design changes, the staff determined that the ABWR design features and requirements for controlling combustible gases satisfy regulations in 10 CFR 50.44(c) and are consistent with the guidance in RG 1.7. Hence, the staff found this departure acceptable from the I&C perspective.

This departure is also evaluated in Chapter 6 of this SER.

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

This departure is classified as requiring prior NRC approval. In COLA Part 7, "Departures Report," Section 2.1, the applicant describes and evaluates this departure per the requirements of Section VIII.A.4 of Appendix A to 10 CFR Part 52.

The staff reviewed this departure and found that it includes the following five primary changes to the I&C architecture of the certified ABWR DCD, Revision 4:

1. Elimination of obsolete data communication technology.
2. Elimination of unnecessary inadvertent actuation prevention logic and equipment.
3. Clarifications of digital controls nomenclature and systems.
4. Final selection of platforms that changed the implementation architecture.
5. Identification of testing and surveillance changes for SSLC.

Section 7.4 of the FSAR includes an examination and discussion of the I&C aspects for the ARI function, the SLCS, and the reactor shutdown cooling mode of RHR. The staff found that this departure impacts the interface between the SSLC and ARI functions and the RSS required for a safe shutdown in this section. The staff found that only the changes in Items 1 and 3 above are relevant to the certified ABWR DCD Tier 2, Revision 4, Section 7.4. Item 2 is associated with the ELCS and is evaluated in Section 7.3 of this SER. Items 4 and 5 are related to the

SSLC systems and are reviewed in both Sections 7.2 and 7.4 of this SER.

The first change is to the I&C architecture in the certified ABWR DCD, which replaces the EMS and NEMS included as the communication protocol in the certified ABWR DCD, with separate and independent system level communication capabilities. The interface between the SSLC and systems in this section is implemented via one-way data communication with adequate isolation.

The third change noted above to the I&C architecture in the certified ABWR DCD is to clarify the use of digital controls nomenclature and systems associated with the new data communication technology and selected platform referred to above. This third change replaces all references to the previous EMS- and NEMS-related terminology and their primary components with a generic data communication reference.

The staff found that the changes from this departure to the interface between the systems in this section and the SSLC systems meet the regulatory requirements in 10 CFR 50.55a(h) (IEEE Std 603–1991) and GDC 24, and conforms to the guidance in DI&C-ISG-04. The staff also found that the relevant changes in this departure do not depart from the certified ABWR design concepts and functional requirements for the systems required for a safe shutdown. Therefore, the staff found the change acceptable.

Refer to Sections 7.1, 7.2, 7.3, and 7.9S of this SER for additional evaluations of this departure.

Tier 2 Departure*

The following Tier 2* departure identified by the applicant in this section requires prior NRC approval, and the full scope of its technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by this Tier 2* departure.

- STD DEP 1.8-1 — Tier 2* Codes, Standards, and Regulatory Guide Edition Changes

The staff found that the applicant has changed FSAR Sections 7.4.1 and 7.4.2 by replacing IEEE Std 279 with IEEE Std 603–1991, which meets the requirement of 10 CFR 50.55a(h). Therefore, the staff found the change acceptable.

Refer to Section 7.2 of this SER for the detailed evaluation of this departure from the I&C perspective.

Tier 2 Departures Requiring Prior NRC Approval

The following Tier 2 departure identified by the applicant in this section requires prior NRC approval, and the full scope of its technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by this Tier 2 departure.

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

The staff reviewed this departure and found that it includes the following changes:

- Medium voltage rating of the PG buses are increased to 13.8 kV.
- Medium voltage rating of the PIP buses are decreased to 4.16 kV.
- Medium voltage rating of the Class 1E buses are decreased to 4.16 kV.
- EDG ratings are increased to 7,200 kW and 4.16 kV.
- CTG ratings are increased to 13.8 kV and to at least 20 MWe.
- The time required for the CTG to start and achieve steady-state voltage and frequency is increased from two minutes to "less than 10 minutes," as provided by RG 1.155 for an SBO alternate ac source.

In its response to RAI 08.03.01-4, Supplement 3, dated June 17, 2010 (ML101720635), the applicant adds the following additional changes to Departure STD DEP 8.3-1:

- The capability to power the fine motion control rod drives (FMCRDs) directly from the PIP bus and the direct transfer capability is changed to occur at the 480 volt level
- Power supplies to the FMCRD power distribution panels A-1, A-2, B-1, B-2, C-1, and C-2 and transfer switches have been re-classified as non-Class 1E
- Isolation between Class 1E bus and non-Class 1E FMCRD loads is provided by two Class 1E protective devices in series. The Class 1E breaker trip prior to upstream breaker trip is assured by circuit protection coordination and testing of breakers. The zone selective interlock feature is removed.

The staff found that the applicant made relevant changes to FSAR Subsections 7.4.1.3, 7.4.1.4.4 and 7.4.2.4.4. The staff also found that this departure specifically impacts the power sources for the reactor shutdown and electrical power distribution system for the RSS. The staff found that the proposed changes will improve reliability with divisional and safety/nonsafety isolation and that independence is increased through the use of stub buses; through greater flexibility for maintenance, surveillance, and inspection via the dual-voltage design; and through the increased availability of multiple sources of power to the various buses in the revised design and the ability to isolate the buses individually, if needed. The staff found that the changes to this section reflect the rating and other electrical changes, which do not have direct impacts on the safe shutdown I&C system. The staff reviewed the changes in this departure with the safe shutdown I&C systems and found that they meet the requirements of Clause 8.1 of IEEE Std 603–1991, 10 CFR 50.63, and GDC 17, "Electric power systems." Hence, the staff determined that this departure is acceptable from the I&C perspective.

This departure and the applicant's response to RAI 08.03.01-4, Supplement 3 dated June 17, 2010 (ML101720635), is evaluated in Chapter 8 of this SER. In its response to RAI 08.03.01-4, Supplement 3,dated June 17, 2010, the applicant proposes changes to FSAR Subsection 7.4.2.1.2, that remove the zone selective interlock feature associated with breaker coordination. Acceptability of this FSAR change is evaluated in Chapter 8. RAI 08.03.01-04 is closed in Chapter 8 of this SER and thus is closed here.

Tier 2 Departures Not Requiring Prior NRC Approval

The following Tier 2 departures not requiring prior NRC approval identified by the applicant in this section may also be evaluated in other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these departures.

- STD DEP 1.1-2 Dual Units at STP, Units 3 and 4

The certified ABWR design is for a single unit. The COLA is submitted for two units. However, the two units do not share any systems that are required for the safe shutdown that are addressed in FSAR Section 7.4. The applicant has changed FSAR Subsection 7.4.2.2.2 accordingly, and the staff found the change acceptable.

Refer to Section 7.3 of this SER for the detailed evaluation of this departure from the I&C perspective.

- STD DEP 7.4-1 Alternate Rod Insertion Function (ARI) Description

The staff reviewed this departure, which provides additional details on the functioning of the I&C for this nonsafety-related ARI system. The departure adds further details for each item but does not change the basic characteristics of the system.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation 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 NRC approval. The applicant's process for evaluating departures and other changes to the certified DCD is subject to NRC audits and inspections.

- STD DEP 7.4-2 Residual Heat Removal (RHR) Alarm

The staff reviewed the Departures Report regarding this departure, which replaces the alarm for "RHR Logic Power Failure" with the alarm for "ELCS out of Service." The second change in this departure clarifies that only the LPFL mode of the RHR system has an arming feature. However, COLA FSAR Subsections 7.3.2.3.2, 7.3.2.4.2, and 7.4.2.3.2 state that the parent RHR system annunciates activity at the loop level, and the individual mode of the RHR system is not separately annunciated. According to Section 5.8 of IEEE Std 603–1991, a system status indication shall be provided. Because there are a few operation modes (LPFL, wetwell and drywell spray cooling, and suppression pool cooling) for the RHR system, the display of the operation mode for the RHR system shall be provided to minimize the possibility of ambiguous indications that could be confusing to the operator. The staff was unable to determine whether it is reasonable for this departure not to require prior NRC approval. Therefore, the staff issued RAI 07.03-4 requesting the applicant to provide additional clarifications.

In its response to RAI 07.03-4, dated September 22, 2009 (ML092680017), the applicant explains that there is no substantive departure from the certified ABWR DCD Revision 4 design. This is because the departure from the certified design is not a departure from the design of the equipment and its operation, but the applicant provided an improved description and clarification over that found in the certified design. The applicant also clarifies that the human-system interface design criteria will be employed to present the optimal mode status information/indication to the control room operator via the use of modern video display units. The staff found this response acceptable, and RAI 07.03-4 is resolved. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.03-4

is closed.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation 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.

- STD DEP Admin

The applicant made changes to FSAR Subsection 7.4.2.1.1, "General Functional Requirements Conformance;" Section 7.4.3, "References;" and Figures 7.4-1, "Standby Liquid Control System IBD (Sheets 1–6);" and 7.4-2, "Remote Shutdown System IED (Sheet 1 of 1);" that corrected a reference title and provided clearer descriptions. 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. Administrative departures do not affect the presentation of any design discussion or the qualification of any design margin. Within the review scope of this section, the staff found it reasonable that this departure does not require prior NRC approval.

7.4.5 Post Combined License Activities

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

7.4.6 Conclusion

The 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 systems required for a safe shutdown, 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 10 CFR Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the systems required for a safe shutdown that were incorporated by reference have been resolved.

The staff compared the additional information in the COLA to the relevant NRC regulations and the guidance in Section 7.4 NUREG–0800. The staff's review concluded that the applicant has adequately addressed the identified Tier 1 and Tier 2* departures in accordance with Section 7.4 of NUREG–0800, and 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. The staff concludes that the applicant has provided sufficient information to satisfy the requirements of the regulations.

7.5 Information Systems Important to Safety

7.5.1 Introduction

This section of the FSAR addresses safety-related display systems that provide information for the safe operation of the plant during normal operation, anticipated operational occurrences, and accidents. The information systems important to safety include those systems that provide information for the manual initiation and control of safety systems to indicate that plant safety functions are being accomplished and to provide guidance to appropriate actions that can be taken to mitigate the consequences of anticipated operational occurrences and accidents. The safety parameter display system (SPDS), information systems associated with the emergency response facility, and the nuclear data link are information systems important to safety. The post-accident monitoring (PAM) system receives variables that are monitored. The PAM system provides information that is required to permit control room operators to take manual actions and safety systems to accomplish their safety functions, or provide operators with information.

7.5.2 Summary of Application

Section 7.5 of the STP, Units 3 and 4, COLA FSAR Revision 12 incorporates by reference Section 7.5 of the certified ABWR DCD Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in Section 7.5, 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 describes the removal of the MSIV automatic closure and scram based on the high MSLRM.

- STD DEP T1 2.14-1 — Hydrogen Recombiner Requirements Elimination

This departure reflects the elimination of the hydrogen recombiner requirement to maintain equipment needed to mitigate a design-basis LOCA hydrogen release.

Tier 2 Departure*

- STD DEP 1.8-1 — Tier 2* Codes, Standards, and Regulatory Guide Edition Changes

This departure updated some codes, standards, and RGs to more current revisions/editions.

Tier 2 Departure Requiring Prior NRC Approval

- STD DEP 7.5-1 — Post-Accident Monitoring (Drywell Pressure)

This departure describes the updated PAM design requirements to more closely follow the guidance of RG 1.97, BTP HICB-10, and Three Mile Island (TMI)-related criteria 10 CFR 50.34.

Tier 2 Departures Not Requiring Prior NRC Approval

- STD DEP 11.5-1 — Process and Effluent Radiation Monitoring and Sampling System

This departure describes several changes made to the process and effluent radiation monitoring and sampling system.

- STD DEP Admin

This departure describes minor corrections such as editorial or administrative errors in the certified ABWR DCD, Revision 4 (e.g., misspelled words, incorrect references, table headings, etc.).

7.5.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG–1503. In addition, the relevant requirements of the Commission regulations for the information systems important to safety, and the associated acceptance criteria, are in Section 7.5 of NUREG–0800.

In accordance with Section VIII, "Processes for Changes and Departures," of Appendix A to 10 CFR Part 52, "Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies Tier 1, Tier 2*, and Tier 2 departures. Tier 1 and Tier 2* departures require prior NRC approval and are subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.A.4 and Section VIII.B.6, respectively. Tier 2 departures that affect TS or TS Bases require prior NRC approval and are subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.C.4. Tier 2 departures that do not require 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 of 10 CFR 50.59.

Reviews of the departures are based on meeting the current regulatory requirements, the acceptance criteria, and the guidelines in NUREG–0800, Table 7-1 Revision 5 (March 2007). In accordance with 10 CFR 50.55a(h), COLAs filed on or after May 13, 1999, which depart from the certified ABWR DCD, Revision 4 must meet the requirements for safety systems in IEEE Std 603–1991 and in the correction sheet dated January 30, 1995. In addition, applicable guidelines in DI&C-ISG documents are also used to evaluate the departures from the certified ABWR design.

7.5.4 Technical Evaluation

As documented in NUREG–1503, the staff reviewed and approved Section 7.5 of the certified ABWR DCD. The staff reviewed Section 7.5 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 information systems important to safety.

[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 reviewed the following information in the COL FSAR:

Tier 1 Departures

The following Tier 1 departures identified by the applicant in this section require prior NRC approval, and the full scope of their technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these Tier 1 departures.

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

The staff found that the applicant has changed FSAR Subsection 7.5.2.1, "Post Accident Monitoring System," and Table 7.5-2, "ABWR PAM Variable List," to delete MSIV closure and reactor scram on high steamline radiation levels via the MSL radiation monitoring system in this departure. The staff found the changes in FSAR Section 7.5 acceptable.

Refer to Sections 7.1, 7.2, and 7.3 of this SER for the detailed evaluations of this departure from the I&C perspective. Refer to Chapter 11 of this SER for an in-depth evaluation of this departure.

- STD DEP T1 2.14-1 — Hydrogen Recombiner Requirements Elimination

The staff found that in FSAR Subsection 7.5.2.1, Tables 7.5-2 and Section 7.5.6, the applicant makes changes associated with the FCS, which is not used for the COLA. The staff also found that this departure modifies DCD Subsection 7.5.2.1(2)(k) and Tables 7.5-2 and 7.5.6 in the FSAR to downgrade the hydrogen and oxygen (H_2/O_2) monitoring subsystems of CAM to nonsafety-related. The staff determined that the changes in FSAR Section 7.5 are acceptable because the containment H_2/O_2 monitoring functions are no longer required for the mitigation of a design basis event.

Refer to Sections 7.2 and 7.3 of this SER for the detailed evaluation of this departure from the I&C perspective.

Tier 2 Departure*

The following Tier 2* departure identified by the applicant in this section requires prior NRC approval, and the full scope of its technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by this Tier 2* departure.

- STD DEP 1.8-1 — Tier 2* Codes, Standards, and Regulatory Guide Edition Changes

The staff found that the applicant has made a change in Table 7.5-1 in FSAR Section 7.5 to replace IEEE Std 279 with IEEE Std 603–1991, which meets the requirement of 10 CFR 50.55a(h). The staff therefore found the change acceptable.

Refer to Section 7.2 of this SER for the detailed evaluation of this departure from the I&C perspective.

Tier 2 Departure Requiring Prior NRC Approval

The following Tier 2 departure identified by the applicant in this section affects TS and requires prior NRC approval, and the full scope of its technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by this Tier 2 departure.

- STD DEP 7.5-1 Post-Accident Monitoring (Drywell Pressure)

The staff found that the applicant has made changes to FSAR Subsection 7.5.2.1, Tables 7.5-2, Section 7.5-3, and Section 7.5-4. The staff reviewed this departure, which updated the PAM design requirements to more closely follow the guidance of RG 1.97, BTP HICB-10, and TMI-related criteria in 10 CFR 50.34. The identified changes in the departure are requirements that were exempted in the certified ABWR DCD, Revision 4, but are now redesigned to better comply with RG 1.97. Note that the ABWR certified design does not list BTP HICB-10 because it did not exist at the time the ABWR DCD application was submitted, but does refer to Appendix 7-A, BTPs (ICSB). The STP, Units 3 and 4, COLA Part 7, Departures Report, (under departures requiring NRC approval) lists BTP HCIB-10 as a new issue dated June 1997 (designated as Revision 4.) Revision 5 to BTP 7-10 was issued in March 2007. The staff finds that this departure can also satisfy the acceptance criteria of BTP 7-10.

However, in Table 7.2-1, "Reactor Protection System Instrumentation Specifications," of the COL FSAR, the drywell high pressure was changed from 0 to 0.036 megapascals gauge (MPaG) to -15.0 to 30.0 kilopascals gauge (kPaG) (0 to 5.2 pounds per square inch gauge [psig] to -2.2 to 4.4 psig), but Table 7.5-2 in the COL FSAR does not show any change in the narrow range of 0.034 to 0.021 MPaG (4.9 to 3.0 psig). However, the wide range was changed from 0–100 percent to 0–110 percent. Subsections 7.5.2.1(2)(b) in both the DCD and COL FSAR list the narrow range as -34.32 to +34.32 kPaG (-5.0 to +5.0 psig). This range does not match the range in Table 7.5-2 and makes the narrow range beyond the upper limit of the new range for the drywell high pressure.

The staff issued RAI 07.05-1 requesting the applicant to provide sufficient information to clarify this inconsistency. In its response to RAI 07.05-1, dated August 27, 2009 (ML092430132), the applicant provides an acceptable markup of the impacted FSAR Table 7.5-2 and Subsection 7.5.2.1. The staff found this response acceptable and the RAI is resolved. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.05-1 is closed.

The staff's review determined that the changes meet the acceptance criteria in the guidance of RG 1.97, BTP 7-10, "Guidance on Application of Regulatory Guide 1.97," Revision 5, and TMI-related criteria in 10 CFR 50.34. Therefore, the staff found this departure to be acceptable.

Tier 2 Departures Not Requiring Prior NRC Approval

The following Tier 2 departures not requiring prior NRC approval identified by the applicant in this section may also be evaluated in other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these departures.

- STD DEP 11.5-1 — Process and Effluent Radiation Monitoring and Sampling System

The staff reviewed this departure, which makes several changes in the process and effluent radiation monitoring and sampling system. The impacts from this departure on Section 7.5 of the FSAR are related to changes in Table 7.5-2. All changes in Table 7.5-2 associated with process and effluent radiation monitoring and sampling system were evaluated by the staff and found acceptable.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation determined that this departure does not require prior NRC approval. Within the review scope of this section, the staff determined that it is reasonable that the departure does not require NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP Admin

This departure corrects the table numbers and typographical errors in FSAR Section 7.5.1.1, Subsection 7.5.2.1(1)(a), Tables 7.5-2, and 7.5-4. 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. Administrative departures do not affect the presentation of any design discussion or the qualification of any design margin. Within the review scope of this section, the staff found it reasonable that this departure does not require prior NRC approval.

7.5.5 Post Combined License Activities

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

7.5.6 Conclusion

The 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 information systems important to safety. 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 10 CFR Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the information systems important to safety that were incorporated by reference have been resolved.

In addition, the staff compared the additional information in the COLA to the relevant NRC regulations and the guidance in Section 7.5 of NUREG–0800. The staff's review concluded that the applicant has adequately addressed the identified Tier 1, Tier 2* and Tier 2 requiring prior NRC approval in accordance with Section 7.5 of NUREG–0800, and review 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.departures. The staff concludes that the applicant has provided sufficient information to satisfy the requirements of the regulations.

7.6 All Other Instrumentation Systems Required for Safety

7.6.1 Introduction

This section of the FSAR addresses those systems required for safety but not previously discussed in other sections of the certified ABWR DCD, although some aspects of these systems are included in previous sections of Chapter 7. This section examines and discusses the I&C aspects of the following plant systems:

- Neutron monitoring systems (i.e., SRNM, LPRM, and APRM).
- Process radiation monitoring system.
- High-pressure/low-pressure interlock protection functions.
- CAM system.
- Suppression pool temperature monitoring (SPTM) system.

7.6.2 Summary of Application

Section 7.6 of the STP, Units 3 and 4, COL FSAR Revision 12 incorporates by reference Section 7.6 of the certified ABWR DCD Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 7.6, the applicant provides the following:

Tier 1 Departures

- STD DEP T1 2.2-1 — Control Systems Changes to Inputs, Tests, and Hardware

This departure changes the DCD Tier 1 ITAAC requirement for the RCIS related to the acceptance criteria associated with testing one dual–redundant, non-Class 1E uninterruptible power supply at a time.

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

This departure removes the MSIV automatic closure and reactor scram based on the high MSLRM.

- STD DEP T1 2.14-1 — Hydrogen Recombiner Requirements Elimination

This departure eliminates the hydrogen recombiner requirement to maintain equipment needed to mitigate a design-basis LOCA hydrogen release.

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

This departure changes I&C architecture and nomenclature that are needed to address obsolete data communication technology and the selection of DI&C platforms.

Tier 2 Departure*

- STD DEP 1.8-1 — Tier 2* Codes, Standards, and Regulatory Guide Edition Changes

This departure updated some codes, standards, and RGs to more current revisions/editions.

Tier 2 Departure Not Requiring Prior NRC Approval

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

The certified ABWR DCD Revision 4, is based on a single-unit site. STP, Units 3 and 4, is a dual-unit project. This departure describes the common supporting systems shared by STP, Units 3 and 4, and the existing STP, Units 1 and 2.

- STD DEP 7.1-1 References to Setpoints and Allowable Values

This departure describes clarifications in the FSAR that wherever the TS is referenced for setpoints or margins, the correct reference is to the methods for calculating the setpoints and margins, as described in the TS Bases.

- STD DEP 7.1-2 ATWS DB for Startup Range Neutron Monitoring

This departure clarifies the power for the stepping motor driver modules and also adds as a general functional requirement under the safety design bases (DB) that the SRNM and the APRM subsystems, respectively, will provide the ATWS permissive signals to the ELCS.

- STD DEP 7.6-1 Oscillation Power Range Monitor (OPRM) Logic

This departure clarifies that the OPRM logic system is independent from the APRM.

- STD DEP 7.6-2 SPTM Subsystem of Reactor Trip and Isolation System

This departure clarifies that the suppression pool temperature monitoring (SPTM) system is a subsystem of the RTIS.

- STD DEP 7.6-3 SPTM Sensor Arrangement

This departure provides additional clarification and detail regarding the location of the temperature sensors in the suppression pool.

- STD DEP 7.6-4 Range of Power Range Neutron Monitoring Operability

This departure clarifies that the power range neutron monitors (PRNM) provide information for monitoring the average power level of the reactor core and the local power level when the power range begins at approximately five percent of power.

- STD DEP 11.5-1 Process and Effluent Radiation Monitoring and Sampling System

This departure changes the process and effluent radiation monitoring and sampling system.

- STD DEP Admin

This departure describes minor corrections such as editorial or administrative errors in the

certified ABWR DCD, Revision 4 (e.g., misspelled words, incorrect references, table headings, etc.).

COL License Information Item

- COL License Information Item 7.2 OPRM Oscillation Monitoring Logic

The applicant provides supplemental information to address COL License Information Item 7.2 from the certified ABWR DCD, Revision 4.

7.6.3 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 all other instrumentation systems required for safety, and the associated acceptance criteria, are in Section 7.5 of NUREG–0800.

In accordance with Section VIII, "Processes for Changes and Departures," of Appendix A to 10 CFR Part 52, "Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies Tier 1, Tier 2*, and Tier 2 departures. Tier 1 and Tier 2* departures require prior NRC approval and are subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.A.4, and Section VIII.B.6, respectively. Tier 2 departures that do not require 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 of 10 CFR 50.59.

Reviews of the departures are based on meeting the current regulatory requirements, acceptance criteria, and guidelines in NUREG–0800, Table 7-1, Revision 5 (March 2007). In accordance with 10 CFR 50.55a(h), COL applications filed on or after May 13, 1999, which depart from the certified ABWR DCD, Revision 4, must meet the requirements for safety systems in IEEE Std 603–1991 and in the correction sheet dated January 30, 1995. In addition, applicable guidelines in DI&C-ISG documents are also used to evaluate the departures from the certified ABWR design.

7.6.4 Technical Evaluation

As documented in NUREG–1503, NRC staff reviewed and approved Section 7.6 of the certified ABWR DCD. The staff reviewed Section 7.6 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 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 Departures

The following Tier 1 departures identified by the applicant in this section require prior NRC approval, and the full scope of their technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these Tier 1 departures.

- STD DEP T1 2.2-1 — Control Systems Changes to Inputs, Tests, and Hardware

The staff reviewed this departure, which changes the DCD Tier 1, Table 2.2.1, "Rod Control and Information System," ITAAC Item 11 requirement for the RCIS related to the acceptance criteria associated with one of the dual–redundant, non-Class 1E uninterruptible power supplies at a time. Section 7.6, "All Other Instrumentation Systems Required for Safety," of the COL FSAR states that Table 7.6-5 and Figure 7.6-2 are impacted by Tier 1 departure STD DEP T1 2.2-1. According to the Departures Report in Part 7 of the application, this departure impacts DCD Tier 1, Section 2.2, "Control and Instrument Systems," and DCD Tier 2, Section 7.7, "Control Systems Not Required for Safety." The staff was unable to determine any correlation between this departure and the COL FSAR Section 7.6. In RAI 07.06-3, the applicant was asked to resolve this discrepancy and provide the departure(s) that impact Table 7.6-5, "Reactor Operator Information for NMS," and Figure 7.6-2, "Neutron Monitoring System IBD (Sheets 1, 9,9a, 9b, 14)."

In its response to RAI 07.06-3, dated May 05, 2010 (ML101270282), the applicant clarifies that the scope of Departure STD DEP T1 2.2-1 had previously been changed and certain related COLA updates were overlooked, and the changes per this departure are now limited only to DCD Tier 1, ITAAC Table 2.2.1. Based on the current scope of Departure STD DEP T1 2.2-1, the applicant proposes to revise FSAR Tier 2, Section 7.6, Table 7.6-5 and Table 21.0-1; and Tier 1, Sections 2.2 and 2.2.7, "Reactor Protection System." This departure no longer applies to the FSAR Tier 2, Section 7.6, including all subsections, tables, and figures.

The staff found these proposed FSAR changes acceptable. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.06-3 is closed.

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

This departure modifies DCD Section 7.6.1.2, "Process Radiation Monitoring System – Instrumentation and Controls," and Figure 7.6.1.2 in the FSAR by downgrading the main steamline radiation monitoring subsystem to nonsafety-related. The staff found this change acceptable.

Refer to Section 7.2 of this SER for the detailed evaluation of this departure from the I&C perspective.

- STD DEP T1 2.14-1 — Hydrogen Recombiner Requirements Elimination

This departure modifies DCD Subsection 7.6.1.6, "Containment Atmospheric Monitoring (CAM) System—Instrumentation and Controls," in the FSAR by downgrading the H_2/O_2 monitoring subsystem of the CAM system to nonsafety-related. The staff found this change acceptable.

Refer to Section 7.3 of this SER for the detailed evaluation of this departure from the I&C perspective.

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

The staff reviewed this departure and found that it includes the following five primary changes to the I&C architecture of the certified ABWR DCD, Revision 4:

1. Elimination of obsolete data communication technology.
2. Elimination of unnecessary inadvertent actuation prevention logic and equipment.
3. Clarifications of digital controls nomenclature and systems.
4. Final selection of platforms that changed the implementation architecture.
5. Identification of testing and surveillance changes to the SSLC.

Only changes in Items 1, 3, and 4 are relevant to the certified ABWR DCD FSAR Section 7.6, Revision 4. Item 2 is related to the ELCS and is evaluated in Section 7.3 of this SER. Item 5 is related to both the RTIS and ELCS and is reviewed in both Sections 7.2 and 7.3 of this SER. The first change to the I&C architecture in the certified ABWR DCD replaces the EMS and the NEMS included as the communication protocol in the certified ABWR DCD, with separate and independent system level communication capabilities. This change impacts the interface with the NMS addressed in this section. However, the interface between the NMS and the RTIS or ELCS is via a separate one-way data communication. The unidirectional communication uses the fiber optic cables that provide electrical isolation.

The third change noted above to the I&C architecture in the certified ABWR DCD clarifies the use of digital controls nomenclature and systems associated with the above new data communication technology and selected platform. This third change replaces all references to the previous EMS- and non-NEMS related terminology and primary components with a generic data communication reference.

The fourth change is related to the platform change for the NMS, which the staff reviewed. The applicant found it necessary to incorporate available platforms and to also meet both the regulatory and technical requirements.

The staff found that the above changes to the NMS in this section of the certified ABWR DCD do not depart from the certified ABWR design concepts and functional requirements for the safety systems. The staff also found that the changes meet the requirements in 10 CFR 50.55a(h) (IEEE Std 603–1991), GDC 13, and DI&C-ISG-04. Therefore, the staff found this departure acceptable.

Refer to Sections 7.1, 7.2, 7.3, and 7.9S of this SER for additional evaluations of this departure.

Tier 2 Departures*

The following Tier 2* departure identified by the applicant in this section requires prior NRC approval, and the full scope of its technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by this Tier 2* departure.

- STD DEP 1.8-1 Tier 2* Codes, Standards, and Regulatory Guide Edition Changes

The staff found that the applicant changes FSAR Subsection 7.6.2 by replacing IEEE Std 279 with IEEE Std 603–1991, which meets the requirements of 10 CFR 50.55a(h). The staff found this change acceptable.

Refer to Section 7.2 of this SER for the detailed evaluation of this departure from the I&C perspective.

Tier 2 Departures Not Requiring Prior NRC Approval

The following Tier 2 departures not requiring prior NRC approval identified by the applicant in this section may also be evaluated in other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these departures.

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

The certified ABWR design is for a single unit; the submitted COLA is for two units that do not share any systems addressed in this FSAR section. The applicant has changed FSAR Section 7.6.2 accordingly.

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.

Refer to Section 7.3 of this SER for an additional evaluation of this departure.

- STD DEP 7.1-1 References to Setpoints and Allowable Values

This departure modifies DCD Subsection 7.6.1.3, "High Pressure/Low Pressure Systems Interlock Protection Functions," in the FSAR by referring to the bases in COLA Chapter 16 for methods of calculating setpoints and margins, for the high pressure/low pressure systems interlock protection systems.

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.

Refer to Section 7.3 of this SER for the additional evaluation of this departure

- STD DEP 7.1-2 ATWS DB for Startup Range Neutron Monitoring

The staff reviewed this departure, which clarifies the power sources for the stepping motor driver modules and also adds, as a general functional requirement under the safety DB, that the SRNM and the APRM subsystems will provide ATWS permissive signals to the ELCS. The impacts of this departure on DCD FSAR Tier 2, Section 7.6 are related to the changes in

Table 7.6-5, “Reactor Operator Information for NMS,” which are all associated with this departure and were reviewed and found acceptable.

In COLA Part 7, “Departures Report,” Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant’s evaluation 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 NRC approval. The applicant’s process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 7.6-1 Oscillation Power Range Monitor (OPRM) Logic

The staff reviewed the Departures Report regarding this departure, which clarifies the OPRM logic system reflecting that the OPRM is independent from the APRM. FSAR Tier 1, Revision 2, Figure 2.2.5, “Neutron Monitoring System,” shows that the OPRM is part of the APRM system. However, Subsection 7.6.1.1.2.2 states that the APRM is independent from OPRM. The staff was unable to determine whether it is reasonable that this departure does not require prior NRC approval. Therefore, the staff issued RAI 07.06-1 requesting the applicant to clarify this inconsistency.

In its response to RAI 07.06-1, dated August 27, 2009 (ML092430132), the applicant provides a markup of the impacted FSAR sections and revises this departure to clarify the inconsistency. In addition, the applicant implemented the proposed FSAR changes in Revision 3 of the STP, Units 3 and 4, COLA. The staff found the applicant’s response to RAI 07.06-1 acceptable, and this RAI is closed.

In COLA Part 7, “Departures Report,” Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant’s evaluation determined that this departure does not require prior NRC approval. The staff conducted an audit of this Tier 2 departure (see audit summary letter dated January 25, 2010, ML093360537) and its evaluation process and found it reasonable that the departure does not require NRC approval.

- STD DEP 7.6-2 SPTM Subsystem of Reactor Trip and Isolation System

The staff reviewed this departure, which further clarifies and defines the functional design and implementation of the digital controls platforms. The SPTM system will not be impacted by adding this clarification. This proposed change will not have any impact on Tier 1, Tier 2*, TS, TS bases, or operational requirements.

In COLA Part 7, “Departures Report,” Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant’s evaluation 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 NRC approval. The applicant’s process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 7.6-3 SPTM Sensor Arrangement

The staff reviewed this departure, which further clarifies and illustrates the location of the

temperature sensors in the suppression pool in relation to the SRVs. The departure states that the SRV discharge line quenchers are in direct sight of two sets of SPTM system temperature sensors.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation 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 NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 7.6-4 — Range of Power Range Neutron Monitoring Operability

The staff reviewed this departure, which corrects the bottom of the power range for the operation of the PRNM from 15 percent to its actual value of 5 percent. Consequently, this change is more favorable to and correctly reflects the actual design, which overlaps with the SRNM for neutron flux monitoring in the range of 5 percent to 15 percent of the rated thermal power. Furthermore, the departure does not change any physical features of the plant or any SSCs important to safety or fission product barriers.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation 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 NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 11.5-1 — Process and Effluent Radiation Monitoring and Sampling System

The staff reviewed this departure, which changes the instrument engineering diagram in Figure 7.6-5 (Sheets 1 to 10), "Process Radiation Monitoring System."

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation determined that this departure did not require prior NRC approval. Within the review scope of this section, the staff found it reasonable that the departure does not require NRC approval. The applicant's process for evaluating departures and other changes to the DCD are subject to NRC inspections.

Refer to Chapters 9, "Auxiliary Systems," 11, "Radiocative Waste Management," and 12, "Radiation Protection," of this SER for additional evaluations of this departure.

- STD DEP Admin

The applicant corrects a referenced table number in FSAR Subsection 7.6.1.1.3, "Reactor Operator Information," and Figure 7.6-4a, "Basic Configuration of a Typical Neutron Monitoring System Division," that corrects the title of the figure. 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. Administrative departures do not affect the presentation of any

design discussion or the qualification of any design margin. Within the review scope of this section, the staff found it reasonable that this departure does not require prior NRC approval.

COL License Information Item

- COL License Information Item 7.2 APRM Oscillation Monitoring Logic

The applicant had originally proposed to provide the required information as an amendment to the FSAR at least one year prior to fuel load (COM 4.4-3). The method proposed by the applicant was not an acceptable resolution to the staff. In RAI 07.06-2, the applicant was asked to provide a method of resolution that will allow the staff to reach a satisfactory safety conclusion. In its response to RAI 07.06-2, dated May 05, 2010 (ML101270282), the applicant states that it will implement the APRM oscillation monitoring logic in accordance with the ABWR DCD without any departures, and will revise FSAR Tier 2, Section 7.6.3.1. Proposed FSAR changes are shown below:

> The following standard supplement addresses COL License Information Item 7.2.
>
> There are no departures from the fuel design licensing basis that are described in the reference ABWR DCD, including the core thermal hydraulic design described in Section 4.4. The APRM oscillation logic is designed in accordance with the BWR Owners Group Stability Option III and described in Subsection 7.6.1.1.2.2.

The staff found these proposed FSAR changes acceptable. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.06-2 is closed.

7.6.5 Post Combined License Activities

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

7.6.6 Conclusion

The 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 all other information systems required for safety, 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 10 CFR Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to all other instrumentation systems required for safety that were incorporated by reference have been resolved.

In addition, the staff compared the additional information in the application to the relevant NRC regulations and the guidance in Section 7.5 of NUREG–0800. The staff's review concluded that the applicant has adequately addressed the COL license information item, the Tier 1, Tier 2*, and Tier 2 departures requiring prior NRC approval in accordance with Section 7.6 of NUREG-0800, and 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. The staff concludes that the applicant has provided sufficient information to satisfy NRC requirements.

7.6S Interlock Systems Important to Safety

The title of NUREG–0800, Section 7.6 is "Interlock Systems Important to Safety." However, there is no corresponding section in the certified ABWR DCD, Revision 4, to address interlock systems important to safety. The interlock systems that are important to safety are addressed in Subsections 7.4.1.3, "Reactor Shutdown Cooling Mode–Instrumentation and Controls;" (Items 7 and 11); 7.6.1.3, "High Pressure/Low Pressure Systems Interlock Protection Functions;" 7.6.2.3, "High Pressure/Low Pressure Systems Interlock Function;" and Table 7.4-1, "Reactor Shutdown Cooling Bypasses and Interlocks." This supplemental section in the COLA was created to provide consistency with the structure of NUREG–0800, Chapter 7. The COLA FSAR makes no change to the interlock logics included in the certified ABWR DCD, Revision 4 Sections 7.4.1.3, 7.6.1.3, 7.6.2.3, and Table 7.4-1.

Refer to Sections 7.4 and 7.6 of this SER for detailed evaluations of interlock systems important to safety.

7.7 Control Systems Not Required for Safety

7.7.1 Introduction

This section of the FSAR addresses control systems that the applicant does not consider essential for the safety of the plant. These systems primarily use DI&C equipment and transmit information via communication networks. Of the 16 systems listed in ABWR DCD Chapter 7, this section discusses the following 9 systems:

1. NBS – reactor vessel instrumentation.
2. RCIS.
3. Recirculation Flow Control System (RFCS).
4. Feedwater Control System (FWCS).
5. Process Computer Function (PCF) –- Performance and Monitoring Control System (PMCS) and Power Generation Control System (PGCS) subsystems.
6. Neutron Monitoring System – automated traversing incore probe (ATIP) and multi-channel rod block monitoring subsystems.
7. Automatic Power Regulator (APR) System.
8. Steam Bypass and Pressure Control System (SB&PC).
9. PDN.

Although these systems are not directly needed for the performance of safety functions, the operation of these systems is important to the reliability of the plant. These nonsafety-related systems are designed so that their failure will not prevent the proper operation of the safety systems. The nonsafety systems are also designed to be of a high quality, so as to minimize the challenges to safety system functions.

7.7.2 Summary of Application

Section 7.7, "Control Systems Not Required for Safety," of the STP, Units 3 and 4, COL FSAR Revision 12 incorporates by reference Section 7.7 of the certified ABWR DCD, Revision 4, referenced in 10 CFR Part 52, Appendix A. Section 7.7 also incorporates by reference Section 7 of the STPNOC application to amend the design certification rule for the U.S. ABWR, "ABWR STP Aircraft Impact Assessment (AIA) Amendment," Revision 3, dated September 2010, (the AIA Amendment). On December 16, 2011, the AIA Amendment was certified by a final rule

amending 10 CFR Part 52, Appendix A (76 FR 78096). In addition, in FSAR Section 7.7, the applicant provides the following:

Tier 1 Departures

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

Departure STD DEP T1 3.4-1 revises the descriptions of the I&C systems that are divided into five primary types of changes. Two types of change describe changes applied to the control systems: elimination of obsolete data communication technology and clarification of digital controls nomenclature and systems.

Tier 2 Departure*

- STD DEP 1.8-1 Tier 2* Codes, Standards, and Regulatory Guide Edition Changes

Departure STD DEP 1.8-1 identifies Tier 2* items in Tier 2, Tables 1.8-20 and 1.8-21, which will be updated to more current revisions/standards.

Tier 2 Departures Requiring Prior NRC Approval

- STD DEP 7.7-10 Control Rod Drive System Interfaces

Departure STD DEP 7.7-10 implements revisions associated with the RCIS, the PMCS, interfaces with the CRDS, and certain related TS Bases.

- STD DEP 7.7-18 Rod Control and Information System Operator Information

Departure STD DEP 7.7-18 implements revisions associated with the RCIS reactor operator interface functions including annunciations, status information, and operator controls.

- STD DEP 8.3-1 Plant Medium Voltage Electrical Design

Departure STD DEP 8.3-1 changes the medium-voltage electrical distribution system from a single voltage system of 6.9 kV to a dual voltage system consisting of 13.8 kV and 4.16 kV.

- STD DEP 10.4-5 Condensate and Feedwater System

Departure STD DEP 10.4-5 changes the TS 3.3.4.2 Bases to show that there are four feedwater pumps with four feedwater pump adjustable speed drives (ASDs), while the referenced ABWR DCD specifies two feedwater pump ASDs.

Tier 2 Departures Not Requiring Prior NRC Approval

- STD DEP 5.4-1 Reactor Water Cleanup System

Departure STD DEP 5.4-1 changes to the reactor water cleanup system include increasing the flow capacity of the two pumps and two filter demineralizers and increasing the design pressure of the pumps and heat exchangers.

- STD DEP 7.7-1 RPV Water Level Instrumentation

Departure STD DEP 7.7-1 clarifies that only those RPV water level instrument lines with a condensing chamber can have entrained non-condensable gases and thus, they will be the only ones continually flushed with water supplied by the CRDS.

- STD DEP 7.7-2 SRV Discharge Pipe Temperature Data Recording

Departure STD DEP 7.7-2 implements a design upgrade to replace the multipoint recorders with a more accurate and more current technology described as an historian function digital system.

- STD DEP 7.7-3 Feedwater Turbidity

Departure STD DEP 7.7-3 removes the feedwater turbidity monitoring subsystem.

- STD DEP 7.7-4 Automated Power Regulator/Rod Control and Information System Interface

Departure STD DEP 7.7-4 clarifies that the automatic power regulator (APR) system is actually the direct controlling system that interfaces with the RCIS to accomplishing the automatic rod movement mode, and the power generation control system (PGCS) interfaces only with the APR system to initiate various reactor power change control tasks.

- STD DEP 7.7-5 Rod Control and Information System (RCIS) Display

Departure STD DEP 7.7-5 clarifies the wording of the referenced ABWR DCD by providing more precise information about the available display at the RCIS dedicated operator interface (DOI) on the main control panel.

- STD DEP 7.7-6 Rod Control and Information System Commands

Departure STD DEP 7.7-6 clarifies that redundant command signals (more than a single signal) are sent from the recirculation flow control system (RFCS) to the RCIS for the ARI function, and redundant command signals (more than a single signal) are sent from the RFCS to the RCIS for the selected control rod run-in (SCRRI) function.

- STD DEP 7.7-7 Rod Control and Information System (RCIS) Design Details

Departure STD DEP 7.7-7 implements changes to the RCIS descriptions in the FSAR to provide clarity, additional information, and a more complete design description.

- STD DEP 7.7-9 Selected Control Rod Run-In (SCRRI) Function

Departure STD DEP 7.7-9 clarifies that the CRDS also mitigates a loss of feedwater heating event. The departure adds information and a more complete design description showing the two functional needs for the SCRRI.

- STD DEP 7.7-11 Rod Withdrawal Sequence Restrictions

Departure STD DEP 7.7-11 significantly expands the DCD discussion of the ganged rod movement and ganged withdrawal sequence restrictions.

- STD DEP 7.7-12 Rod Control and Information System Indication

Departure STD DEP 7.7-12 updated the discussion of the detailed design of the referenced rod pull sequence.

- STD DEP 7.7-13 Optical Isolation

Departure STD DEP 7.7-13 removes the detailed description of the specific type of technology used for the optical isolation of rod block signals received by the nonsafety RCIS from Class 1E systems.

- STD DEP 7.7-14 Rod Control and Information System Bypass

Departure STD DEP 7.7-14 implements and updates changes in the discussion of the RCIS bypass capabilities and provides a clearer and more complete description of the design and operation of the RCIS system.

- STD DEP 7.7-20 Recirculation Flow Control Logic

Departure STD DEP 7.7-20 provides a more complete description by stating that the 70-percent limit is for a “rod pattern where rated power accompanies 100% flow” and provides further information concerning manual and automatic operation for other rod patterns and power levels.

- STD DEP 7.7-22 Automated Thermal Limit Monitor (ATLM) Description

Departure STD DEP 7.7-22 expands the discussion and description of the automated thermal limit monitor (ATLM) setpoint and rod block action and the interface of interacting systems.

- STD DEP 7.7-23 Automated Traversing Incore Probe (ATIP) Function

Departure STD DEP 7.7-23 discusses inputs from the "automatic fixed incore probe (AFIP)" to be used for gain adjustment factors for local power range monitoring (LPRM) and explains that this function is provided by the automated traversing incore probe (ATIP) rather than the AFIP.

- STD DEP 7.7-24 Steam Bypass and Pressure Control Interfaces

Departure STD DEP 7.7-24 clarifies and corrects the description of the I&C interfaces for the steam bypass and pressure control (SB&PC) System.

- STD DEP 7.7-27 RCIS Table Deletion

Departure STD DEP 7.7-27 removes Table 7.7-1, "RCIS Module Operation Environment," because it is unnecessary.

- STD DEP 9.5-3 System Description – Reactor Internal Pump Motor-Generator Sets

Departure STD DEP 9.5-3 implements several changes to the technical description of the nonsafety-related motor-generator (MG) set equipment, which provides power to reactor internal pumps (RIPs) to clarify the DCD technical descriptions or to reflect changes in the actual equipment design implementation details that have evolved since the certified ABWR DCD descriptions were written.

- STD DEP Admin

Departure STD DEP Admin implements administrative departures that are defined as minor corrections, such as editorial or administrative errors in the referenced ABWR DCD (e.g., misspelled words, incorrect references, table headings, etc.).

7.7.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG–1503 and in NUREG-1948, "Final Safety Evaluation Report Related to the Aircraft Impact Amendment to the U.S. Advanced Boiling Water Reactor (ABWR) Design Certification," dated June 2011, (the SER related to the AIA Amendment). In addition, the relevant requirements of the Commission regulations for the control systems not required for safety, and the associated acceptance criteria, are in Section 7.7 of NUREG–0800.

In accordance with Section VIII, "Processes and Changes and Departures," of Appendix A to 10 CFR Part 52, "Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies Tier 1, Tier 2*, and Tier 2 departures. Tier 1 and Tier 2* departures require prior NRC approval and are subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.A.4, and Section VIII.B.6, respectively. Tier 2 departures that affect TS or TS Bases require prior NRC approval and are subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.C.4. Tier 2 departures that do not require 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 of 10 CFR 50.59.

Reviews of the departures are based on meeting the current regulatory requirements, acceptance criteria, and guidance in NUREG–0800, Table 7-1, Revision 5 (March 2007).

7.7.4 Technical Evaluation

As documented in NUREG–1503 and NUREG–1948, the staff reviewed and approved Section 7.7 of the certified ABWR DCD and AIA Amendment. The staff reviewed Section 7.7 of the STP, Units 3 and 4, COL FSAR and checked the referenced ABWR DCD and AIA Amendment to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD and AIA Amendment 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 control systems not required for safety.

The staff reviewed the following information in the COL FSAR:

Tier 1 Departure

The following Tier 1 departure identified by the applicant in this section requires prior NRC approval, and the full scope of its technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by this Tier 1 departure.

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

Departure STD DEP T1 3.4-1 is required because of five primary types of changes in the I&C architecture:

1. Elimination of obsolete data communication technology.
2. Elimination of unnecessary inadvertent actuation prevention logic and equipment.
3. Clarification of digital controls nomenclature and systems.
4. Final selection of platforms that changed the implementation architecture.
5. Testing and surveillance changes for SSLC.

Two of these changes specifically apply to departures in the FSAR Section 7.7: type (1), "Elimination of obsolete data communication technology," and type (3), "Clarifications of digital controls nomenclature and systems." This Tier 1 departure is evaluated in other sections of Chapter 7. In this section, this departure accounts for a number of changes in terminology affecting various subsections, including Subsections 7.7.1.2, "Rod Control and Information System—Instrumentation and Controls;" 7.7.1.4, "Feedwater Control System—Instrumentation and Controls;" 7.7.1.5, "Plant Computer Function (PCF) —Instrumentation and Controls;" 7.7.1.7, "Automatic Power Regulator System—Instrumentation and Controls;" 7.7.2.5, "Plant Computer Function—Instrumentation and Controls;" and; 7.7.2.9, "Plant Data Network—Instrumentation and Controls." For example, a type (1) change eliminates references to the NEMS originally planned for the ABWR architecture and replaces the NEMS with independent system level data communication capabilities. A type (3) change renames the "Process Computer System" as the "Plant Computer Function."

[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 the type (1) change in FSAR Section 7.7 acceptable, because the elimination of the multiplexer concept required all related references to be replaced with generic data communication terms that represent current and improved technology without a significant decrease in the level of safety provided by the original ABWR design. This "standard" departure is intended to be applicable to COL applicants that reference the ABWR DCD, so this departure will not result in any loss of standardization.

The staff found the type (3) change in FSAR Section 7.7 acceptable because the referenced ABWR DCD defined many functional design requirements in terms typically reserved for hardware. The terminology is corrected to refer to the requirement as a "function," so as to eliminate confusion between purely functional requirements and physical requirements defined in the DCD. The revised terminology better defines the design and implementation with current DI&C technology and control platforms. Again, the use of these revised terms better represents the current and improved technology without a significant decrease in the level of safety the original ABWR design provides. For technical and regulatory compliance evaluations of this departure, refer to Sections 7.2, 7.3, and 7.9S of this SER.

Tier 2 Departure*

The following Tier 2* departure identified by the applicant in this section requires prior NRC approval, and the full scope of its technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by this Tier 2* departure.

- STD DEP 1.8-1 — Tier 2* Codes, Standards, and Regulatory Guide Edition Changes

DCD Tier 2, Table 1.8-20 indicates how the referenced ABWR DCD complies with NRC RGs, and DCD Tier 2, Table 1.8-21 lists the applicability of industry codes and standards. This departure identifies Tier 2* items in these two tables that are being updated to more current revisions/editions. In DCD Tier 2, Subsection 7.7.2.1.2, IEEE Std 279 was replaced with IEEE Std 603–1991. The staff found this change acceptable because IEEE Std 603–1991, as amended, is incorporated by reference in 10 CFR 50.55a(h)(2) and is the edition of the standard currently endorsed by the NRC. Hence, the staff determined that this departure is acceptable from the I&C perspective.

Tier 2 Departures Requiring Prior NRC Approval

The following Tier 2 departures identified by the applicant in this section require prior NRC approval, and the full scope of their technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these Tier 2 departures.

- STD DEP 7.7-10 — Control Rod Drive System Interfaces

The applicant lists this departure as requiring prior NRC approval. Subsection 7.7.1.2.1 of the ABWR DCD provides the RCIS interfaces with the "CRD Control System for Single Rod Movement" in Subsection 7.7.1.2.1(1), for "Withdrawal Cycle" in Subsection 7.7.1.2.1(2), for "Insert Cycle" in Subsection 7.7.1.2.1(3), and for "Ganged Rod Motion" in Subsection 7.7.1.2.1(4). Departure STD DEP 7.7-10 implements the following revisions in the rod movement subsections noted above:

- Replaces the PMCS normal operational manual mode cathode ray tube (CRT) display with the RCIS DOI on the main control room panel.

- Revises the description of allowed operator single rod movement manual commands in Subsection 7.7.1.2.1(1) and changes the subsection name from “Introduction” to “Single Rod Movement.” The ABWR DCD identifies four rod movement commands as “SINGLE ROD,”, “ROD GANG,”, “STEP,”, and “CONTINUOUS,” as well as commands “IN” and “OUT.”. The applicant revises this to three rod movement commands: as “STEP,”, “NOTCH,”, and “CONTINUOUS.” that serve as means to initiate all rod movement. In place of the “IN” and “OUT,” “INSERT” and “WITHDRAW” movement commands are used by activating associated hard push button switches located adjacent to the RCIS DOI on the main control panel.

- Changes the title of Subsection 7.7.1.2(2) to “Withdrawal Cycle” and provides a more clear and complete description of the withdrawal cycle including defining nominal rod distance movement in millimeters (mm) for a “STEP”, “NOTCH”, and “CONTINUOUS” control rod movement and the full-in and full-out positions. This departure defines the “STEP” (18.3 mm [0.72 inches (in.)]) and the “NOTCH” (73.2 mm [2.9 in.]; 4 times the nominal step movement distance).

- Changes the title of Subsection 7.7.1.2(3) to “Insert Cycle” and provides a description of similarities and differences from the “withdrawal” cycle.

- Changes the title of Section 7.7.1.2.1(4) to “Ganged Rod Movement” and improves the description of the ganged rod movement.

- Adds a discussion of the rod action and position information (RAPI) rod block operations. The description states that during all of the operator selections for control rod withdrawal there is continuous monitoring of the selection and movement by the RAPI function of the RCIS that enforces the rod block function. Input signals to the RAPI that would cause the RAPI to prevent undesired control movement come from both external sources and sources internal to the RAPI. The rod block function applies in both single and ganged rod movement.

- Revises the description of ganged rod motion interface.

- Revises the specific method described in TS Bases for Subsection B 3.9.4, “Control Rod Position Indication,” using the synchros to verify rod full-in position.

The applicant evaluated the proposed Departure STD DEP 7.7-10 and determined that it complies with the requirements in Section VIII.C.4 of Appendix A to 10 CFR Part 52.

In this departure, the “Description” describes a change to the TS Bases for Subsection B 3.9.4. However, the “Evaluation Summary” discusses the TS Bases for B 3.4.3. The staff issued RAI 07.07-9 requesting the applicant to correct this discrepancy and provide sufficient justification for NRC approval of the departure. In its response to RAI 07.07-9 dated September 22, 2009 (ML092680017), the applicant revises and corrects the departure by specifically referencing the bases of TS 3.9.4. The response adequately addresses RAI 7.07-9; therefore, RAI 07.07-9, is closed.

Further, the departure "Description" did not sufficiently identify all the changes included in Subsection 7.7.1.2.1. The staff issued RAI 07.07-10 requesting the applicant to identify all the changes to Subsection 7.7.1.2.1, parts (1), (2), (3), and (4). In its response to RAI 07.07-10, dated September 22, 2009 (ML092680017), the applicant revises the departure "Description" to sufficiently identify the changes, and improves the FSAR Subsection 7.7.1.2.1, parts (1), (2), (3), and (4) with more clear and complete descriptions of the rod movement control topics and improves subsection names. The improved justification for the departure in the departure "Evaluation Summary" is acceptable. The staff found that the response adequately addresses RAI 7.07-10, therefore, RAI 07.07-10 is resolved. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.07-10 is closed.

Departure STD DEP 7.7-10 implements a number of changes to the ABWR DCD that basically provide some improvements that fit better with the selected I&C platform, without changing the essential functions. The main benefits of this departure are: (1) the organization and presentation of the information that provides more clarity and understanding of the operator controls for rod movement, and (2) the protection logic used to issue rod blocks to prevent a violation of the fuel thermal operating limits.

- The DOI is part of the design utilizing recent DI&C technology. The DOI is simply an alternative technical means of achieving the display and control functions to interface with the RCIS. For example, replacing the obsolete CRT with flat screen panel technology.

- In the renamed Subsection 7.7.1.2.1(1) ("Single Rod Movement)," the control rod movement terms "INSERT" and "WITHDRAWAL" that replace "IN" and "OUT" match terms used in the current BWRs and have the same meanings. The ABWR DCD introduction in Subsection 7.7.1.2.1(1) already clarifies that the operator selects either the single rod movement or the ganged rod movement. Therefore, the separation of the presentation into single versus ganged rod movement is an acceptable choice. The amount of rod movement changes from two possibilities—"CONTINUOUS" and "STEP"—to three possibilities by adding "NOTCH." The addition of the "NOTCH" provides a rod movement distance choice between "CONTINUOUS" and "STEP," thus giving the operator more selection choices and control.

- In the section on withdrawal in Subsection 7.7.1.2.1(2), the rod movement distance is defined for each of the three rod movements—"CONTINUEOUS," "STEP," and "NOTCH." During these operator selections for rod withdrawals, there is a continuous monitoring of the selection and movement by two different systems—the ATLM and the Rod Worth Minimizer (RWM)—to avoid operator errors; handle possible component failures; and prevent a violation of fuel thermal operating limits.

- The renamed insert cycle in Subsection 7.7.1.2(3) describes the similarities to and differences from the withdrawal cycle and includes a lengthy duplication of the functioning of the insert cycle.

- The discussion on the renamed ganged rod movement in Subsection 7.7.1.2.1(4) improves the description of the ganged rod movement. The ganged control rod movement was approved in the certified ABWR DCD. The improved descriptions represent a more flexible but still acceptable alternative, method of control rod movement. To ensure an acceptable control rod movement, a database titled

"Reference Rod Pull Sequence" keeps track of the current control rod positions and helps to ensure that a correct rod pattern is achieved.

- Subsection 7.7.1.2.1(5) discusses ganged withdrawal sequence restrictions and rules. The section refers to the RWM, where the specific enforcement logic is located, rather than to the general system RCIS. The discussion basically retains the gang withdrawal function described in the certified ABWR DCD. Some unnecessary details were deleted such as, "The light crosses the boundary of the isolator to the interface of the RCIS …," while an additional clarification was added in the FSAR to enhance understanding. The function of the rod block to protect against control rod position errors applies in both single and ganged rod movements. The staff noted that an important typographical error in the certified design had been corrected. With the correction, this restriction will ensure that Groups 1–4 will be withdrawn only if Groups 5–10 are in the full-in position.

- The description of the ganged rod motion interface was improved to provide additional clarity and understanding.

- The FMCRD system provides the ABWR operator with the ability to move the control rods in small increments, whereas the current BWR plants use a hydraulic method of rod movements consisting of 152.4-mm (6-in.) steps. In the fully inserted position, the synchros information provides an accurate indication of the control rod position and is therefore an acceptable alternative method.

FSAR Section 1.8, "Conformance with Standard Review Plan and Applicability of Codes and Standards," of the certified ABWR DCD, Revision 4, identifies conformance with the SRP and applicability of codes and standards. ABWR DCD FSAR Tier 2, Table 1.8-19 indicates conformance with SRP Section 7.7 of NUREG–0800 (Revision 3, February 1984); Appendix 7-A (Revision 2, July 1981); and BTP ICSB 14, "Spurious Withdrawals of Single Control Rods in Pressurized Water Reactor," (Revision 2, July 1981). FSAR Tier 2, Section 1.8 of the STP, Unit 3 and 4, COLA states that the information in this section of the ABWR DCD, including all subsections and tables, is incorporated by reference with certain departures, with a standard supplement, and with a site-specific supplement. No departure is taken from Table 1.8-19. Revisions to Table 1.8-21 state that STP, Unit 3 and 4, FSAR Tier 2, conforms to IEEE Std 384–1992 and IEEE Std 603–1991. Therefore, based on the above information and a review of the changes of this departure as listed, the staff found that STD DEP 7.7-10 has adequately addressed the requirements identified in SRP Section 7.7 of NUREG–0800, Revision 5 (March 2007). Therefore, the staff found that the changes in departure STD DEP 7.7-10 are acceptable.

- STD DEP 7.7-18 — Rod Control and Information System Operator Information

Departure STD DEP 7.7-18 implements the following revisions in Subsection 7.7.1.2.3 of the ABWR DCD:

- Revises the list of RCIS annunciation activations at the main control panel to be consistent with the current RCIS design.

- Revises the list of RCIS status information on the RCIS DOI on the main control panel to be consistent with the current RCIS design.

- Revises the list of RCIS operator functions allowed through the RCIS DOI panel and related RCIS displays, indications, and associated controls on the MCR panel and on the RCIS cabinets and panels to be consistent with the current RCIS design.

- Revises the list of RCIS-related information displayed for the operator by MCR equipment other than the RCIS DOI to be consistent with the current RCIS design.

- Allows the use of current and improved digital technology and related features in the design, such as the application of fiber optic cables that provide electrical isolation and help protect the I&C electronics from electromagnetic interference.

In addition to the changes to Subsection 7.7.1.2.3 of the ABWR DCD Tier 2, Revision 4 described in the four revisions noted above, Departure STD DEP 7.7-18 implements revisions to Subsections B 3.9.3, "Control Rod Position;" B 3.10.3, "Control Rod Withdrawal – Hot Shutdown;" B 3.10.4, "Control Rod Withdrawal – Cold Shutdown;" and B 3.10.5, "Control Rod Drive (CRD) Removal – Refueling;" of the TS Bases to revise the manner in which the RCIS is placed in the scram test mode. In these TS Bases, the DCD refers to the use of an RCIS "Rod Test Switch" to allow two control rods to be withdrawn for scram testing. In the current RCIS design, this "Rod Test Switch" is placed in the scram test mode through the use of the RCIS DOI panel to accomplish the same function and intent (i.e., the switch is now a touch panel button). Thus, in Bases B 3.10.3, "Background," B 3.10.4, "Background," and "Applicable Safety Analyses," and B 3.10.5, "Background," and "Applicable Safety Analyses" of Section 16.0, "Technical Specifications," of the DCD; the term "Rod Test Switch" is replaced with the term "RCIS scram test mode"; and in Subsections B 3.9.3, "Background," and "Applicable Safety Analyses," the term "Rod Test Switch" is replaced with the phrase "is placed in the scram test mode." This proposed change consists only of rewording the phrase for purposes of clarification and editorial correction, with no change to the meaning or intent of the original TS Bases.

The applicant evaluated the proposed exemption in Departure STD DEP 7.7-18 and determined that it complies with the requirements in Section VIII.C.4 of Appendix A to 10 CFR Part 52.

However, in TS Bases B 3.10.4, "LCO," Departure STD DEP 7.7-18, is listed as one of the departures describing the change. But, Departure STD DEP 7.7-18 does not sufficiently identify this change. The staff issued RAI 07.07-8 requesting the applicant to clarify and sufficiently justify this apparent discrepancy before the staff can accept this departure. In its response to RAI 07.07-8, dated September 22, 2009 (ML092680017), the applicant revises subsection B 3.10.3 and replaces "rod test switch" with "RCIS scram test mode." The staff found the applicant has adequately addressed RAI 07.07-8. Therefore, the staff considers RAI 07.07-8 to be closed**.**

Departure STD DEP 7.7-18 implements several changes, deletions, and additions to the RCIS that provide the reactor operator with information described in FSAR Tier 2, Subsection 7.7.1.2.3. Descriptions of some status indicators described in FSAR Section 7.7.1.2.3 were improved to be more specific or to provide additional information. Other status information or indicators were moved from the main control panel to the DOI. Several examples that illustrate the change and the reason for the change follow:

- A rod insert block was needed and added to match with the rod withdrawal block annunciator alarm on the main control panel.

- The DOI added a “semi-automatic” mode indication that provides an indication whether “STEP,” “NOTCH,” or “CONTINUOUS” is selected and whether “SINGLE ROD” or “GANGED ROD” is selected. These changes were needed because the design adds the “NOTCH” rod movement control and revises and improves the selection control method.

- The DOI status information description for two “FMCRDs full-in position” indications was revised to clearly indicate that one is based on synchro signals and the other is based on position reed switch signals.

- The position of all FMCRDs is used instead of the average percentage insertion, in keeping with this design indicating the rod position in steps.

- The “Ganged Misalignment” annunciator was moved from the main control panel to the DOI.

The staff finds that the changes, deletions, additions, indicator movements, and adjusted descriptions are consistent with the current RCIS design and are therefore acceptable. Although some descriptions were edited and some status information moved the overall functional operation and information support to the reactor operator, the RCIS is effectively the same as the certified design.

Section 1.8, of the certified ABWR DCD Revision 4, identifies conformance with the SRP and applicability of codes and standards. In ABWR DCD Tier 2, Revision 4, Table 1.8-19 indicates conformance with SRP Section 7.7 of NUREG–0800 (Revision 3, February 1984); Appendix 7-A (Revision 2, July 1981); and BTP ICSB 14 (Revision 2 July 1981). FSAR Tier 2, Section 1.8 of the STP, Unit 3 and 4, COLA states that the information in Section 1.8 of the certified ABWR DCD, including all subsections and tables, is incorporated by reference with certain departures, a standard supplement, and a site-specific supplement. No departure is taken from Table 1.8-19. Revisions to Table 1.8-21 state that STP, Unit 3 and 4, FSAR Tier 2, conforms to IEEE Std 384–1992 and IEEE Std 603–1991. Therefore, based on the above information and a review of the changes in this departure as listed, the staff found that Departure STD DEP 7.7-18 has adequately addressed the requirements identified in SRP Section 7.7 of NUREG–0800.

- STD DEP 8.3-1 Plant Medium Voltage Electrical Design

This departure changes the medium-voltage electrical distribution of the ABWR DCD from a single 6.9 kV system to a dual voltage consisting of 13.8 kV and 4.16 kV. The applicant states that this departure does not affect any Tier 1 or Tier 2* DCD, but the design change results in changes to TS and TS Bases. This departure requires a change in the TS and TS Bases and therefore requires NRC approval.

This departure is evaluated in Chapter 8 and Chapter 16 of this SER.

- STD DEP 10.4-5 Condensate and Feedwater System

The referenced ABWR DCD specifies two feedwater pump ASDs. TS 3.3.4.2 Bases is revised to show that there are four feedwater pumps and four ASDs. The control and logic instrument and electrical diagram and the IBD in Figures 7.7-7, “Recirculation Flow Control System IBD (Sheets 1 - 3, 5 - 8);” 7.7-8, “Feedwater Control System IED (Sheets 1-3);” and 7.7-9, “Feedwater Control System IBD (Sheets 1 - 14 including 6a and 9a);” reflect the additional I&C

for the FWCS and RFCS. The staff noted that the "Description" section in this departure contains a table that compares the major components of the condensate and feedwater system between the referenced ABWR DCD and the referenced ABWR DCD with departures. The staff determined that this departure is acceptable from the I&C perspective, because upgrading the design to one ASD per feedwater pump is considered an improvement. This departure is evaluated in Chapter 10, "Steam and Power Conversion," of this SER.

Tier 2 Departure Not Requiring Prior NRC Approval

The following Tier 2 departures not requiring prior NRC approval identified by the applicant in this section may also be evaluated in other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these departures.

- STD DEP 5.4-1 — Reactor Water Cleanup System (Figures 7.7-8 and 7.7-9)

The flow capacity of the two pumps and two filter demineralizers in the reactor water cleanup system is doubled from one percent of the rated feedwater flow to two percent. This change will improve system maintainability and availability by allowing only one of the two redundant pumps to handle the full cleanup flow and filtering functional requirements. This departure is also addressed in Chapter 5, "Reactor Coolant System and Connected Systems," of this SER.

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, 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.

- STD DEP 7.7-1 — RPV Water Level Instrumentation

Subsection 7.7.1.1(6) adds a clarification that only those instrument lines with a condensing chamber are flushed and identifies the reactor vessel instrumentation with condensing pots. The concern of noncondensable gas build-up in the water column in the reactor vessel referenced leg water level instrument lines (i.e., the reactor vessel instrument lines at the elevation near the main steamline nozzles), is addressed by continually flushing these instrument lines with water supplied by the CRDS for those instrument lines with a condensing chamber. The applicant adds that this clarification applies to items "(a) through (e)" of DCD Subsection 7.1.1.1(6). The original design intent was for flushing to only apply to lines with condensing chambers, which was not clear in the original DCD. This departure provides this clarification.

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, determined that this departure does not require prior NRC approval. However, DCD Subsection 7.1.1.1(6) "(e)" represents the "Reactor Well Water Level Range." This range is used to monitor the reactor water level when the reactor vessel head is removed and the reactor system is flooded during refueling, with a calibration at 0 MPaG (0 psig) and 48.9 degrees Celsius (C) (120 degrees Fahrenheit [F]). The lower point uses the RPV tap below the top of the active fuel. The upper point is far above the RPV. The staff was unable to determine whether it is reasonable for this departure not to require prior NRC approval. The staff questioned whether this reactor well water level range instrument actually could have a condensing chamber, as stated in the departure. Therefore, the staff issued RAI 07.07-7

requesting the applicant to verify that this water level instrument actually has a condensing chamber.

In its response to RAI 07.07-7, dated September 22, 2009 (ML092680017), the applicant states that the reactor well water level range instrument does not have a condensing chamber and "e" is a typographical error that should be replaced with "d." The applicant corrects this error in Revision 3 of the COL FSAR. The staff found this correction acceptable and RAI 07.07-7 is closed.

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.

- STD DEP 7.7-2 SRV Discharge Pipe Temperature Data Recording

In Subsections 7.7.1.1(10) and (15), the term "historian function" replaces technologically specific terms such as "multipoint recorder" or "process computer." Often, specific terms from the ABWR DCD are too specific or too old or the instrumentation itself is obsolete. The use of the term "historian function" assures that the data recording function is still accomplished, without specifying the equipment that is now obsolete or that no longer accurately fits the description.

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, 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.

- STD DEP 7.7-3 Feedwater Turbidity

In Subsection 7.7.1.1(15), "Reactor Operator Information," part (g) concerns the recording of feedwater turbidity in the MCR and an associated high-alarm annunciation. This departure states that because there is no practical manner for performing this measurement, and because measuring turbidity is not considered to have any safety significance, this (g) subsection and a related reference to the feedwater corrosion product (turbidity) monitor in Subsection 7.7.1.1(16) will be deleted.

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, determined that this departure does not require prior NRC approval. The staff conducted an audit on this Tier 2 departure and its evaluation process and found it reasonable that the departure does not require prior NRC approval. For additional information on this audit, see NRC Audit Report dated January 25, 2010 (ML093360537)

- STD DEP 7.7-4 Automatic Power Regulator/Rod Control and Information System Interface

Section 7.7.1.2(1)(a)(ii) of the referenced ABWR DCD describes the PGCS as initiating control changes in the automatic rod movement mode. The STP, Units 3 and 4, FSAR clarifies and corrects the description to state that the APR is actually the direct controlling system that interfaces with the RCIS to accomplish the automatic rod movement mode, and the PGCS interfaces only with the APR to initiate various reactor power change control tasks.

The reactor power change algorithms are implemented in the APR. Section 7.7.1.2 is updated to be consistent with this DCD description, which reflects the proper role of the APR and PGCS. This departure is a clarification only and does not affect the design or functionality of any SSC important to safety.

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, 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 NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 7.7-5 Rod Control and Information System Display

In COL FSAR Subsection 7.7.1.2(1)(b), the applicant clarifies the wording and terminology used to identify more precisely the display information available to the operator from the RCIS through the RCIS DOI on the main control panel. This design does not affect the design or function of any SSC important to safety. This departure simply provides a more complete design description.

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

- STD DEP 7.7-6 Rod Control and Information System Commands

ABWR DCD Tier 2, Subsection 7.7.1.2(1)(f) describes the command "signal" from the RFCS to the RCIS for the ARI, and Subsection 7.7.1.2(1)(g) describes the command "signal" from the RFCS to the SCRRI. The description of the initiation was changed to reflect that the design involves "signals." The three channels of the RFCS (triple redundant) provide each of the two channels of the RCIS logic (dual redundant) with the ARI and SCRRI signals. RCIS internal logic to initiate the RCIS, ARI, and SCRRI functions is based on two-out-of-three logic within each channel of the RCIS. Consequently, initiation of the ARI and SCRRI functions is based on multiple signals from the RFCS.

This departure has no negative impact on the logic for the initiation of the ARI or SCRRI from the RFCS. Nor does the departure have any negative effects on any design or function of an SSC important to safety.

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, 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.

- STD DEP 7.7-7 Rod Control and Information System (RCIS) Design Details

This departure changes the referenced ABWR DCD RCIS descriptions in FSAR Subsections 7.7.1.2(2), 7.7.1.2(3), 7.7.1.2(5), and 7.7.1.2(6) to provide clarity, additional

information, and a more complete design description of the RCIS. This departure lists seven changes that apply to Subsection 7.7.1.2 and to other subsections. These changes include an expanded description of the RCIS monitoring channels, extensive information on the cabinet arrangement as to what functions are located in which cabinet, descriptions of additional RCIS-related panels and cabinets to be consistent with Figure 7.7-2 and various major RCIS subsystem functions, final remote communication cabinet implantation details, final fine motion driver cabinet implementation details, and detailed descriptions of the RCIS multiplexing network information and interfaces with Class 1E systems.

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation determined that this departure does not require prior NRC approval.

The staff reviewed the Departures Report regarding this departure, which indicates changes to Item (5) in Subsection 7.7.1.2 of the ABWR DCD describing power sources. However, there are no changes to Item (5) shown in STP, Units 3 and 4, FSAR Subsection 7.7.1.2(5) for Subsection 7.7.1.2 (5) of the DCD. The staff was unable to determine whether it is reasonable for this departure not to require prior NRC approval. Therefore, the staff issued RAI 07.07-6 requesting the applicant to clarify and correct this discrepancy. In one of the seven types of changes in this departure and in Item (3), "RCIC Multiplexing Network," the "multiplexing" term is used. Departure STD DEP T1 3.4-1 states in Item (1) of the five primary changes that "The elimination of the multiplexer concept required all references to the system(s) and primary components to be replaced with a generic data communication reference." The staff issued RAI 07.07-3 requesting the applicant to clarify this apparent discrepancy.

In its response to RAI 07.07-6, dated August 27, 2009 (ML092430132), the applicant deletes "(5)" in 7.7.1.2 from the list of subsections affected by this departure. The staff found this response acceptable because departure STD DEP 7.7-7 provided in the departure report section of COLA indicated changes to FSAR subsection 7.7.1.2(5), whereas STP, Units 3 and 4, FSAR Subsection 7.7.1.2(5) did not show any proposed changes to this subsection. In its response to RAI 07.07-6, the applicant corrected the departure report. Hence, there are no changes being made to certified design discussed in this subsection. Therefore, RAI 07.07-6 is resolved and closed. In its response to RAI 07.07-3, dated August 27, 2009 (ML092430132), the applicant clarifies that although the description of and justification for STD DEP T1 3.4-1 identifies Item (1), the elimination of the large multiplex system architecture of the "Essential Multiplexer System (EMS) and the Non-Essential Multiplexer System (NEMS)" originally envisioned in the ABWR architecture, a dedicated RCIS multiplex communication configuration remains both a proven and functional part of the system and no changes are required. The staff found this response acceptable. The applicant adequately addresses RAI 07.07-3, and therefore, RAI 07.07-3, is closed.

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.

- STD DEP 7.7-9 Selected Control Rod Run-In Function

This departure states, "Subsection 7.7.1.2(6) of the reference ABWR DCD states that the

Control Rod Drive (CRD) System provides for electromechanical insertion of selected control rods for core thermal/hydraulic stability control."

In COLA Part 7, "Departures Report," Section 3.0, the applicant describes and evaluates this departure per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. The applicant's evaluation determined that this departure does not require prior NRC approval.

The staff reviewed the Departures Report regarding this departure, which adds in the STP, Units 3 and 4, FSAR "…the CRD system also provides for mitigation of a loss of feedwater heating event showing the two functional needs for SCRRI." This function of the SCRRI is already detailed in Subsections 7.7.1.2(1)(g) and 7.7.1.2.2(2)(b) of the DCD. However, DCD Subsection 7.7.1.2(6) is titled "(6) RCIS Scope," and discusses equipment included in the scope but does not discuss the function of the CRD system, as claimed. The staff was unable to determine whether it is reasonable for this departure not to require prior NRC approval. Therefore, the staff issued RAI 07.07-4 requesting the applicant to clarify and correct the discrepancy between the DCD and this departure.

In its response to RAI 07.07-4 dated August 27, 2009 (ML092430132), the applicant states that the discrepancy is an editorial error and inserts the missing heading: "(7) Integral Functional Design" in the departures report. The staff found that this response adequately addresses RAI 07.07-4, and therefore, RAI 07.07-4 is closed.

The applicant's evaluation determined that this departure does not require prior NRC approvalThe staff 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.

- STD DEP 7.7-11 Rod Withdrawal Sequence Restrictions

In this departure, STP, Units 3 and 4, FSAR Subsection 7.7.1.2.1(5) provides additional descriptions and clarifications that expand the DCD discussion of the ganged rod movement and ganged withdrawal sequence restrictions, including notable examples such as the following:

- Item (5)(a) provides additional details on the ganged rod mode that describe the "checker board" pattern following the withdrawal of all Group 1, 2, 3, and 4 control rods.

- In Item (5)(b), the departure states that the system allows up to 26 rod gangs (for control rods in rod Groups 1, 2, 3, and 4) to be withdrawn simultaneously when in the startup or run mode, under the stated restrictions.

- In Item (5)(b)(vi), the departure revises the maximum allowable difference in rod positions between the leading and trailing operable control rods.

- In Item (5)(b), the departure revises the restrictions on the withdrawal of rods in groups.

- In the "Introduction" under Item (5), the phrase indicating that the RWM of the RCIS ensures adherence to certain ganged withdrawal sequence restrictions was revised to remove the condition that the RWM restriction functions only below the low power setpoint and the reactor mode switch is in startup or run mode, but these are included in list of restrictions for the RCIC that follows.

The departure changes cited above provide more complete details describing the ganged rod withdrawal restrictions. The departure changes Subsections 7.7.1.2.1(5)(b)(vi)(c) and (d) so that the maximum allowable difference between operable control rods in certain groups is revised from 146 mm to 152 mm (5.75 in. to 6.0 in.) with certain restrictions. The applicant states in the evaluation that the basic functioning of the RWM of the RCIS to ensure that there are restrictions on certain ganged control rod movements is unchanged,

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, 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 NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 7.7-12 Rod Control and Information System Indication

This departure updated the discussion of the detailed design of the reference rod pull sequence (RRPS) in STP, Units 3 and 4, FSAR Subsection 7.7.1.2.1(6). This departure describes four clarifying changes that are primarily editorial in nature. For example, it clarifies that the PCF and not the PMCS is used for storing, modifying, and providing compliance verification for the RRPS.

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, 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.

- STD DEP 7.7-13 Optical Isolation

This departure removes overly restrictive optical isolation information from the STP, Units 3 and 4, FSAR Subsection 7.7.1.2.1(7) discussion of the rod block function. This change removes the detailed description of the specific type of technology used for optical isolation of rod block signals received by the nonsafety-related RCIS from Class 1E systems. The referenced ABWR DCD wording discusses the details of a specific technology.

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, 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 NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 7.7-14 Rod Control and Information System Bypass

This departure discusses five changes in STP, Units 3 and 4, FSAR Subsection 7.7.1.2.1 concerning the RCIS bypass capabilities. For example, there are changes in the descriptions regarding the specific location and related operator interface where specific bypass functions can be performed (e.g., update of control rods to be placed in the "Inoperable" status can be performed at the RCIS DOI and descriptions of the bypass permissive switch for performing certain bypass operations are added for clarity). The applicant states that these changes are a result of RCIS design evolution based on experience at operating plants and involve an enhanced discussion of RCIS bypass capabilities. The applicant also notes that "this departure

is not the result of any underlying design change and functional requirements of the RCIS are unchanged."

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, 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.

- STD DEP 7.7-20 Recirculation Flow Control Logic

Subsection 7.7.1.3(1) of the referenced ABWR DCD describes the automatic operation of the RFCS as being available only at power levels above 70 percent.

STD DEP 7.7-20 implements the following revisions to Subsection 7.7.1.3(4) of the ABWR DCD:

- Provides a more complete description by stating that the 70 percent limit is for a "rod pattern where rated power accompanies 100 percent flow." Provides further information concerning manual and automatic operation for other rod patterns and power levels. Therefore, the statement "if the power level is above 70% rated" is removed from 7.7.1.3(1).

- Describes an operation below approximately 25 percent, in lieu of previous information about an operation below 70 percent.

- Enhances load follow capability to include the specific interfacing systems required for this mode of operation, in lieu of the original "main turbine regulator control."

- Changes terminology for the "main turbine pressure regulator" to "APR," and the "semi-automatic mode" becomes "core flow mode."

STD DEP 7.7-20 revises the rate limiter rate of change to five percent for increasing speeds and minus five percent for decreasing speeds in Subsection 7.7.1.3(8)(e) in the ABWR DCD to be consistent with the speed change rate described in DCD Tier 2, Subsections 15.3.2.1.1, "Identification of Causes," and 15.4.5.1.1, "Identification of Causes."

STD DEP 7.7-20 updated the terminology in Figure 7.7-5, "Recirculation Flow Control System IED (Sheets 1-2)," and Figure 7.7-7, "Recirculation Flow Control System IBD (Sheets 1-9)," to be consistent with Subsection 7.7.1.3, "Recirculation Flow Control System—Instrumentation and Controls."

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, 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 NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 7.7-22 Automated Thermal Limit Monitor Description

This departure implements an expanded description of the ATLM setpoint and rod block action

found in the ABWR DCD. Subsections 7.7.1.5(7)(c) and 7.7.1.5(7)(e) are expanded in the STP, Units 3 and 4, FSAR to further describe the interface of the interacting systems.

The description of the ATLM setpoint and rod block action in the ABWR DCD Subsection 7.7.1.5.1 is expanded in the STP, Units 3 and 4, FSAR to further describe the interface of the interacting systems. The FSAR states that when an ATLM setpoint update is requested after calculating the power distribution within the core, the computer sends data to the ATLM of the RCIS on the calculated fuel thermal operating limits and corresponding initial LPRM values. FSAR Tier 1 of the ABWR DCD contains information on the ATLM, but the proposed change in the departure has no effect on it. This change is an expansion of the description of the interface between interacting systems and the ATLM. The setpoint calculation is performed using the nuclear steam supply (NSS) performance module within the PMCS. There is no underlying design change and no SSC important to safety is affected.

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, 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 NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 7.7-23 — Automated Traversing Incore Probe (ATIP) Function

Subsection 7.7.1.5.1 of the referenced ABWR DCD discusses the clarification and expansion of the description and function of the "automatic fixed incore probe (AFIP)". The STP, Units 3 and 4, FSAR explains that this function is provided by the ATIP rather than the AFIP in the ABWR. In Subsection 7.7.2.6.2, the departure adds that the ATIP system has isolation valves and is required to perform the automatic containment isolation function in compliance with GDC 56, "Primary containment isolation," by following the guidance of RG 1.11, Revision 0, "Instrument Lines Penetrating Primary Reactor Containment."

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, 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 NRC approval. The applicant's process for evaluating departures and other changes to the DCD are subject to NRC inspections.

- STD DEP 7.7-24 — Steam Bypass and Pressure Control Interfaces

Subsection 7.7.1.8(7a) of the ABWR DCD states that an external signal interface for the SB&PC system is narrow range dome pressure signals from the SB&PC system to the RFCS. STP, Units 3 and 4, FSAR Subsection 7.7.1.8(7a) states that the "narrow range dome pressure signals" are replaced by "validated dome pressure signals." The signals are validated based on the value of the pressure and the number of signals that are in the valid range. Other items in Tier 2, Subsection 7.7.1.8 clarify which is the sending unit and which is the receiving unit.

Subsection 7.7.2.8.1 of the ABWR DCD Tier 2 states that the SB&PC does not interface with any engineered safeguard or safety system. STP, Units 3 and 4, FSAR Tier 2, Subsection 7.7.2.8.1, states that the SB&PC system receives the reactor pressure and water level from the NBS, but only from nonsafety instrumentation. This departure clarifies that the SB&PC system does not interface with any safety instrumentation, even though the SB&PC

interfaces with a safety-related system through the sensing lines. The transmitters used to convert the pressure and differential pressure to electrical signals are the interface and the nonsafety instrumentation.

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, 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.

- STD DEP 7.7-27 RCIS Table Deletion

Table 7.7-1, "RCIS Module Operation Environment," of the referenced ABWR DCD provides the environmental conditions for the RCIS module operation environment that consists of temperature, relative humidity, atmospheric pressure, radiation levels, and seismic acceleration. There is no reference to this table in DCD Section 7.7 or elsewhere in the DCD. DCD Subsection 7.7.1.2.5 refers the reader to references in Section 3.11, "Environmental Qualification of Safety-Related Mechanical and Electrical Equipment," which provides the requirements for nonsafety equipment subject to adverse environments. Therefore, Table 7.7-1 was deleted because the information is repeated and is thus unnecessary.

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, 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.

- STD DEP 9.5-3 System Description - Reactor Internal Pump Motor-Generator Sets

This departure consists of several changes to the technical description of the nonsafety-related MG set equipment that provides power to the RIPs. These changes are being made to clarify the original DCD technical descriptions or to reflect changes in the actual equipment design implementation details that have evolved since the original DCD descriptions were written. This departure is addressed in Chapter 9 of this report. Paragraph 7.7.1.3(7) deletes a specific power device type "gate-turn-off (GTO)." The purpose of this sentence is to describe how to implement the recirculation pump trip function in the ASDs. The description is consistent with the ASD design. Paragraph 7.7.1.3(8)(c) also clarifies changes that replace the term "rectifier section" with "rectifier circuitry"; and "provides the required circuitry" replaces the phrase "includes gate turn off thyristors."

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, 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.

- STD DEP Admin

Throughout STP, Units 3 and 4, FSAR Subsection 7.7, the applicant identifies several administrative departures. Administrative departures are defined as minor corrections, such as

editorial or administrative errors, in the referenced ABWR DCD (e.g., misspelled words, incorrect references, and table headings, etc.). Administrative departures do not affect the presentation of any design discussion or the qualification of a design margin.

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, 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.

7.7.5 Post Combined License Activities

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

7.7.6 Conclusion

The staff's finding related to the information incorporated by reference is in NUREG–1503 and NUREG–1948. The staff reviewed the application and checked the referenced DCD and AIA Amendment. The staff's review confirmed that the applicant has addressed the required information relating to control systems not required for safety, 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 10 CFR Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the control systems not required for safety that were incorporated by reference have been resolved.

In addition, the staff compared the additional information in the COLA to the relevant NRC regulations and the guidance in Section 7.7 of NUREG–0800. The staff's review concluded that the applicant has adequately addressed the identified Tier 1 and Tier 2* and Tier 2 departures requiring prior NRC approval in accordance with Section 7.7 of NUREG–-0800, and 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. The staff concludes that the applicant has provided sufficient information to satisfy the requirements of the NRC regulations.

7.8 COL License Information

7.8.1 Introduction

This section of the FSAR discusses COL information items.

7.8.2 Summary of Application

Section 7.8, "COL License Information," of the STP, Units 3 and 4, COL FSAR Revision 12 incorporates by reference Section 7.8 of the certified ABWR DCD Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 7.8, the applicant provides the following:

COL License Information Items

- COL License Information Item 7.3 Effects of Station Blackout on the HVAC

The applicant states that "During the station blackout (SBO) scenario, control room HVAC can be unavailable for up to 10 minutes while the Alternate AC source starts and connects to the safety buses." The applicant commits (COM 7.8-1) to performing a "control room temperature rise analysis using as-procured and as-built equipment information" for the SBO scenario. The analysis will demonstrate that the equipment available and used during SBO will not generate sufficient heat to raise environmental temperature above the qualified limits of the operating equipment. In accordance with 10 CFR 50.71(e), the FSAR will be updated to reflect the results of the analysis.

- COL License Information Item 7.4 Electrostatic Discharge on Exposed Equipment Components

This COL license information item addresses the effects of electrostatic discharge on exposed equipment components.

- COL License Information Item 7.5 Localized High Heat Spots in Semiconductor Materials for Computing Devices

This COL license information item addresses localized high-heat spots in semiconductor materials for computing devices. The applicant commits (COM 7.8-2) to provide an updated FSAR to reflect the results of the environmental qualification at the time that purchase orders are placed for the SSLC systems.

7.8.3 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 COL license information items, and the associated acceptance criteria, are in Chapter 7 of NUREG–0800. In particular, the regulatory requirements include: 10 CFR 50.55a(h), 10 CFR Part 50, Appendix A, GDC 4, 13, and 19.

7.8.4 Technical Evaluation

As documented in NUREG–1503, the staff reviewed and approved Section 7.8 of the certified ABWR DCD. The staff reviewed Section 7.8 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.

COL License Information Items

- COL License Information Item 7.3 Effects of Station Blackout on the HVAC

Specific information provided by the applicant to address COL License Information Item 7.3 includes Commitment (COM 7.8-1), which commits the applicant to perform a control room temperature-rise analysis before fuel loading and using as-procured and as-built equipment. The analysis will demonstrate that the available equipment used during an SBO will not generate sufficient heat to raise the environmental temperature above the qualified limits of the operating equipment. This type of analysis is typically performed using industry standard practices and tools (such as Gothic) which the applicant has used in performing other similar analyses. Commitment (COM 7.8-1) will track the applicant's commitment to perform an analysis of the control room temperature heat rise for the SBO scenario based on plant-specific environmental parameters.

- COL License Information Item 7.4 Electrostatic Discharge on Exposed Equipment

Specific information provided by the applicant to address COL License Information Item 7.4 includes implementation of General Electric (GE) recommendations (response to Question 420.90 in Chapter 20 of the ABWR DCD) for limiting the effects of electrostatic discharge at keyboards, keyed switches, and other exposed equipment. The applicant also provides assurance that the grounding and shielding techniques employed are consistent with the GE recommendations. The applicant commits to verify the lack of susceptibility of ABWR control equipment to electrostatic discharges using the test procedures included in International Electrotechnical Commission (IEC) Publication 801-2, "Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment," and Publication 801-2, Part 2 "Electrostatic Discharge Requirements," which meet the following acceptance criteria:

- No change in trip output status shall be observed during the test.

- Equipment shall perform its intended functions after the test.

The applicant will use ITAAC Table 3.4, Item 12, to document these test results.

Based on the staff's evaluation, IEC Publication 801-2 is no longer active. IEC 61000-4-2, "Electromagnetic Compatibility," (EMC) Part 4-2, "Testing and Measurement Techniques - Electrostatic Discharge Immunity Test," replaces IEC 801-2. This international standard relates to the immunity requirements and test methods for electrical and electronic equipment subjected to static electricity discharges directly from operators and to adjacent objects. The standard also defines ranges of test levels that relate to different environmental and installation conditions and establishes test procedures. The staff issued RAI 07.08-1. In its response to RAI 07.08-1, dated August 27, 2009 (ML092430132), the applicant states that IEC 61000-4-2 will be used to qualify electrical and electronic equipment subjected to electrostatic discharges. Accordingly, the applicant proposes an update to FSAR Sections 7.8.2 and 7A.3 and Table 1.8-21. RG 1.180, Revision 1, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems," endorses the IEC 61000 series standards and ensures compliance with the stated regulations. Therefore, the staff's review confirmed that the applicant has adequately addressed COL License Information Item 7.4 in accordance with Chapter 7 of NUREG–0800. The applicant's letter, dated

February 9, 2009 (ML090430154), committed to conformance with RG 1.180 and proposed an update to FSAR Table 1.9S-1 accordingly.

The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5, Section 7.8, but has not yet updated FSAR Table 1.9S-1 to reflect the commitment to conform with RG 1.180. In a letter dated April 19, 2010 (ML101120084), that revised and replaced in its entirety, the response to RAI 07.01-14 and stated that after further consideration, the applicant deemed it more appropriate to include the new and revised information in existing FSAR Tables 1.8-20, 1.8-21, and 1.8-21a. Following staff questions regarding the phrases used to describe the licensing of the Common-Q platform, the applicant again revised and replaced in its entirety, the response to RAI 07.01-14 in a letter dated September 23, 2010 (ML102700189). The staff confirmed that the applicant has included the proposed changes, including RG 1.180, in FSAR Tables 1.8-20, 1.8-21, and 1.8-21a of FSAR Revision 6. Therefore, RAI 07.08-1 is closed.

- COL License Information Item 7.5 Localized High Heat Spots in Semiconductor Materials for Computing Devices

The applicant provides specific information to address COL License Information Item 7.5 that includes Commitment (COM 7.8-2) to update the FSAR with the results of environmental qualifications of the SSLC systems. The applicant provides an acceptable alternative to the thermal analysis performed at the circuit board, instrument, and panel design stages that are called for in the ABWR DCD. The applicant commits to include the provisions in the purchase specifications for the SSLC systems, which will ensure that the supplied equipment is designed to perform its intended safety functions in the installed normal, abnormal, and accident environments. Equipment purchase specifications for the RPS equipment permit the supplier to use convective cooling with no fans. This is acceptable because the digital components to be used in the RPS are of the type that generates less heat. Equipment purchase specifications for the ELCS state that the supplier shall be permitted to provide the ELCS equipment that uses internal forced air cooling and that a local temperature sensor and diagnostic alarm shall be provided for each cabinet. This is acceptable because the internal forced air cooling is an effective method of removing heat from the digital components and the local temperature sensors provide a warning and an alert in the case of a fan failure. Temperature rise internal to the cabinet will be verified during the environmental qualification and during factory acceptance testing for each cabinet. Commitment (COM 7.8-2) will track whether the applicant performs the above stated actions and will document the environmental qualification results in the FSAR.

7.8.5 Post Combined License Activities

The applicant identifies the following commitments:

- Commitment (COM 7.8-1) – Perform a control room temperature rise analysis using as-procured and as-built equipment information for the SBO scenario, before fuel loading. The FSAR will be updated to reflect the results of the analysis.

- Commitment (COM 7.8-2) – Provide an updated FSAR to reflect the results of the environmental qualification at the time that purchase orders are placed for the SSLC systems.

7.8.6 Conclusion

The 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 COL license 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 10 CFR Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the COL license information items that were incorporated by reference have been resolved.

In addition, the staff compared the additional information in the COLA to the relevant NRC regulations and the guidance in Chapter 7, NUREG–0800. The staff's review concluded that the applicant has adequately addressed COL License Information Items 7.3, 7.4, and 7.5 in accordance with Chapter 7 of NUREG–0800. The staff concludes that the applicant has provided sufficient information to satisfy the requirements of the NRC regulations.

7.8S Diverse Instrumentation and Control Systems

This section of the FSAR refers to FSAR Section 7C.5, "Details of Final Implementation of Diversity in ABWR Protection System," for the discussion on the diversity of the I&C systems. The staff's evaluation of the diverse I&C systems is in Section 7C, "Defense Against Common-Mode Failure in Safety-Related, Software-Based I&C Systems," of this SER.

7.9S Data Communications Systems

7.9S.1 Introduction

This supplemental section of the FSAR addresses the essential (safety-related) and nonessential (nonsafety-related) data communication functions (DCFs) that are part of or that support the systems described in COLA FSAR Sections 7.1S and 7.2 through 7.7. The DCFs reviewed in this section includes communication between systems and communication between computers within a system. This supplemental section addresses both safety and nonsafety communication systems. Internal computer buses are specifically excluded from the definition of DCF used in this section.

7.9S.2 Summary of Application

This supplemental section includes an overview of the ABWR data communication system for STP, Units 3 and 4. In this supplemental section, the applicant addresses both the safety-related and nonsafety-related DCFs, which are part of or support the I&C systems described in COLA FSAR Revision 12 Sections 7.1S and 7.2 through 7.7. Specifically, this section includes data communications between systems and between divisions within a system. Communication within a system is an integral part of that system. The DCFs of the RTIS, NMS, and ELCS are required to support the safety-related functions of these systems. The DCFs associated with the SSLC systems perform data collection and distribution using both local and remote data acquisition and control units, which are connected by dedicated data links and/or networks for the above three safety-related systems.

The safety-related data communication systems also provide alarm and status data from safety-related plant sensors located in the SSLC systems to the nonsafety-related PICS for MCR indication and computer logging, through isolated gateway interfaces and the nonsafety-related

PDN. It also provides selected safety-related plant process data to the nonsafety-related control systems through isolated gateway interfaces. The interconnection of Class 1E communication to non-Class 1E devices is achieved using fiber optic cable, which provides the necessary electrical isolation. Communication from safety-related to nonsafety-related systems is controlled by the safety device to assure that no communication task will interfere with the safety system performing its intended functions. The majority of the nonsafety-related data communications are performed through a plant-wide PDN. The PDN distributes process and other data required to support the nonsafety-related operational functions.

7.9S.3 Regulatory Basis

Reviews of this supplemental section are based on meeting the current regulatory requirements, the acceptance criteria, and guidelines in NUREG–0800, Table 7-1, Revision 5 (March 2007). In accordance with 10 CFR 50.55a(h), COLAs filed on or after May 13, 1999, which depart from the certified ABWR DCD, Revision 4, must meet the requirements for safety systems in IEEE Std 603–1991 and in the correction sheet dated January 30, 1995. In addition, the staff used the applicable guidelines in DI&C-ISG documents to evaluate the departures from the certified ABWR design.

7.9S.4 Technical Evaluation

The staff reviewed the applicant's supplemental changes to the certified ABWR DCD Revision 4, using the review procedures described in Section 7.9 of NUREG–0800. The staff's evaluation of this supplemental section affecting the certified ABWR DCD Revision 4, is as follows.

The DCFs are an integral part of the RTIS, NMS, and ELCS safety platforms. The staff found that the RTIS, NMS, and ELCS platforms meet the applicable quality requirements and standards in 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants"; 10 CFR 50.55a(h) (IEEE Std 603–1991); and IEEE Std 7-4.3.2-2002. In addition, the DCF software quality, as a part of the overall software quality for the DI&C safety-related systems, will be inspected as a post-COL activity through the ITAAC process.

The staff found in the COLA that the communication between divisions for the SSLC safety systems preserves divisional independence, so that a failure in one division does not affect other divisions. Therefore, the staff found that the DCFs of the SSLC systems conform to the guidelines for the application of the single-failure criterion in IEEE Std 379–1992, "IEEE Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems," as supplemented by RG 1.53, Revision 2, "Application of the Single-Failure Criterion to Nuclear Power Plant Protection Systems."

The safety-related DCFs are integral functions of the SSLC systems. The SSLC testing features and surveillances that are covered in Subsection 7.1.2.1.6 of the COLA also include the DCF function testing. After reviewing the above relevant section of the COLA, the staff found that the DCFs of the SSLC system satisfy the requirements in the guidelines for periodic testing in RG 1.22, "Periodic Testing of Protection System Actuation Functions," and RG 1.118, Revision 3, "Periodic Testing of Electric Power and Protection Systems." See Section 7.1 of this SER for additional evaluations of the SSLC testing features and surveillances.

SSLC bypass and inoperable status indications (BISI) that encompass those related to the

DCFs provide information to meet the requirements in RG 1.47, "Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems." So after reviewing the BISI description in the application, the staff determined that the bypass and inoperable status indication for the DCF functions conforms to the guidelines of RG 1.47. Based on this review, the staff concluded that the DCFs satisfy the requirement of IEEE Std 603–1991, with regard to the system bypass and inoperable status indications.

In its letter dated February 9, 2009 (ML090430154), and in the revised responses to the RAI 07-6 dated December 30, 2009 (ML100050181), the applicant indicates that RG 1.152, Revision 2 will be followed for the RTIS and NMS, because the new field-configurable logic device-based platform will be used for these two systems. But the ELCS will be in conformance with RG 1.152, Revision 1 because the applicant states that the Common Q platform approved by the NRC will be used for this ELCS. The applicant will address any new changes to the approved Common Q platform and associated DI&C security concerns in a technical report under the Tier 1, Table 3.4 ITAAC/DAC as a post-COLA activity. The applicant will address all new DI&C security requirements through the ITAAC closure process, as post-COL activities according to any new DI&C security guidelines. The applicant submits the programmatic cyber security plan to meet 10 CFR 73.54. The certified ABWR DCD Tier 1, Revision 4, Table 3.4, covers ITAAC items for the SSLC systems that include software development plans and the inspections of the computer development process and design outputs. The inspections of the above ITAAC items for software lifecycle development plans are included as post-COL activities. The safety-related DCFs are integral functions of the SSLC systems. Therefore, the staff concluded that the DCF systems conform to the guidance of RG 1.152, and the special characteristics of DCF systems have been adequately addressed.

The DCF functions were included in the staff's review of the diversity and defense-in-depth (D3) analysis for the RTIS and ELCS. The D3 attributes of the DCF functions are covered in FSAR Sections 7.8S, "Diverse Instrumentation and Control Systems," and Appendix 7C. Refer to Sections 7.8S and Appendix 7C of this SER for detailed evaluations of the diverse I&C systems. The staff found that SSLC divisions are physically separated and electrically isolated from one another. The divisions have separate power sources, and the transmission of logic signals between divisions is through qualified isolation devices. The protective covering of the fiber optic cables used for the DCF data communication network is flame retardant. The cables pass through safety class barriers, where necessary, that separate Class 1E circuits and equipment from other Class 1E equipment or from non-Class 1E equipment. The DCF equipment is kept physically separate to minimize the effects of design-basis events. The staff also found that during operations, the functionality of the DCFs for the ELCS, NMS, and RTIS is independent of nonsafety-related systems. Therefore, the staff determined that DCF functions conform to the guidelines in RG 1.75, Revision 3, "Criteria for Independence of Electrical Safety Systems," for protection system independence. The staff also concluded that the DCF functions satisfy the requirements for independence of IEEE Std 384–1992 and IEEE Std 603–1991.

DCD Tier 1, Section 2.7.5, "Multiplexing Systems," states that "data cannot be transmitted from the non-safety-related side to EMS" safety-related equipment. However, COLA FSAR Tier 2, Section 7.9S.2.2 allows manual data transmission from the nonsafety-related PICS to the safety-related NMS. The staff issued RAI 07.09-8, requesting the applicant to make necessary changes for purposes of consistency, to provide sufficient information on how the manual data transmission will be implemented, and to illustrate how to prevent any adverse impact on the safety-related NMS from the manual operation. In its response to RAI 07.09-8, dated September 24, 2009 (ML092710226), the applicant states that data cannot be transmitted from

the nonsafety-related equipment to online safety-related equipment. A separate offline method is used to transfer LPRM calibration data from PICS to NMS, which places the NMS receiving division in an inoperative status and requires a key lock switch to be enabled at the NMS to allow the transfer. Manual verification is required before the NMS division is placed back in service. The staff determined that the explanation in the RAI response is acceptable, and therefore, RAI 07.09-8 is closed.

The DCFs are integral functions of the SSLC systems. The staff found that for the SSLC systems, divisions are physically separated and electrically isolated from one another. The divisions have separate power supplies. The data communication of logic signals between divisions is via qualified isolation devices. There is no online data communication from the nonsafety-related control systems to the safety-related systems. The data communication from the safety-related control systems to the nonsafety-related systems is through fiber optic cables, which also provide the electrical isolation between the safety- and nonsafety-related systems. Based on the review of system independence and separation, the staff concluded that the DCF satisfies the requirement of IEEE Std 603–1991 with regard to systems independence. Therefore, the staff found that the DCFs also meet the requirements of GDC 22.

The RTIS and NMS systems are designed to fail into a safe state upon the loss of communication. The ELCS fails as-is during communication failure. That is, system controllers continue to operate based on the last command. The staff determined that the failure mode for RTIS, NMS, and ELCS is acceptable. The DCF failure modes are accounted for in the failure modes and effects analysis for the RTIS and ELCS. Based on the staff's review, the staff concluded that the SSLC protection systems, which include the DCFs, satisfy the requirements of GDC 23.

The DCFs are integral functions of the RTIS, ELCS, and NMS safety systems. There are one-way data communications from the RTIS or ELCS to plant operating control systems. This unidirectional data communication is based on the fiber optic cables. During normal operation, there is also only one-way data communication from the safety-related NMS to plant operating control systems via the fiber optic cables. During normal operation, there is manual data transmission from the nonsafety-related plant control system to the safety-related NMS. This manual data transmission from PICS to only one division of NMS at a time occurs when it's placed in the inoperable mode. The staff found this manual data communication function acceptable. During normal operation, the control system that is usually used to control the plant power does not have any adverse impact on the safety systems. The SSLC protection systems are separate from the plant operating control system. Any failure from the plant control system component will not impair the safety systems. Based on the review of the interfaces between the DCFs and plant operating control systems, the staff concluded that the RTIS, ELCS, and NMS safety systems satisfy the requirements of IEEE Std 603–1991, with regard to the control and protection system interactions. Therefore, the staff also found that the DCFs satisfy the requirements of GDC 24.

The DCFs are an integral part of the RTIS, NMS, and ELCS and support their safety-related functions. The DCFs also support the functions of the information systems important to safety, such as the PAM system. The DCFs are integral functions of the safety interlock system. The staff found that DCFs used in information systems that are important to safety, and in interlock systems important to safety, transmit the variables and commands necessary to maintain the fission process, the integrity of the reactor core, the reactor coolant pressure boundary, and the containment and its associated systems within prescribed operating ranges during a plant

shutdown. Therefore, the staff determined that the DCFs employed by the information and interlock systems important to safety satisfy the requirements of GDC 13.

The staff found that the DCFs in the COLA detect errors using self-diagnostic tests such as checksum, parity check, or the reception of a keep-alive signal. If the data are not available, the safety logic takes predetermined actions based on the specific data involved. The staff found that the DCFs of the SSLC safety systems have the simplicity of the communication design, which is of a high reliability. Hence, the staff determined that the DCFs in the COLA support the reliability requirements in 10 CFR 50.55a(h) (IEEE Std 603–1991).

The DCF systems that are integral parts of the SSLC systems support instruments and controls within the control room to allow actions to be taken to maintain the nuclear power unit in a safe condition during a shutdown, including a shutdown following an accident. In the COLA, the staff also found that equipment at appropriate locations outside the control room provides support to achieve: (1) a prompt, hot shutdown of the reactor; and (2) a subsequent, cold shutdown of the reactor. Therefore, the staff concluded that the DCFs employed by the safe shutdown system satisfy the requirements of GDC 19.

The staff's review included the identification of those systems and components for the DCF systems that are designed to survive the effects of earthquakes, other natural phenomena, abnormal environments, and missiles. STP, Units 3 and 4, COL FSAR Section 7.9S.2.5 states that all of the equipment implementing the DCFs of the SSLC, which is located in Seismic Category I structures, meets the requirements of RG 1.100, Revision 2, "Seismic Qualification of Electrical and Mechanical Equipment for Nuclear Power Plants," and IEEE Std 344–1997. Based on the review, the staff concluded that the applicant has identified DCF systems and components consistent with the design bases for those DCF systems. The staff also reviewed electromagnetic interference/radio-frequency interference susceptibility and seismically exposed portions of the DCFs. Sections 3.10, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment," and 3.11, "Environmental Qualification of Safety-Related Mechanical and Electrical Equipment," of this SER address the qualification programs to demonstrate the capability of these systems and components to survive these events. Refer to Sections 3.10 and 3.11 of this SER for additional evaluations. Therefore, the staff found that the identification of the DCF systems and components satisfy the requirements of GDC 2, "Design Bases for Protection Against Natural Phenomena," and GDC 4, "Environmental and Dynamic Effects Design Bases."

Setpoint analyses accounting for measurement inaccuracies attributable to the DCF will be conducted in accordance with the guidance of RG 1.105, Revision 3. The applicant has submitted Technical Report WCAP-17119-P, "Methodology for South Texas Project Units 3 and 4 ABWR Technical Specifications Setpoints." For the technical and regulatory compliance evaluations, refer to Section 7.1 of this SER. Also, as an ITAAC item in the certified ABWR DCD Tier 1, Table 3.4, the setpoints for initiating safety-related functions will be determined, documented, and maintained for NRC's inspection, which is included as a post-COLA activity. The staff concluded that the DCF systems adequately support the RTIS and ELCS safety functions as necessary, to sense accident conditions and anticipated operational occurrences, in order to initiate protective actions consistent with the accident analysis presented in Chapter 15, "Transient and Accident Analysis," of the COLA FSAR. Therefore, the staff determined that the DCFs appropriately support RTIS and ELCS compliance with the requirements of GDC 20.

The staff found that each communication interface in the DCF systems operates independently and also asynchronously. The maximum time delay from input to output is deterministic. The data transmission for the safety-related systems is purely unidirectional, without acknowledgement from the other end. The data transmission cycle time is fixed and the communication is of the deterministic type. Therefore, based on this review, the staff determined that the DCF performance meets the requirements and guidelines in the BTP 7-21, Revision 5, "Guidance on Digital Computer Real-Time Performance"; DI&C-ISG-04; and 10 CFR 50.55a(h) (IEEE Std 603–1991).

The staff found that the COLA specifies that only the one-way data transfer is allowed from the safety-related to the nonsafety-related systems for the DCF functions. The COLA states that there is no unprotected electronic paths in the DCF functions by which unauthorized personnel can change plant software or display erroneous status information. There are security-protected external interfaces but no remote access to the safety systems. Based on this review, the staff determined that the DCF functions meet the requirements, standards, and guidance in 10 CFR 50.55a(h) (IEEE Std 603–1991), IEEE Std 7-4.3.2-2002, RG 1.152, and DI&C-ISG-04.

The safety-related DCFs are integral functions of the SSLC systems, which include the safety-related ELCS, NMS, and RTIS. For the SSLC systems, the staff issued RAI 07.09-1 and RAI 07.09-2 requesting the applicant to provide sufficient information detailing how communication isolation and interface are implemented for the gateways among multiple digital platforms, especially the ones to be used between the safety-related NMS and the nonsafety-related PICS, because manually conducted communication is needed from the PICS to the NMS. In its response to RAI 07.09-1 and RAI 07.09-2, dated September 22, 2009 (ML092680017), the applicant committed to revising this supplemental section in a future revision of the COLA. The staff found the responses acceptable. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.09-1 and RAI 07.09-2 are closed.

Both the fiber optic cable and its components such as terminations, field splices, and connectors are critical to providing electrical and communication isolation for the fiber optic-based and safety-related systems. The staff issued RAI 07.09-3 requesting the applicant to provide sufficient qualification information in the COLA for the fiber optic cable components intended to prevent the fiber optic cable-related CCFs. In its response to RAI 07.09-3, dated September 22, 2009 (ML092680017), the applicant states that the qualification of all safety-related I&C equipment is within the scope of the ITAAC. The staff has verified the adequacy of the related ITAAC and found it to be acceptable such that when the ITAAC is performed and the acceptance criteria are met, there is reasonable assurance that the facility has been constructed and will operate in conformance with the COL, the provisions of the Atomic Energy Act of 1954, and NRC regulations. The staff found the applicant's response acceptable and therefore, RAI 07.09-3 is closed.

COLA FSAR Section 7.9S.3.1, "Plant Data Network (PDN) Functions," states that network gateways are safety-related, but Figure 7.9S-1, "Data Communication Interfaces," shows that the gateways are not safety-related. The staff issued RAI 07.09-4 requesting the applicant to clarify this inconsistency. In its response to RAI 07.09-4, dated September 22, 2009 (ML092680017), the applicant confirms that the network gateways are nonsafety-related. The applicant committed to revise the related FSAR section. The staff found the applicant's response acceptable. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.09-4 is closed.

According to SRP Section 7.9 and BTP 7-21, the staff requested the applicant to provide the system design analysis because the DI&C system proposed in the COLA is different from the one included in the certified ABWR DCD, Revision 4. In addition, the certified ABWR DCD, Revision 4, requires a safety and hazards analysis, a sneak circuit analysis, and a timing analysis for the DI&C systems. However, those analyses are not included in the applicant's COLA. Therefore, the staff issued RAI 07.09-5, requesting the applicant to provide sufficient information addressing those analysis requirements. In its response to RAI 07.09-5 dated September 22, 2009 (ML092680017), the applicant states that the verification of the I&C system design and analysis will be accomplished during the ITAAC phase. The staff has verified the adequacy of the related ITAAC and found it to be acceptable such that when the ITAAC is performed and the acceptance criteria are met, there is reasonable assurance that the facility has been constructed and will operate in conformance with the COL, the provisions of the Atomic Energy Act of 1954, and NRC regulations. Thus, the staff found the applicant's response to RAI 07.09-5 acceptable and therefore, RAI 07.09-5 is closed.

Because the technical reports for the field-configurable logic device-based NMS and RTIS will not be included as part of the COLA, the staff issued RAI 07.09-6 requesting the applicant to provide sufficient information in the COLA on how the configurable logic device-related technical issues are addressed in the NMS and RTIS design to meet the safety and reliability requirements such as timing, delay, race conditions, gate skew, power dissipation, partitioning, maintainability, testability, tool usage and qualification, and environmental and fabrication issues related to the underlying technologies to be used. In its response to RAI 07.09-6, dated September 22, 2009 (ML092680017), the applicant states that all of the issues mentioned in the RAI will be addressed in a technical report in support of ITAAC/DAC activities. The staff has verified the adequacy of the related ITAAC and found it to be acceptable, such that when the ITAAC is performed and the acceptance criteria are met, there is reasonable assurance that the facility has been constructed and will operate in conformance with the COL, the provisions of the Atomic Energy Act of 1954, and NRC regulations. Thus, the staff found the applicant's response to RAI 07.09-6 acceptable and therefore, RAI 07.09-6 is closed.

7.9S.5 Post Combined License Activities

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

7.9S.6 Conclusion

The staff reviewed the information in this supplemental section for conformance to the requirements and guidelines in the regulations, RGs, and industry codes and standards applicable to the DCFs associated with SSLC systems. The staff concluded that the applicant has adequately identified the regulations and guidelines applicable to the DCFs. Based on the review, the staff found reasonable assurance that the DCFs associated with SSLC systems conforms to the regulations and guidelines applicable to the DCF system. In addition, the inspection and verification of the associated technical reports and ITAAC items of the proposed new data communication technology and platforms are such that when the ITAAC is performed and the acceptance criteria are met, there is reasonable assurance that the facility has been constructed and will operate in conformance with the COL, the provisions of the Atomic Energy Act of 1954, and NRC regulations.

7A Design Response to Appendix B, ABWR LRB Instrumentation and Controls

7A.1 Introduction

This FSAR appendix addresses corresponding changes to the original design responses to the ABWR licensing review board (LRB) in the certified ABWR DCD Appendix 7A, Revision 4, which were caused by some of the departures in the COLA Part 7, "Departures Reports."

7A.2 Summary of Application

Appendix 7A of the STP, Units 3 and 4, COL FSAR Revision 12 incorporates by reference Appendix 7A of the certified ABWR DCD Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Appendix 7A, the applicant provides the following:

Tier 1 Departures

- STD DEP T1 2.14-1 Hydrogen Recombiner Requirements Elimination

This departure reflects the elimination of the hydrogen recombiner requirement to maintain the equipment needed to mitigate a design-basis LOCA hydrogen release.

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

This departure describes changes to the I&C architecture and nomenclature that are needed to address obsolete data communication technology and the selection of DI&C platforms.

Tier 2 Departure*

- STD DEP 1.8-1 Tier 2* Codes, Standards, and Regulatory Guide Edition Changes

This departure updated some codes, standards, and RGs to more current revisions/editions.

Tier 2 Departures Not Requiring Prior NRC Approval

- STD DEP 7.1-1 References to Setpoints and Allowable Values

This departure clarifies that wherever the TS is referenced in the FSAR for setpoints or margins, the correct reference is to the methods for calculating the setpoints and margins, as described in the TS Bases.

- STD DEP Admin

This departure describes minor corrections, such as editorial or administrative errors in the certified ABWR DCD, Revision 4 (e.g., misspelled words, incorrect references, table headings, etc.).

7A.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 design response to Appendix B, ABWR LRB I&Cs, and the associated acceptance criteria, are in Sections 7.2 through 7.9 of NUREG–0800.

In accordance with Section VIII, "Processes for Changes and Departures," of Appendix A to 10 CFR Part 52, "Design Certification Rule for the U.S. Advanced Boiling Water Reactor," the applicant identifies Tier 1, Tier 2*, and Tier 2 departures. Tier 1 and Tier 2* departures require prior NRC approval and are subject to the requirements of 10 CFR Part 52, Appendix A, Section VIII.A.4, and Section VIII.B.6, respectively. Tier 2 departures that do not require 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 of 10 CFR 50.59.

Reviews of the departures are based on meeting the current regulatory requirements, acceptance criteria, and guidelines in NUREG–0800, Table 7-1, Revision 5 (March 2007). In accordance with 10 CFR 50.55a(h), COLAs filed on or after May 13, 1999, which depart from the certified ABWR DCD, Revision 4, must meet the requirements for safety systems in IEEE Std 603–1991 and in the correction sheet dated January 30, 1995. In addition, applicable guidelines in DI&C ISG documents are also used to evaluate the departures from the certified ABWR design.

7A.4 Technical Evaluation

As documented in NUREG–1503, the staff reviewed and approved Appendix 7A of the certified ABWR DCD. The staff reviewed Appendix 7A 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 appendix.

The staff reviewed the following information in the COL FSAR:

Tier 1 Departures

The following Tier 1 departures identified by the applicant in this section require prior NRC approval, and the full scope of their technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these Tier 1 departures.

- STD DEP T1 2.14-1 Hydrogen Recombiner Requirements Elimination

The departure modifies DCD Table 7A-1, "List of Equipment Interface with Essential MUX Signals," in the FSAR by deleting the FCS, which is not used in the COLA. The staff found the departure acceptable.

[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.

Refer to Section 7.3 of this SER for the detailed evaluation of this departure from the I&C perspective.

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

The staff reviewed this departure and found that it includes the following five primary changes to the I&C architecture of the certified ABWR DCD, Revision 4:

1. Elimination of obsolete data communication technology.
2. Elimination of unnecessary inadvertent actuation prevention logic and equipment.
3. Clarifications of digital controls nomenclature and systems.
4. Final selection of platforms that changed the implementation architecture.
5. Identification of testing and surveillance changes for the SSLC.

The staff found that the relevant impacts from this departure on the certified ABWR DCD Revision 4, Appendix 7A, are related to the obsolete multiplexing systems and associated technical issues. All changes made to Section 7A, Table 7A-1 and Figure 7A-1, "Safety System Logic and Control (SSLC)," are associated with the above change Items 1, 3, and 4. Due to this departure, the applicant revised the responses to NRC requests related to multiplexing systems, electrical isolators, computer hardware, and computer software. These revised responses to the NRC requests are in accordance with the proposed DI&C architecture departure described in the FSAR Sections 7.1S and 7.9S. This change does not depart from the certified ABWR design concepts and functional requirements.

In its response to the staff RAI 07.02-4, dated September 24, 2009 (ML092710226), the applicant replaces FSAR Figure 7A-1, "Safety System Logic and Control (SSLC)," with new FSAR Figure 7.9S-1, "Data Communications Interfaces," which illustrates, at a block diagram level, the entire plant DI&C architecture including the safety-related DI&C platforms and their data communications configurations. The staff reviewed this response and found the proposed FSAR change adequately captures the design information of the proposed I&C platforms and associated data communication functions. This RAI response is therefore acceptable. The staff confirmed that the applicant has included the proposed changes in FSAR Revision 5. Therefore, RAI 07.02-4 is closed.

Refer to Sections 7.1, 7.1S, 7.2, 7.3, and 7.9S of this SER for additional evaluations of this departure.

Tier 2 Departures*

The following Tier 2* departure identified by the applicant in this section requires prior NRC approval, and the full scope of its technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by this Tier 2* departure.

- STD DEP 1.8-1 Tier 2* Codes, Standards, and Regulatory Guide Edition Changes

This departure modifies DCD Section 7A.2 in the FSAR by replacing IEEE Std 279 with IEEE Std 603–1991, which meets the requirements of 10 CFR 50.55a(h). This departure also updated the military standards on EMC to the current version. This update complies with the guidelines in RG 1.180.

Refer to Section 7.2 of this SER for the detailed evaluation of this departure from the I&C perspective.

Tier 2 Departures Not Requiring Prior NRC Approval

The following Tier 2 departures not requiring prior NRC approval identified by the applicant in this section may also be evaluated in other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by these departures.

- STD DEP 7.1-1 References to Setpoints and Allowable Values

This departure modifies DCD Subsection 7A.7 by referring to the bases in STP, Units 3 and 4, COL FSAR Chapter 16 for methods of calculating setpoints and margins.

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.

- STD DEP Admin

The applicant changed Subsection 7A.2, “Multiplexing Systems,” to clarify and specify associated grammatical corrections.

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.

7A.5 Post Combined License Activities

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

7A.6 Conclusion

The 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, 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 10 CFR Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the design response to Appendix B, ABWR LRB I&Cs that were incorporated by reference have been resolved.

The staff reviewed departures in this appendix for conformance to the current regulations and applicable guidelines. The staff concluded that the applicant has adequately identified the regulations and guidelines applicable to these systems. Based on this review, the staff found with reasonable assurance that the departures in this appendix generally conform to the guidelines applicable to these systems.

In addition, the staff compared the additional information in the COLA to the relevant NRC regulations and the guidance in Sections 7.2 through 7.9 of NUREG–0800. The staff's review concluded that the applicant has adequately addressed the identified Tier1 and Tier 2* departures in accordance with Sections 7.2 through 7.9 of NUREG–0800, and found it reasonable that the identified Tier 2 departures are characterized as not requiring prior NRC approval per 10 CFR 52 Appendix A, Section VIII.B.5. The staff concludes that the applicant has provided sufficient information to satisfy the requirements of the NRC regulations.

7B Implementation Requirements for Hardware/Software Development

Appendix 7B of the STP, Units 3 and 4, COL FSAR incorporates by reference Appendix 7B, "Implementation Requirements for Hardware/Software Development," of the ABWR DCD Revision 4, referenced in 10 CFR Part 52, Appendix A, with no departures or supplements. The 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 10 CFR Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the Implementation Requirements for Hardware/Software Development have been resolved.

7C Defense Against Common-Mode Failure in Safety-Related, Software-Based I&C Systems

7C.1 Introduction

This FSAR appendix addresses the defense against common-mode failure and implementation of diversity in the ABWR protection system.

7C.2 Summary of Application

Appendix 7C of the STP, Units 3 and 4, COL FSAR Revision 12 incorporates by reference Appendix 7C of the certified ABWR DCD Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Appendix 7C, the applicant provides the following:

Tier 1 Departure

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

This departure changes I&C architecture and nomenclature in Figure 7C-1 to address obsolete data communication technology and the selection of DI&C platforms.

Tier 2 Departure Not Requiring Prior NRC Approval

- STD DEP Admin Administrative Departures

The administrative departures are defined as minor corrections, such as editorial or administrative errors in the reference ABWR DCD (e.g., misspelled words, incorrect references, table headings, etc.). The applicant removes an incorrect reference to Appendix 7A.

[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.

7C.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 "Defense Against Common-Mode Failure in Safety-Related, Software-Based I&C Systems," and the associated acceptance criteria, are in Section 7.1 of NUREG–0800.

In accordance with Section VIII, "Processes for Changes and Departures," of Appendix A to 10 CFR 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 design departures are satisfied based on meeting the requirements of the current regulatory requirements, acceptance criteria, and guidelines in NUREG–0800, Table 7-1, Revision 5 (March 2007). In accordance with 10 CFR 50.55a(h), applications filed on or after May 13, 1999, that depart from the referenced CDM must meet the requirements for safety systems in IEEE Std 603–1991 and in the correction sheet dated January 30, 1995. In addition, applicable guidelines in DI&C ISG Documents DI&C-ISG-02, DI&C-ISG-03, DI&C-ISG-04, and DI&C-ISG-05 are also used to evaluate the departures from the certified ABWR design.

Regarding SRP acceptance criteria for plants with a digital reactor trip system (RTS) or ESF actuation system, the NRC position on D3 is in Item II.Q, "Defense Against Common-Mode Failures in Digital Instrument and Control Systems," of the Staff Requirements Memorandum (SRM) on SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs." SRM requirements applicable to diverse I&C functions are as follows:

> If a postulated common-mode failure could disable a safety function, then a diverse means, with a documented basis that the diverse means is unlikely to be subject to the same common-mode failure [as the safety system], shall be required to perform either the same function [as the safety system function that is vulnerable to common mode failure] or a different function [that provides adequate protection]. The diverse or different function may be performed by a non-safety system if the system is of sufficient quality to perform the necessary functions under the associated event conditions.
>
> A set of displays and controls located in the main control room shall be provided for manual system-level actuation of critical safety functions and monitoring of parameters that support the safety functions. The displays and controls shall be independent and diverse from the safety computer system[s] ….

7C.4 Technical Evaluation

As documented in NUREG–1503, the staff reviewed and approved Appendix 7C of the certified ABWR DCD. The staff reviewed Appendix 7C 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 appendix.

The staff reviewed the following information in the COL FSAR:

Tier 1 Departure

The following Tier 1 departure identified by the applicant in this section requires prior NRC approval, and the full scope of its technical impact may be evaluated in the other sections of this SER. For more information, refer to COLA Part 7, Section 5.0 for a listing of all FSAR sections affected by this Tier 1 departure.

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

Tier 1 Departure STD DEP T1 3.4-1 is divided into the following five primary changes in the I&C architecture:

1. Elimination of obsolete data communication technology.
2. Elimination of unnecessary inadvertent actuation prevention logic and equipment.
3. Clarifications of digital controls nomenclature and systems.
4. Final selection of platforms that changed the implementation architecture.
5. Identification of testing and surveillance changes.

In COLA Part 7, "Departures Report," Section 2.1, the applicant describes and evaluates this departure per the requirements of Section VIII.A.4 of Appendix A to 10 CFR Part 52. Items 1, 3, and 4 of this departure are relevant to the changes in FSAR Sections 7C.1, "Introduction;" 7C.3, "Defense Against Common-Mode Failure;" 7C.4, "Common Mode Failure Analysis;" and 7C.5, "Details of Final Implementation of Diversity in ABWR Protection System;" and Figure 7C-1, "Implementation of Additional Diversity in SSLC to Mitigate Effects of Common-Mode Failures." All of the changes in this section are limited to the proposed SSLC platform configurations, related data communication architectures, and nomenclature. These changes do not depart from the certified ABWR design concepts and processes employed to achieve defense against common-mode failure in safety-related, software-based I&C systems and diversity implemented in the ABWR protection system. Existing DCD Tier 1, Table 3.4, ITAAC Item 16 continues to apply to the STP, Units 3 and 4, design, which verifies that diversity is provided, as described in Tier 1, Section 3.4C, "Diversity and Defense-in-Depth Considerations," in the form of a hardwired backup of a reactor trip, diverse display of important process parameters, D3 arrangement of equipment, and equipment diversity. The staff compared the proposed design descriptions in FSAR Tier 2, Section 7C to the relevant NRC regulations; the guidance in Section 7.8 of NUREG–0800 and BTP 7-19, Revision 5, "Guidance for Evaluation of Diversity and Defense-in-Depth in Digital Computer-Based Instrumentation and Control Systems; D&IC-ISG-02; and SECY-93-087 and concluded that the applicant is in compliance with the NRC regulations.

[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 2 Departure Not Requiring Prior NRC Approval

- STD DEP Admin Administrative Departures

The applicant made one administrative correction in FSAR Section 7C.1, which removes an incorrect reference to Appendix 7A. 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, the staff found it reasonable that this departure does not require prior NRC approval.

7C.5 Post Combined License Activities

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

7C.6 Conclusion

The 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, and no outstanding information is expected to be addressed in the COL FSAR related to this appendix. Pursuant to 10 CFR 52.63(a)(5) and 10 CFR Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the "Defense Against Common-Mode Failure in Safety-Related, Software-Based I&C Systems," that were incorporated by reference have been resolved.

In addition, the staff compared the additional information in the COLA to the relevant NRC regulations and the guidance in Section 7.1 and BTP 7-19 of NUREG–0800; D&IC-ISG-02; and SRM to SECY-93-087. The staff's review concluded that the applicant has adequately addressed the identified Tier 1 departure in accordance with the NRC regulations.