12.0 RADIATION PROTECTION

This chapter provides information on radiation protection methods and estimated occupational radiation exposures to operation and construction personnel during normal operations and anticipated operational occurrences (AOOs). In particular, AOOs may include refueling; purging; fuel handling and storage; radioactive material handling, processing, use, storage, and disposal; maintenance; routine operational surveillance; in-service inspection; and calibration. Specifically, this Final Safety Analysis Report (FSAR) chapter provides information on facility and equipment design, planning and procedures programs, and techniques and practices employed by the applicant to meet the radiation protection standards in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20 and to be consistent with the practices in the appropriate regulatory guides (RGs) that are used to implement U.S. Nuclear Regulatory Commission (NRC) regulations. Finally, this chapter provides updated information that supplements the Advanced Boiling-Water Reactor (ABWR) design control document (DCD) with a site-specific assessment of doses to members of the public from anticipated routine liquid and airborne effluent releases.

12.1 Ensuring That Occupational Radiation Exposures Are As Low As Is Reasonably Achievable

12.1.1 Introduction

This section of the FSAR addresses administrative programs and procedures. In conjunction with facility design, they ensure that the occupational radiation exposure to personnel will be kept as low as is reasonably achievable (ALARA).

12.1.2 Summary of Application

Section 12.1 of the South Texas Project (STP) Units 3 and 4 combined license (COL) FSAR incorporates by reference Section 12.1 of the certified ABWR DCD (Revision 4) referenced in 10 CFR Part 52, Appendix A, with no departures. In addition, in FSAR Section 12.1, the applicant provides the following:

COL License Information Items

- COL License Information Item 12.1 Regulatory Guide 8.10

The applicant references Nuclear Energy Institute (NEI) Template 07-03, “Generic FSAR Template Guidance for Radiation Protection Program Description, to address conformance with RG 8.10. In COL FSAR Section 12.1.4 the applicant references Section 12.5S of the COL FSAR which contains the commitment to NEI 07-03

- COL License Information Item 12.2 Regulatory Guide 1.8

The applicant references NEI 07-03 to address conformance with RG 1.8. In COL FSAR Section 12.1.4 the applicant references Section 12.5S of the COL FSAR which contains the commitment to NEI 07-03.

COL License Information Item 12.3 Operational Radiation Exposures

The applicant references NEI 07-03 to address criteria and conditions for implementing various operating procedures and techniques to ensure that occupational exposures are ALARA, by using the guidance of NUREG–1736. In COL FSAR Section 12.1.4 the applicant references Section 12.5S of the COL FSAR which contains the commitment to NEI 07-03.

- COL License Information Item 12.4 Regulatory Guide 8.8

The applicant references NEI 07-03 to address conformance with RG 8.8. In COL FSAR Section 12.1.4 the applicant references Section 12.5S of the COL FSAR which contains the commitment to NEI 07-03.

12.1.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is documented in NUREG–1503, “Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor.” In addition, the relevant requirements of the Commission regulations for ensuring that occupational radiation exposures are ALARA and the associated acceptance criteria are in Section 12.1 of NUREG–0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants,” of the Standard Review Plan (SRP).

The regulatory basis for accepting that occupational radiation exposure to personnel will be kept ALARA is based on meeting the requirements of 10 CFR 20.1101. Specifically, that there is a policy formulated in accordance with the ALARA provisions of 10 CFR 20.1101(b) to ensure that occupational radiation exposure will be ALARA.

In addition, the information that follows describes the regulatory bases for accepting the resolution of the STD COL information items.

COL License Information Item 12.1 is based on meeting the requirements of 10 CFR Part 20, “Standards for Protection against Radiation,” and the guidance of RG 8.10 (Revision 1), "Operating Philosophy for Maintaining Occupational Radiation Exposures ALARA."

COL License Information Item 12.2 is based on meeting the requirements of 10 CFR Part 20 and the guidance of RG 1.8 (Revision 32), "Qualification and Training of Personnel for Nuclear Power Plants."

COL License Information item 12.3 is based on meeting the requirements of 10 CFR Part 20 and the guidance of RG 1.7 (Revision 3), “Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants, LWR."

COL License Information Item 12.4 is based on meeting the requirements of 10 CFR Part 20 and the guidance of RG 8.8 (Revision 3), “Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be ALARA.”

Moreover, COL license information items in Section 12.1 are based on following the guidance of RGs 1.8, 8.2, 8.7, 8.9, 8.13, 8.15, 8.27, 8.28, 8.29, 8.34, 8.35, 8.36, and 8.38 and the guidance in NEI 07-03 (Revision 7), “Generic FSAR Template Guidance for Radiation Protection Program Description.”

12.1.4 Technical Evaluation

As documented in NUREG–1503, the NRC staff reviewed the approved Section 12.1 of the certified ABWR DCD. The staff reviewed Section 12.1 of the STP Units 3 and 4 COL FSAR. The staff also checked the referenced ABWR DCD to ensure that the combination of information in the COL FSAR and information in the ABWR DCD 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 ensuring that occupational radiation exposures are ALARA.

The staff reviewed the information in the STP COL FSAR:

COL License Information Item

- COL License Information Item 12.1 Regulatory Guide 8.10

The applicant provides additional information in FSAR Subsection 12.1.4.1 to address the resolution of DCD COL License Information Item 12.1, which states:

> Compliance with RG 8.10 shall be demonstrated by the COL applicant.

The FSAR states that this COL License Information Item is addressed in NEI 07-03 which is referenced in Appendix 12.5S of the FSAR. The NRC staff completed the review and safety evaluation of NEI 07-03 in "Safety Evaluation Regarding the Nuclear Energy Institute Technical Report 07-03 "Generic FSAR Template Guidance for Radiation Protection Program Description" Revision 7," as documented below and in ADAMS document number ML090410709.

The staff reviewed the final version of NEI 07-03 with respect to compliance with RG 8.10. NEI 07-03 states that plant management will establish a written policy on radiation protection that is consistent with the guidance in RG 8.10 and that the responsibilities of the Radiation Protection Manager will be consistent with the guidance in RG 8.10 and will include establishing, implementing, and enforcing the Radiation Protection Program. In addition, management is committed to assuring that each individual working at the facility understands and accepts responsibility for following radiation protection procedures and instructions provided by radiation protection staff and for maintaining his or her dose ALARA. The staff found that for COL applications, NEI 07-03, Revision 7, provides an acceptable template for assuring that the RP program meets applicable NRC regulations and conforms with applicable guidance as documented in ADAMS document number ML090510379. The final accepted version was published by NEI in May 2009 as NEI 07-03A (Revision 0), which is documented in ADAMS document number ML091490684.

The staff issued **Request for Additional Information (RAI) 3013–Question 12.05-4** requesting the applicant to update the FSAR to reference the final accepted version of NEI 07-03. The applicant's response to Question 12.05-4 (letter U7-C-STP-NRC-090113 dated August 20, 2009) commits to add the accepted version of NEI 07-03 to a future COL application revision. The staff found the proposed COL FSAR revision acceptable. Because the template addresses the applicant's commitment to RG 8.10, the staff cannot consider COL License Information Item

[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.

12.1 resolved until the COL FSAR is revised to reflect the accepted version of NEI 07-03. This RAI is **Confirmatory Item 12.01-1**.

- COL License Information Item 12.2 Regulatory Guide 1.8

The applicant provides additional information in FSAR Subsection 12.1.4.2 to address the resolution of DCD COL License Information Item 12.2, which states:

> Compliance with RG 1.8 shall be demonstrated by the COL applicant.

The FSAR states that this COL License Information Item is addressed in NEI Template 07-03, which is referenced in Appendix 12.5S of the FSAR.

As discussed above, the staff found that for COL applications, NEI 07-03, Revision 7, provides an acceptable template for assuring that the RP program meets applicable NRC regulations and conforms with applicable guidance including RG 1.8. This RG states that the American National Standards Institute (ANSI)/American Nuclear Society (ANS)-3.1-1993, with certain additions, exceptions, and clarifications delineated in the RG, provides acceptable criteria for the selection; qualification; and training of personnel for nuclear power plants. NEI Template 07-03 states that the Radiation Protection Manager, Radiation Protection Technicians, and Radiation Protection Supervisory and Technical Staff will be trained and qualified in accordance with the guidance in RG 1.8. As discussed in RAI 3013–Question 12.05-4 above, the staff requested the applicant to update the FSAR to reference the final accepted version of NEI 07-03. The applicant's response to Question 12.05-4 commits to add the accepted version of NEI 07-03 to a future COL FSAR application revision. Because the template addresses the applicant's commitment to RG 1.8, the staff cannot consider COL License Information Item 12.2 resolved until the COL FSAR is revised to reflect the accepted version of NEI 07-03. (See **Confirmatory Item 12.01-1**.)

- COL License Information Item 12.3 Operational Radiation Exposures

The applicant provides additional information in FSAR Subsection 12.1.4.3 to address the resolution of DCD COL License Information Item 12.3, which states:

> COL applicants will provide, to the level of detail provided in RG 1.70, the criteria and/or conditions under which various operating procedures and techniques shall be provided to ensure that occupational radiation exposures ALARA are implemented.

NRC staff reviewed the applicant's response to COL License Information Item 12.3 related to criteria and conditions under which various operating procedures and techniques will be implemented to ensure that occupational radiation exposures are ALARA using the guidance in NUREG–1736, to the level of detail described in RG 1.206. The staff also reviewed the applicant's response to ensure that the applicant has committed to follow the guidance in the following RGs: 8.2, 8.7, 8.9, 8.13, 8.15, 8.27, 8.28, 8.29, 8.34, 8.35, 8.36, and 8.38. Many of the criteria and conditions in COL License Information Item 12.3 are addressed in FSAR Subsection 12.1.4.3 and in NEI 07-03 which is referenced in Section 12.5S of the FSAR.

NEI 07-03 addresses various operating procedures and techniques used in dose-related activities found in typical nuclear plants. These activities include refueling, in-service inspections, radwaste handling, spent fuel handling, normal operations, routine maintenance,

sampling, and calibration. The template allows COL applicants to modify procedures based on design and site-specific information. The staff reviewed the categories listed in the template for coverage of the ABWR activities. Based on the review, the staff determined that NEI 07-03 does not fully describe all elements of an ALARA program. NEI Template 07-08, "Generic FSAR Template Guidance for Ensuring That Occupational Radiation Exposures are as Low as is Reasonably Achievable (ALARA)," supplements the ALARA program description in NEI 07-03 with information that describes the roles and responsibilities of management and staff, training requirements, and key elements of an effective ALARA program. The staff found that for COL applications, NEI 07-08, Revision 3, provides an acceptable template for assuring that the ALARA program meets applicable NRC regulations and guidance provided it is used in conjunction with NEI 07-03A, Revision 0, "Generic FSAR Template Guidance for Radiation Protection Program Description" as documented in ADAMS document number ML091130034. The final accepted version was published by NEI in October 2009 as NEI 07-08A (Revision 0), which is documented in ADAMS document number ML093220178.

The applicant's description of the ALARA program does not reference NEI 07-08. The staff issued **RAI 3014–Question 12.01-1** requesting the applicant to provide additional information concerning the review and possible incorporation of NEI 07-08 into the FSAR. The applicant's response to Question 12.01-1 (letter U7-C-STP-NRC-090103 dated August 12, 2009) commits to incorporate by reference the accepted version of NEI 07-08 in a future COL FSAR application revision. The staff found the proposed COL FSAR revision acceptable because the NEI 07-08 template presents the functional elements of an ALARA program that, if met, would demonstrate compliance with 10 CFR 20.1101. Because the template addresses the applicant's commitment to provide operating procedures and techniques ensuring that occupational radiation exposures are ALARA, the staff cannot consider COL License Information Item 12.3 resolved until the COL FSAR is revised to reflect the accepted version of NEI 07-08. This RAI is **Confirmatory Item 12.01-2**.

Because the NEI 07-03 template addresses the applicant's commitment to provide operating procedures and techniques to ensure that occupational radiation exposures are ALARA, the staff cannot consider COL License Information Item 12.3 resolved until the COL FSAR is revised to reflect the accepted version of NEI 07-03. (See **Confirmatory Item 12.01-1**.)

- COL License Information Item 12.4 Regulatory Guide 8.8

The applicant provides additional information in Subsection 12.1.4.4 to address the resolution of COL License Information Item 12.4, which states:

> Compliance with RG 8.8 shall be demonstrated by the COL applicant.

The FSAR states that COL License Information Item 12.4 is addressed by the site-specific information in Subsection 12.1.4.4. FSAR Subsection 12.1.4.4 references the conformance of the design with RG 8.8 as documented in Sections 12.1 and 12.3 of the ABWR DCD, and identifies FSAR Sections 12.1, 12.3, 12.4, and 12.5 as addressing the operational portions of the objectives of RG 8.8. FSAR Subsection 12.5.3.1 states that the Operational Radiation Protection Program is described in FSAR Section 12.5S. NEI 07-03, with site-specific supplements, is incorporated by reference as the basis for the Operational Radiation Protection Program in Section 12.5S of the FSAR. As discussed above, the staff found that for COL applications, NEI 07-03, Revision 7, provides an acceptable template for assuring that the RP program meets applicable NRC regulations and conforms with applicable guidance including RG 8.8. NEI 07-03 and the supplemental information in FSAR Section 12.5S address the

operational portions of RG 8.8 that are not addressed in the ABWR DCD, including a description of the plant organization, personnel, and personnel responsibilities; facilities (to the extent that they are not described in the DCD); instrumentation; and equipment. The template also includes a description of radiation protection procedures sufficient to provide adequate control over the receipt, possession, use, transfer, and disposal of byproduct, source, and special nuclear materials. These procedures also assure compliance with the applicable requirements in 10 CFR Parts 19, 20, 50, 70, and 71. The procedures described in this template include procedures for radiation protection training, access control of radiation areas, methods to maintain exposures ALARA, personnel monitoring, respiratory protection, and contamination control. As discussed in RAI 3013–Question 12.05-4 above, the staff requested the applicant to update the FSAR to reference the final accepted version of NEI 07-03. The applicant's response commits to add the accepted version of NEI 07-03 to a future COL FSAR application revision. Because the template addresses the applicant's commitment to RG 8.8, the staff cannot consider COL License Information Item 12.4 resolved until the COL FSAR is revised to reflect the accepted version of NEI 07-03. (See **Confirmatory Item 12.01-1**.)

Additionally, the applicant's FSAR is based on evidence that the ABWR design, methods, approach, and interactions are in accordance with the ALARA provisions of 10 CFR 20.1101(b) and RG 8.8 (Regulatory Position C.2) and will incorporate measures for reducing the need for time spent in radiation areas; measures to improve accessibility to components requiring periodic maintenance or in-service inspection; measures to reduce the production, distribution, and retention of activated corrosion products throughout the primary system; measures for assuring that occupational radiation exposure during decommissioning will be ALARA; reviews of the design by competent radiation protection personnel; instructions to designers and engineers regarding the ALARA design; experience gained from operating plants and past designs; and the continuation of facility design reviews. The objective of the plant radiation protection design is to maintain individual doses and total person-Sievert (person-rem) doses to plant workers (including construction workers) and to members of the general public ALARA, and to maintain individual doses within the limits of 10 CFR Part 20. The staff's review considered all plant sources of direct radiation and airborne radioactive contamination within restricted areas.

By incorporating by reference NEI 07-03 and NEI 07-08, the applicant provides a management commitment to ensure that STP Units 3 and 4 will be designed, constructed, and operated in a manner consistent with the above criteria and that facility management will review radiation exposure trends periodically to determine major changes in problem areas and to note the worker groups that are accumulating the highest exposures. The facility staff will use this information to recommend design modifications or changes in plant procedures. This practice, as described in STP COL FSAR Section 12.1, and the associated NEI generic templates, conforms to those practices described in RGs 8.8 and 8.10. This management commitment is discussed further in SER section 12.5.

12.1.5 Post Combined License Activities

There are no post COL activities related to this section.

12.1.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to "Ensuring

That Occupational Radiation Exposures Are As Low As Is Reasonably Achievable." With the exceptions of Confirmatory Items **12.01-1 and 12.01-2**, there is no outstanding information expected to be addressed in the COL FSAR related to this section. As a result of these open and/or confirmatory items, the staff is unable to finalize its conclusions relating to **"**Ensuring That Occupational Radiation Exposures Are As Low As Is Reasonably Achievable**"** in accordance with the NRC requirements.

The staff's finding relating to information incorporated by reference is in NUREG–1503. The staff's review confirmed that there is no outstanding information related to this section. Pursuant to 10 CFR 52.63(a)(5) and Part 52, Appendix A, Section VI.B.1, all nuclear safety issues related to ensuring that occupational radiation exposures are ALARA that were incorporated by reference have been resolved.

In addition, the staff concluded that the relevant information in the COL FSAR is acceptable and meets the requirements defined in the ABWR DCD, which is incorporated by reference into 10 CFR Part 52, Appendix A. The staff's conclusion is based on the following:

- The applicant has adequately addressed COL License Information Items 12.1, 12.2, 12.3, and 12.4 regarding design and operational considerations for the plant's radiation protection program. The applicant's proposed resolution to these COL license information items is to reference the information in NEI Template 07-03 and NEI Template 07-08, which incorporate the guidance in RGs 1.8, 8.8, and 8.10 and contain a commitment to provide operating procedures and techniques to ensure that occupational radiation exposures are ALARA. On this basis, the staff found that the information in these templates is acceptable and resolves these COL license information items.
- The staff concluded that the ALARA policy, design, and implementation considerations are acceptable because the applicant meets the training requirements of 10 CFR 19.12; the ALARA provisions of 10 CFR 20.1101(b); and the guidance in RGs 8.8 (Regulatory Position C.2) and 8.10 (Regulatory Position C.1).

12.2 Radiation Sources (Related to RG 1.206, Section C.I.12.2, "Radiation Sources")

12.2.1 Introduction

This section of the FSAR addresses the issues related to contained radiation sources and airborne radioactive material sources during normal operations, AOOs, and accident conditions affecting the in-plant radiation protection program.

This section of the Safety Evaluation Report (SER) also addresses doses to members of the public from radioactive effluent releases. All liquid effluent releases are conducted and monitored through the liquid waste management system (LWMS) for processed liquids generated during the operation of the LWMS, the gaseous waste management system (GWMS), and the solid waste management system (SWMS). Airborne releases from the operation of the LWMS, GWMS, SWMS, and the ventilation exhaust systems servicing radiologically controlled areas where process equipment is located, monitored, and discharged through their respective stacks. Specifically, the reactor/fuel building stack, the turbine building stack, and the radwaste building (RW/B) stack.

12.2.2 Summary of Application

Section 12.2 of the STP Units 3 and 4 COL FSAR incorporates by reference Section 12.2 of the certified ABWR DCD (Revision 4) referenced in 10 CFR Part 52, Appendix A. One Tier 1 departure and four Tier 2 departures, including Admin departures, affecting Section 12.2 were identified by the applicant.

In addition, in FSAR Section 12.2, the applicant provides the following information:

Tier 1 Departure

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

The referenced ABWR DCD Section 2.15.13 states that the exterior walls of the RW/B below grade and the basemat are classified as Seismic Category I. This departure revises the seismic category of the RW/B substructure from Seismic Category I to nonseismic.

Tier 2 Departures Not Requiring Prior NRC Approval

- STD DEP 5.4-1 Reactor Water Cleanup System

The flow capacity of the two pumps and two filter demineralizers in the Reactor Water Cleanup system (CUW) is doubled from 1 percent of rated feedwater flow to 2 percent. The proposed change improves cleanup water system reliability by providing a backup pump and filter demineralizer capability to handle 100 percent of the CUW flow and filtering requirements. This departure revises Table 12.2-9 to include the source term for both CUW demineralizers.

- STD DEP 11.2-1 Liquid Radwaste Process Equipment

This section of the referenced ABWR DCD, including all subsections, figures, and tables (except for Piping and Instrumentation Diagram IDs), is completely replaced due to a departure in the design of the liquid radioactive waste system. The departure includes the use of mobile technology and deletes the forced-circulation concentrator system and other permanently installed liquid radwaste processing equipment.

- STD DEP 11.4-1 Radioactive Solid Waste Update

The applicant completely replaces Tier 2 Section 11.4 of the certified ABWR DCD, including all subsections, figures, and tables. This standard departure in the design of the SWMS deletes the solidification, incineration, and compacting processes included in the ABWR DCD. Thus, no part of ABWR DCD Section 11.4 is incorporated by reference.

Administrative Departure

- STD DEP Admin

The applicant defines administrative departures as minor corrections, such as editorial or administrative errors in the referenced ABWR DCD (i.e., misspellings, incorrect references, table headings, etc.). The applicant identifies an Administrative Departure in this section with respect to an incorrect table reference.

COL License Information Item

- COL License Information Item 12.5 Compliance with 10 CFR Part 20 and 10 CFR Part 50, Appendix I

In Section 12.2.3, the applicant provides site-specific information on gaseous and liquid releases to address compliance with 10 CFR Part 20 and 10 CFR Part 50, Appendix I.

Supplemental Information

Contained Sources

RG 1.206 Part C.I.12.2.1, "Contained Sources," states that "the applicant should describe the sources of radiation, during normal plant operations and accident conditions, that are the bases for the radiation protection design" and that the "sources should be described in the manner needed for input to the shield design calculation."

The COL applicant states that the information in section 12.2.1 of the ABWR DCD is incorporated by reference, including all subsections and tables, with supplements to address the departures discussed above.

12.2.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is documented in NUREG–1503. In addition, the relevant requirements of the Commission regulations for "Radiation Sources" and the associated acceptance criteria are in Section 12.2 of NUREG–0800.

COL License Information Item 12.5 relates to compliance with 10 CFR Part 20 and 10 CFR Part 50, Appendix I and is based on meeting the requirements of these documents and the guidelines in RG 1.70 (Revision 3). In addition, the regulatory basis for accepting the resolution to COL License Information Item 12.5 is in 10 CFR 20.1201, as it relates to limiting occupational radiation doses.

The regulatory basis for accepting the supplementary information in assessing doses to members of the public associated with liquid and gaseous effluent releases in unrestricted areas is established in 10 CFR 20.1301(e), 10 CFR 20.1302, 10 CFR 50.34a and 50.36a, Appendix A to 10 CFR Part 50, General Design Criteria (GDC) 60 and 64, Appendix I to 10 CFR Part 50, Sections II.A, II.B1, II.C, and II.D, 10 CFR 52.80(a) for performance of the LWMS, GWMS and SWMS, and Generic Letter 89-01. SRP acceptance criteria include RGs 1.109, 1.110, 1.111, 1.112, 1.113, and 1.206. Full descriptions of the applicable regulatory and acceptance criteria are in SRP Sections 11.2 to 11.5 (NUREG–0800).

The regulatory basis for accepting that radiation protection equipment and design features will ensure radiation exposure to occupational workers and members of the public will be kept ALARA, and in compliance with the limits identified in 10 CFR 20.1201 and 10 CFR 20.1301, is based on meeting the requirements of 10 CFR 20.1101. Specifically, that there is a policy formulated in accordance with the ALARA provisions of 10 CFR 20.1101(b) to ensure that occupational radiation exposure will be ALARA.

The regulatory basis for accepting that the facility design and procedures for operation will, in accordance with 10 CFR 20.1406, minimize contamination of the facility and the environment and the generation of radioactive waste, to the extent practicable, and facilitate the eventual decommissioning of the facility.

In addition, in accordance with Section VIII, Process for Changes and Departures, of Appendix A to Part 52—Design Certification Rule for the ABWR Design, the applicant identified Tier 2 departure(s) that do not require prior Commission approval. These departures are subject to the requirements of Section VIII, which are similar to the requirements in 10 CFR 50.59.

12.2.4 Technical Evaluation

As documented in NUREG–1503, NRC staff reviewed the approved Section 12.2 of the certified ABWR DCD. The staff reviewed Section 12.2 of the STP Units 3 and 4 COL FSAR. The staff also checked the referenced ABWR DCD to ensure that the combination of information in the COL FSAR and information in the ABWR DCD 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 radiation sources.

This particular section pertains to many aspects of the LWMS and GWMS, the effluent releases, and the regulatory limits associated with each system. Sections 11.2 and 11.3 describe the LWMS and GWMS and the design of each system. Section 12.2 includes the radioactive source terms that will be released from the LWMS and the GWMS and the parameters used to calculate offsite doses from these systems.

The staff reviewed the information in the STP 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 accordingly. For more information, please refer to COLA Part 07, Section 5.0 for a listing of all FSAR sections affected by this Tier 1 departure. In addition, compliance with 10 CFR Part 52, Appendix A, Section VIII.A.4 for this Tier 1 departure will be addressed by the staff in a future exemption evaluation. This will be tracked as global **Open Item 01-1** throughout the staff's SER.

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

This departure is identified in Section 12.2 of the STP Units 3 and 4 COL FSAR because it changes the seismic category of the RW/B substructure from Seismic Category I to nonseismic.

This departure does not result in any change in radiation protection equipment and design features identified in the ABWR DCD used to ensure that occupational radiation exposures associated with operation of the RW/B are ALARA. NRC staff found that this departure does not require any further evaluation as it pertains to the review scope of this section. Additional

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

staff review and evaluation of the acceptability of this departure can be found in Section 14.3 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 accordingly. For more information, please refer to COLA Part 07, Section 5.0 for a listing of all FSAR sections affected by these departures.

- STD DEP 5.4-1 Rector Water Cleanup System

The flow capacity of the two Reactor Water Cleanup System pumps and the two Reactor Water System demineralizers are doubled from 1% of rated feedwater flow to 2% of rated feedwater flow. This provides backup pump and filter demineralizer capability to handle 100% Reactor Water Cleanup flow and filtering requirements. This departure references Table 12.2-9 indicating the radioactive source term for the Reactor Water Cleanup system demineralizers. There is no impact/review required in this section. This departure is further evaluated in SER Section 5.4.

- STD DEP 11.2-1 Liquid Radwaste Process Equipment

The applicant completely replaces this section of the referenced ABWR DCD, including all subsections, figures, and tables (except for Piping and Instrumentation Diagram IDs), due to a departure in the design of the liquid radioactive waste system. The departure includes the use of mobile technology and deletes the forced-circulation concentrator system and other permanently installed liquid radwaste processing equipment. Additional staff review and evaluation of this departure can be found in 11.2 of this SER.

- STD DEP 11.4-1 Radioactive Solid Waste Update

The applicant completely replaces Tier 2 Section 11.4 of the certified ABWR DCD, including all subsections, figures, and tables. This standard departure in the design of the SWMS deletes the solidification, incineration, and compacting processes identified in the ABWR DCD, with Tier 2 departure STD DEP 11.4-1. Thus, no part of ABWR DCD Section 11.4 is incorporated by reference. Additional staff review and evaluation of this departure can be found in 11.4 of this SER.

Administrative Departure

- STD DEP Admin

The applicant defines administrative departures as minor corrections, such as editorial or administrative errors in the referenced ABWR DCD (i.e., misspellings, incorrect references, table headings, etc.). The applicant identifies an Administrative Departure in this section with respect to an incorrect table reference. NRC staff found that this administrative departure does not affect the presentation of any design discussion or qualification of design margin and is acceptable.

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

COL License Information Item

- COL License Information Item 12.5 Compliance with 10 CFR Part 20 and 10 CFR Part 50, Appendix I

The applicant provides additional information in Subsections 12.2.2.1, 12.2.2.2, and 12.2.2.5 to address the resolution of DCD COL License Information Item 12.5, which states:

> The COL applicant will re-evaluate the average annual airborne releases and the average annual liquid releases to the environment for the final plant design and site parameters for conformance to 10 CFR Part 20 and 10 CFR Part 50, Appendix I.

The applicant revises information to supplement the DCD with site-specific parameters for addressing DCD COL License Information Item 12.5, airborne effluent and liquid releases and doses to members of public. As discussed above in the evaluation of the Tier 2 departures affecting this FSAR section, the applicant makes major changes in the LWMS and SWMS as a result of Departures STD DEP 11.2-1 and STD DEP 11.4-1. Although the applicant does not identify Departure STD DEP 11.3-1 as affecting Section 12.2, STD DEP 11.3-1 modifies the GWMS design approved in the ABWR DCD, and that in turn affects the airborne effluent releases identified in DCD COL License Information Item 12.5.

Evaluations of the radioactive waste management system changes were completed under the applicable Chapter 11 SER review. Multiple open items remain in the Chapter 11 liquid effluent and gaseous effluent reviews pending the applicant's submittal of additional information, and the NRC staff's evaluation of the requested information, as described below. Due to these open items the staff is currently unable to determine the applicant's compliance with the guidance prescribed in 10 CFR Part 20 and in 10 CFR Part 50, Appendix I.

Compliance with 10 CFR Part 20 and 10 CFR Part 50, Appendix I – Liquid Effluents

The NRC staff's review identified liquid effluent RAIs requesting the applicant to address 10 CFR Part 20 and 10 CFR Part 50, Appendix I compliance. **RAI 3513–Question 12.02-9** is a supplement to **RAI 2349–Question 12.02-2** requesting the applicant to demonstrate compliance with liquid annual effluent release concentrations that meet the 10 CFR Part 20, Appendix B "unity" concentration limit identified in Note 4 of 10 CFR Part 20, Appendix B. The applicant's response revises the tables and includes the unity calculation in the new tables. The staff found the RAI responses acceptable and these RAIs are therefore closed. Additional liquid effluent RAIs requested the applicant to clarify or correct LWMS tables of radionuclides or concentrations. **RAI 3587–Question 12.02-10** requested corrections in the annual liquid effluent calculated releases. **RAI 3725–Question 12.02-11** asked for revisions of the source terms calculated in the backwash receiving tank in the LWMS. The applicant's response to Question 12.02-11 revises and corrects radionuclides and concentrations in LWMS tables. The staff found the revised LWMS tables acceptable, and the RAIs are resolved. The staff's review identified that the tables, the input parameters, and the resulting doses for evaluating and verifying annual liquid effluent doses to the environment from STP Units 3 and 4 were incomplete in the COL application. The staff issued **RAI 3586–Question 12.02-8**, which is a supplement to **RAI 2337–Question 11.02-2** requesting the applicant to provide the liquid effluent data, the input parameters, and the resulting liquid effluent dose information. Question 11.02-2 is resolved. The applicant's responses to Question 12.02-8 (letter U7-C-STP-NRC-090196 dated November 9, 2009) commits to include the requested liquid effluent data, input parameters, and the resulting liquid effluent dose information in a future COL FSAR application

revision. The staff found the information provided and the proposed COL FSAR revision acceptable and Question 12.02-8 is resolved. Because the applicant has not updated the COL FSAR to include the revised information, Question 12.02-8 is being tracked as **Confirmatory Item 12.02-1.**

Compliance with 10 CFR Part 20 and 10 CFR Part 50, Appendix I – Gaseous Effluents

The NRC staff's review identified gaseous effluent RAIs requesting the applicant to address 10 CFR Part 20 and 10 CFR Part 50, Appendix I compliance. **RAI 1557–Question 12.02-1** requested the applicant to provide the proper reference to gaseous effluent dispersion factors. The applicant's response updates dispersion parameters and updates a table addressing this issue. Because the applicant has not updated the COL FSAR to include the revised information, **Question 12.02-1**, is being tracked as **Confirmatory Item 12.02-2**.

The staff issued **RAI 2553–Question12.02-3** requesting the applicant to provide information demonstrating compliance with gaseous annual effluent release concentrations that meet the 10 CFR Part 20, Appendix B "unity" concentration limit. The applicant's response revises the tables to include the unity calculation in the new tables. The staff found the response acceptable, and this RAI is resolved. The staff's review identified that the tables, the input parameters, and the resulting doses for evaluating and verifying annual gaseous effluent doses to the environment from STP Units 3 and 4 were incomplete in the COL application. The staff issued **RAI 3018–Question 12.02-7** requesting the applicant to provide the gaseous effluent data, the input parameters, and the resulting gaseous effluent dose information. **Question 12.02-7** is being tracked as **Open Item 12.02-1**.

Compliance with 10 CFR 20.1301(e) (40 CFR Part 190)

NRC staff requested additional information for 40 CFR 190 total dose requirements from all dose sources of the nuclear fuel cycle facility. The staff issued **RAI 3795–Question 12.02-12** as a supplement to **RAI 2955–Question 11.02-4** requesting the applicant to provide the required 40 CFR 190 total dose data compliance information. Question 11.02-4 is closed/unresolved and **Question 12.02-12** is being tracked as **Open Item 12.02-2**.

Compliance with 10 CFR Part 50, Appendix A (GDC 60)

NRC staff reviewed STP COL FSAR Section 11.3, and specifically the GWMS, for compliance with Technical Rationale Section 5 of SRP Section 11.3, "Gaseous Waste Management System," which states:

> Compliance with GDC 60 requires that design provisions be included in the nuclear power unit to control releases of radioactive materials in gaseous effluents to the environment during normal plant operation, including anticipated operational occurrences.

Part of the design to control the releases of radioactive materials in gaseous effluents is the influence of the meteorological dispersion parameters in the region of the nuclear power plant. The applicant's response to RAI 1557–Question 12.02-1 addresses changes to the X/Q and D/Q dispersion factors used to calculate releases of gaseous effluents into the environment. After reviewing the applicant's response to RAI 1557–Question 12.02-1, the staff issued **RAI 3280–Question 11.03-6** requesting the applicant to re-evaluate the GWMS design and the releases of gaseous effluents to the environment based on the changes to the dispersion factors. RAI Question 11.03-6 is being tracked as a Confirmatory Item in Chapter 11.

Supplemental Information

RG 1.206 Part C.I.12.2.1, "Contained Sources," states that "the applicant should describe the sources of radiation, during normal plant operations and accident conditions, that are the bases for the radiation protection design" and that the "sources should be described in the manner needed for input to the shield design calculation."

NRC staff issued **RAI 2667–Questions 12.02-4** and **12.02-5** requesting the applicant to provide additional information concerning radiation source and shield design for the skid-mounted, low conductivity waste (LCW) and high conductivity waste (HCW) filter/demineralizer systems that will be utilized in the STP Units 3 and 4 RW/B. The applicant's responses to Questions 12.02-4 and 12.02-5 (letter U7-C-STP-NRC-090113 dated August 20, 2009) (letter U7-C-STP-NRC-090173 dated October 12, 2009) state that the equipment has not been specified at this time, but the design specifications for the equipment will include shielding requirements to ensure that external dose rates from the equipment remain within the dose rate ranges for the zone designations identified in the ABWR DCD and in COL application Figure 12.3-39. The applicant also provides a conservative calculation of the radiation source term information for the HCW and LCW skids, which will be added to the FSAR as Tables 12.2-13b and 12.2.13f in a future COL FSAR revision. Because the equipment has not been specified, the calculation assumes a 'typical' filter/demin skid model and operating assumptions. In order to provide the most conservative source term estimate, the model assumes a 100 percent removal efficiency of the input streams and operation for a 1-year time period. Based on a review of the information provided in the response, and a commitment from the applicant to include the estimated HCW and LCW source term information in the FSAR, the staff found this response and the methodology acceptable. Question 12.02-5 is resolved. Because the COL FSAR has not yet been revised to include the proposed HCW and LCW source term information, **Question 12.02-4** is being tracked as **Confirmatory Item 12.02-3**.

RG 1.206, Part C.I.12.2.1 also states that the applicant should describe any required radiation sources containing byproduct, source, and special nuclear material that may warrant shielding design considerations and may provide a listing of isotope, quantity, form, and use of all sources that exceed 3.7 E+9 Bq (100 millicuries). The staff issued RAI 2667–Question 12.02-6 requesting the applicant to include additional information and to list in FSAR Section 12.2 any radiation sources containing byproduct, source, and special nuclear material that exceed 3.7 E+9 Bq (100 millicuries), including isotope, quantity, form, and use of all sources. The applicant's response to Question 12.02-6 (letter U7-C-STP-NRC-090113 dated August 20, 2009) states that ABWR Subsection 12.2.1.2.9, "Other Radioactive Sources," was incorporated by reference and no additional radiation sources were identified for STP Units 3 and 4. Due to staff knowledge of the need for radioactive sources to calibrate radiation protection instruments, the staff found the response to Question 12.02-6 to be insufficient. Accordingly, Question 12.02-6 is closed/unresolved and the staff issued supplemental **RAI 3854–Question 12.02-13** requesting the applicant to provide additional information about any radiation sources containing byproduct, source, and special nuclear material that exceed 3.7 E+9 Bq (100 millicuries) and that may be required to perform STP Units 3 and 4 radiation detection instrumentation calibration activities. This question is being tracked as **Open Item 12.02-3.**

During review of the revised radiation source tables in COL FSAR Section 12.2, the staff identified that Table 12.2-5a and Table 12.2-5b do not include radiation source term or geometry information for "Spent Fuel Storage"; only the notation "Applicant." Subsequent review of Section 12.2 of the ABWR DCD determined that radioactive source term for the spent fuel pool is referenced in Subsection 12.2.1.2.8 of the ABWR DCD, for a single average fuel

element with decay time, in J/s (W) (Joules/second [Watt]). No COL information item or notations in the ABWR DCD could be located that would require a COL applicant to determine a "Spent Fuel Storage" source term to be included in the COL application. Based on the information provided, the staff found that the Spent Fuel Storage radiation source term and geometry has not been adequately described to allow for verification of the shield design calculations required in Tier 1 ITAAC 3.2a. The staff issued **RAI 3984–Question 12.02-14** requesting the applicant to include radiation source term and geometry information for "Spent Fuel Storage" in Table 12.2-5a and Table 12.2-5b of the STP Units 3 and 4 FSAR. This RAI is being tracked as **Open Item 12.02-4**.

12.2.5 Post Combined License Activities

There are no post COL activities related to this section.

12.2.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to "Radiation Sources." With the exception of **Open Items 01-1, 12.02-1, 12.02-2, 12.02-3, 12.02-4, and Confirmatory Items 12.02-1, 12.02-2 and 12.02-3**, there is no outstanding information expected to be addressed in the COL FSAR related to this section. As a result of these open and confirmatory items, the staff was unable to finalize its conclusions concerning "Radiation Sources" in accordance with NRC the requirements.

12.3 Radiation Protection (Related to RG 1.206, Section C.I.12.3, "Radiation Protection Design Features")

Section 12.3, "Radiation Protection Design Features," and Section 12.4, "Dose Assessment," are treated as separate sections in the SER and in the ABWR DCD. However, these two sections are listed as a single section (Section 12.3-12.4, "Radiation Protection Design Features,") in both RG 1.206 and NUREG–0800. The material discussed in the section "Dose Assessment" is included in a subsection at the end of Section 12.3.

12.3.1 Introduction

This section of the FSAR addresses the issues related to radiation protection equipment and design features used to ensure that occupational radiation exposures are ALARA. The discussion takes into account design dose rates, AOOs, and accident conditions. These issues include facility design features, shielding, ventilation, area radiation and airborne radioactivity monitoring instrumentation, dose assessment, and inspection, test, analysis and acceptance criteria (ITAAC).

12.3.2 Summary of Application

Section 12.3 of the STP Units 3 and 4 COL FSAR incorporates by reference Section 12.3 of the ABWR DCD, Revision 4. The applicant identifies two Tier 1 departures, one Tier 2* departure, and eleven Tier 2 departures—including administrative departures—that affect Section 12.3.

In addition, in FSAR Section 12.3, the applicant provides the following:

Tier 1 Departures

- STD DEP T1 2.14-1 Hydrogen Recombiner Requirements Elimination

This departure refers to 10 CFR 50.44, "Combustible gas control for nuclear power reactors," which was amended after the issuance of the design certification for the ABWR. The amended 10 CFR 50.44 eliminates the requirements for hydrogen control systems to mitigate a design-basis loss-of-coolant accident (LOCA) hydrogen release. As a result of this change, the use of the containment hydrogen and oxygen monitoring instrumentation in the mitigation of a design-basis LOCA is also eliminated. This departure reflects the elimination of the requirement to maintain equipment needed to mitigate a design-basis LOCA hydrogen release. This departure includes the following:

Elimination of hydrogen recombiners.

Reclassification of containment hydrogen and oxygen-monitoring instrumentation from safety-related Category 1 to nonsafety-related Category 2 or Category 3.

- STD DEP T1 3.4-1 Safety-Related Instrumentation and Control (I&C) Architecture

This departure can be grouped into five primary changes:

- 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
- Testing and surveillance changes for Safety System Logic & Control (SSLC)

Tier 2 Departure*

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

This departure identifies Tier 2* items in Table 1.8-20 and Table 1.8-21 that are being updated to more current revisions/editions. Those Tier 2 items that are explicitly revised in the COL application or those that require changes due to changes in the Tier 2* items are also included.

Tier 2 Departures Not Requiring Prior NRC Approval

- STD DEP 1.2-2 Turbine Building

This departure addresses the turbine building redesign to accommodate replacing the turbine generator (the DCD turbine generator is obsolete), resizing the condenser, and replacing the medium voltage electrical system with a dual voltage design requiring equipment relocation into the turbine building.

- STD DEP 3.8-1 Resizing the Radwaste Building

Due to process changes to the radioactive waste treatment systems described in Departures STD DEP 11.2-1 and 11.4-1, the dimensions and layout have changed from those in the DCD.

- STP DEP 9.4-1 — Service Building Heating, Ventilating, and Air Conditioning (HVAC) System

This departure revises the outside inlet air monitoring instrumentation design by removing the provisions for toxic gas monitors and the Technical Support Center (TSC) alarm for high toxic gas concentrations.

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

This departure includes numerous changes to the process and effluent radiation monitoring and sampling system that include additional alarm functions, removing recorders, radiation monitor readout units, and modifying channel ranges.

- STD DEP 12.3-1 — Cobalt Content in Stainless Steel

This departure revises the requirements for the material specification for the stainless steel component exposed to reactor coolant, with a specific reference to the cobalt content in the stainless materials. A graded approach to cobalt concentrations was taken by using various grades of low-cobalt stainless steel, with the material in the core receiving the least amount of cobalt. The cobalt concentrations are allowed to increase with the distance from the core. The overall cobalt limit for all reactor vessel material is 0.05 wt percent.

- STD DEP 12.3-2 — Deletion of CUW Backwash Tank Vent Charcoal Filter

This departure corrects the text description of the backwash tank vent system by deleting the reference to a charcoal filter on that vent system, which does not exist in the design.

- STD DEP 12.3-3 — Steam Tunnel Blowout Panels

This departure removes the Section 12.3 discussion concerning blowout panels and relief and release pathways associated with the steam tunnel, which conflicts with the description in Section 3.8.4 and Subsection 3.12.1.3. This departure also adds the phrase "or equivalent" in Subsection 12.3.1.4.4, which describes the use of lead-loaded silicone foam for sealing penetrations and allows for the use of new or better products.

- STD DEP 12.3-4 — Alarm Capability for Area Radiation Monitors (ARMs)

This departure revises the FSAR to add alarm capability to certain area radiation monitors (ARMs) and adds five additional monitors to the reactor building.

Administrative Departure

- STD DEP Admin

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

COL License Information Items

- COL License Information Item 12.6 Airborne Radionuclide Concentration Calculation

COL License Information Item 12.6 addresses the calculation of the expected airborne radionuclide concentrations to verify the adequacy of the ventilation system before fuel loading.

- COL License Information Item 12.7 Operational Considerations

COL License Information Item 12.7 addresses operational considerations for airborne radiation monitoring, such as the procedures for operations and the calibration of the monitors, as well as the placement of the portable monitors. COL License Information Item 12.7 also includes ARM alarm setpoints.

- COL License Information Item 12.8 Requirements of 10 CFR 70.24

COL License Information Item 12.8 addresses information demonstrating that the plant meets the criticality accident monitoring requirements of 10 CFR 70.24.

- COL License Information Item 12.3.7.4 Material Selection

COL License Information Item 12.3.7.4 (DCD Tier 2) addresses material selection. (This COL License Information Item is not included in DCD Table 1.9-1.)

Supplemental Information

- Radiation Exposure to Construction Workers During Plant Construction

The applicant includes the evaluation of doses to construction workers in FSAR Section 12.3.8.

- 10 CFR 20.1406 Minimization of Contamination to Facilitate Decommissioning

12.3.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is documented in NUREG–1503. In addition, the relevant requirements of the Commission regulations for "Radiation Protection" and the associated acceptance criteria are in Section 12.3-12.4 of NUREG–0800.

The regulatory basis for accepting that radiation protection equipment and design features will ensure radiation exposure to occupational workers and members of the public will be kept ALARA, and in compliance with the limits identified in 10 CFR 20.1201 and 10 CFR 20.1301, is based on meeting the requirements of 10 CFR 20.1101. Specifically, that there is a policy formulated in accordance with the ALARA provisions of 10 CFR 20.1101(b) to ensure that occupational radiation exposure will be ALARA.

The regulatory basis for accepting that the facility design and procedures for operation will, in accordance with 10 CFR 20.1406, minimize contamination of the facility and the environment and the generation of radioactive waste, to the extent practicable, and facilitate the eventual decommissioning of the facility.

In addition, the regulatory bases for accepting the resolution of the STD COL information items are:

- COL License Information Item 12.6 is based on meeting the applicable requirements of 10 CFR Part 20 by following the guidance of RG 8.8.
- COL License Information Item 12.7 is based on meeting the applicable requirements of 10 CFR Part 20 by following the guidance of RG 8.2 and RG 8.8.
- COL License Information Item 12.8 is based on meeting the applicable requirements of 10 CFR Part 50 and 10 CFR Part 70.
- COL License Information Item 12.3.7.4 is based on meeting the applicable requirements of 10 CFR Part 20 by following the guidance of RG 8.8.

Moreover, the STD COL license information items are based on following the guidance of 10 CFR 20, 30, 31, 32, 33, 34, 40, 50, and 70 and NEI 07-03 Revision 7, "Generic FSAR Template Guidance for Radiation Protection Program Description."

In addition, in accordance with Section VIII, Process for Changes and Departures, of Appendix A to Part 52—Design Certification Rule for the ABWR Design, the applicant identified Tier 2 departure(s) that do not require prior Commission approval. These departures are subject to the requirements of Section VIII, which are similar to the requirements in 10 CFR 50.59.

12.3.4 Technical Evaluation

As documented in NUREG–1503, NRC staff reviewed the approved Section 12.3 of the certified ABWR DCD. The staff reviewed Section 12.3 of the STP Units 3 and 4 COL FSAR. The staff also checked the referenced ABWR DCD to ensure that the combination of information in the COL FSAR and information in the ABWR DCD 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 radiation protection.

The staff reviewed the information in the STP 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 their technical impact may be evaluated in the other sections of this SER accordingly. For more information, please refer to COLA Part 07, Section 5.0 for a listing of all FSAR sections affected by these Tier 1 departures. In addition, compliance with 10 CFR Part 52, Appendix A, Section VIII.A.4 for this Tier 1 departure will be addressed by the staff in a future exemption evaluation. This will be tracked as global **Open Item 01-1** throughout the staff's SER.

- STD DEP T1 2.14-1 Hydrogen Recombiner Requirements Elimination

STD DEP T1 2.14-1 is identified in Section 12.3 of the STP Units 3 and 4 COL FSAR because revisions of Reactor Building Zone Maps and Figures 12.3-5, 12.3-10, 12.3-16, and 12.3-21 were required to reflect the elimination of the Hydrogen Recombiners.

[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 that this departure does not result in any change in radiation protection equipment and design features identified in the ABWR DCD that are used to ensure that occupational radiation exposures are ALARA. NRC staff found that this departure does not require any further evaluation as it pertains to the review scope of this section. Additional staff review and evaluation of the acceptability of this departure can be found in Section 16.4.9.11 of this SER.

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

This departure is identified in this section due to changes in the data communication technology that will be used in STP Units 3 and 4. The proposed data communication system separates safety-related and nonsafety-related data communication. Process and Effluent Radiation Monitoring instrumentation is part of the nonsafety instrumentation that is affected by the data communication system changes.

The staff found that this departure does not result in any change in radiation protection equipment and design features identified in the ABWR DCD that are used to ensure that occupational radiation exposures are ALARA. NRC staff found that this departure does not require any further evaluation as it pertains to the review scope of this section. Additional staff review and evaluation of the acceptability of this departure can be found in Sections 16.4.1.1 and 16.4.6.1 of this SER.

- STD DEP T1 2.3-1 Deletion of Main Steam Isolation Valve (MSIV) Closure and Scram on High Radiation

This departure is not identified by the applicant as affecting FSAR Chapter 12. However, the departure was reviewed by the staff for applicability to Chapter 12 because it addresses changes in radiation monitoring instrumentation. This departure deletes the main steam line tunnel radiation monitor closure of the main steam isolation valves and SCRAM trip function, because the function is not credited in the ABWR safety analysis. Also, operational experience indicates spurious reactor trips due to the function. The departure retains the indication of main steam line tunnel radiation levels and alarm functionality.

This departure does not result in any change in radiation protection equipment and design features identified in the ABWR DCD that are used to ensure that occupational radiation exposures are ALARA. Additional staff review and evaluation of the acceptability of this departure can be found in Sections 16.4.6.1 and 11.5 of this SER.

Tier 2 Departure*

The following Tier 2* Departure identified by the applicant in this section require prior NRC approval and the full scope of its technical impact may be evaluated in the other sections of this SER accordingly. For more information, please refer to COLA Part 07, 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 RG Edition Changes

This departure is identified in this section due to updating the referenced NRC RG to RG 1.143 Revision 2, “Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants,” as the referenced RG for STP 3 and 4. The staff found this departure acceptable based on the applicant’s utilization of

the most recent regulatory guidance for the design changes made to the radwaste building and radwaste systems. With respect to the impact of the departure on this section, the acceptability of this departure is limited to RG 1.143, Revision 2.

This departure does not result in any change in radiation protection equipment and design features identified in the ABWR DCD that are used to ensure that occupational radiation exposures are ALARA. NRC staff found that this departure does not require any further evaluation as it pertains to the review scope of this section and is 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 the other sections of this SER accordingly. For more information, please refer to COLA Part 07, Section 5.0 for a listing of all FSAR sections affected by these departures.

- STD DEP 1.2-2 Turbine Building
- STD DEP 3.8-1 Resizing the Radwaste Building
- STP DEP 9.4-1 Service Building HVAC System
- STD DEP 11.5-1 Process and Effluent Radiation Monitoring and Sampling System
- STD DEP 12.3-1 Cobalt Content in Stainless Steel
- STD DEP 12.3-2 Deletion of CUW Backwash Tank Vent Charcoal Filter
- STD DEP 12.3-3 Steam Tunnel Blowout Panels
- STD DEP 12.3-4 Alarm Capability for Area Radiation Monitors (ARMs)

Administrative Departure

- STD DEP Admin

The applicant defines administrative departures as minor corrections, such as editorial or administrative errors in the referenced ABWR DCD (i.e., misspellings, incorrect references, table headings, etc.). The applicant identifies an Administrative Departure in this section with respect to an incorrect table reference. NRC staff found that this administrative departure does not affect the presentation of any design discussion or qualification of design margin and is acceptable.

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

Compliance with 10 CFR Part 20 for Tier 2 Departures Not Requiring Prior NRC Approval

Although the applicant has identified the following Tier 2 Departures as not requiring prior NRC approval, the NRC staff found it necessary to evaluate these departures within the scope of compliance with the requirements of 10 CFR Part 20 in order to make a determination of reasonable assurance that the departures did not result in any changes to radiation protection equipment and design features identified in the ABWR DCD that ensure occupational and public radiation exposures are ALARA, and that STP 3 and 4 will be constructed and operated in compliance with the Part 20 requirements.

- STD DEP 1.2-2 Turbine Building

This departure reflects the turbine building redesign to accommodate replacing the turbine generator, resizing the condenser, and relocating electrical system equipment into the turbine building. This redesign resulted in the need to revise the Turbine Building Radiation Area Zone maps and Figures 12.3-49 through 12.3-53, 12.3-55, 12.3-70 through 12.3.73, and 12.3-75 through 12.3-77. The revised drawings indicate the location changes of the turbine building area radiation monitors. Table 12.3-7, "Area Radiation Monitors Turbine Building," was revised to indicate the location changes. However, the applicant did not provide the bases or the methodology for the monitor locations and sensitivity ranges selected. The staff issued **RAI 3116-Question 12.03-12.04-6** requesting the applicant to provide additional information concerning the relocation of the turbine building ARMs. The applicant's response, (letter U7-C-STP-NRC-090122 dated August 26, 2009) states that the revised ARM locations and sensitivity ranges are consistent with the basis in the ABWR DCD and no additional information should be added to the FSAR. Further evaluation of the revised turbine building ARM locations and sensitivity ranges by the staff concluded that the locations and sensitivity ranges are consistent with the NRC-approved design and location criteria contained in the ABWR DCD. Based on the above discussion, the staff found this departure reasonable regarding compliance with the requirements of 10 CFR Part 20. Accordingly, Question 12.03-12.04-6 is closed.

- STD DEP 3.8-1 Resizing the Radwaste Building

This departure reflects the updated dimensions and layout of the RW/B due to the process changes to the radioactive waste treatment systems described in Departures STD DEP 11.2-1 and 11.4-1. This departure does not result in any change to radiation protection equipment and design features identified in the ABWR DCD that are used to ensure that occupational and public radiation exposures are ALARA. Therefore, the staff found this departure reasonable regarding compliance with the requirements of 10 CFR Part 20. Additional NRC staff review of this departure was completed and documented in Sections 3.8.4, 11.2, and 11.4 of this SER. RAIs related to the RW/B modifications and radioactive waste treatment systems are currently being tracked under Sections 3.8.4, 11.2, and 11.4 of this SER.

- STP DEP 9.4-1 Service Building HVAC System

This departure reflects the removal of the outside inlet air monitoring toxic gas monitors from the service building HVAC system and the removal of the TSC alarm for high toxic gas concentrations based on the site-specific evaluation of onsite and offsite mobile and stationary sources of toxic gases described in FSAR Subsection 2.2S, in accordance with RG 1.78. This departure does not result in any change in radiation protection equipment and design features identified in the ABWR DCD that are used to ensure that occupational and public radiation exposures are ALARA. Therefore, the staff found this departure reasonable regarding

compliance with the requirements of 10 CFR Part 20. Additional NRC staff review of this departure was completed and documented in Sections 2.2 and 6.4 of this SER.

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

This departure includes numerous changes to the process and effluent radiation monitoring and sampling system including additional alarm functions, removing recorders, radiation monitor readout units, and modification of channel ranges. With the exception of the main steam line tunnel radiation monitors, the process and effluent radiation monitoring system changes added additional alarm functionality. A second upscale alarm function was added to the monitors, which provides additional functionality for operational purposes. No safety margins are impacted by this departure. By providing additional functionality and alarm notification capability to plant personnel, this departure represents an overall improvement in the Process and Effluent Radiation Monitoring and Sampling System maintaining public radiation exposures ALARA. Therefore, the staff found this departure reasonable regarding compliance with the requirements of 10 CFR Part 20.

- STD DEP 12.3-1 Cobalt Content in Stainless Steel

This departure reflects the changes in the stainless steel cobalt content material specification for components exposed to reactor coolant. The applicant states that a graded approach to cobalt concentrations will be taken by using various grades of low cobalt stainless steel, with the material in the core containing the lowest amount of cobalt. The cobalt concentrations are allowed to increase with distance from the core. The overall cobalt limit for all reactor vessel materials is 0.05 wt percent. The applicant also describes the use of an ongoing program to monitor industry state-of-the-art developments in material selection options for maintaining exposure ALARA, including Stellite reduction efforts. NRC staff found the applicant's approach reasonable in that it provides more restrictive material selection criteria than the criteria included in the ABWR DCD for RCS alloy cobalt content, as well as a commitment to monitor and reduce, to the extent practicable, the cobalt inventory in the reactor coolant system. Reducing the amount of cobalt in the reactor coolant system in this manner conforms to the guidance in RG 8.8 for maintaining occupational radiation exposures ALARA. Therefore, the staff found this departure reasonable regarding compliance with the requirements of 10 CFR Part 20.

- STD DEP 12.3-2 Deletion of CUW Backwash Tank Vent Charcoal Filter

This departure corrects the text description of the CUW system in Section 12.3 of the ABWR DCD that describes a charcoal filter canister on the backwash tank vent that does not actually exist in the ABWR design. The applicant states that the current intent of the design is for the CUW backwash tank to be vented to the reactor building HVAC exhaust. NRC staff issued **RAI 3117–Question 12.03-12.04-7** requesting the applicant to provide additional information concerning venting the CUW backwash tank directly into the reactor building HVAC exhaust and the possibility of contaminating the HVAC system. The applicant's response (letter U7-C-STP-NRC-090122 dated August 26, 2009) states that the design of the CUW system will include a charcoal filter canister on the backwash tank vent line. The applicant proposes a future COL FSAR revision that will delete STD DEP 12.3-2 and restore the text in the ABWR DCD. The staff found the proposed COL revision acceptable. However, the staff cannot close Question 12.03-12.04-7 until the FSAR is revised. Question 12.03-12.04-7 is **Confirmatory Item 12.03-12.04-1**. However, the applicant does not provide a proposed FSAR revision to include the

equivalent information concerning the CUW backwash tank vent line charcoal filter in the applicable system-related FSAR subsections. Because the lack of information in the system description and drawings was the basis for STD DEP 12.3-2, the staff issued supplemental **RAI 3857–Question 12.03-12.04-12** requesting the applicant to provide additional information. This RAI is being tracked as **Open Item 12.03-12.04-1.**

- STD DEP 12.3-3 Steam Tunnel Blowout Panels

This departure removes the design description and discussion in this section concerning blowout panels and relief and release pathways associated with the steam tunnel. The information is inaccurate and not needed in Section 12.3. Evaluation of the main steam tunnel, safety-related tunnels, and nonsafety-related tunnels containing nonsafety-related equipment is in Sections 3.4 and 3.8 of this SER. This departure also adds the phrase "or equivalent" to the last sentence in Subsection 12.3.1.4.4, which describes the use of lead-loaded silicone foam for sealing penetrations to allow the use of new or better products. NRC staff issued **RAI 3115–Question 12.03-12.04-5** requesting additional information from the applicant in concerning the radiation shielding criteria associated with the lead-loaded silicone foam for sealing penetrations. The applicant's response (letter U7-C-STP-NRC-090121 dated August 26, 2009) identifies the location in the ABWR DCD indicating that the radiation shielding properties of lead-loaded silicone foam for sealing penetrations will have a density equivalent to that of concrete. Based on the additional information in the applicant's response to Question 12.03-12.04-5, the staff found STD DEP 12.3-3 reasonable regarding compliance with the requirements of 10 CFR Part 20 in keeping occupational radiation exposures ALARA. Accordingly, Question 12.03-12.04-5 is resolved.

- STD DEP 12.3-4 Alarm Capability for Area Radiation Monitors (ARMs)

This departure adds local alarm capability to certain ARMs and adds five ARMs to locations within the reactor building. The applicant states that the departure represents a favorable change by providing additional alarm capability to ARMs in the reactor building, the RW/B, and the turbine building. The departure adds additional ARMs in the reactor building beyond those identified in the DCD. NRC staff reviewed this section and determined that there is no change in the design or function of the ARMs. By providing additional notification to plant personnel concerning changes in radiological conditions and keeping occupational radiation exposures ALARA, this departure represents a radiation safety improvement. Therefore, the staff found this departure reasonable regarding compliance with the requirements of 10 CFR Part 20.

COL License Information Items

- COL License Information Item 12.6 Airborne Radionuclide Concentration Calculation

NRC staff reviewed COL License Information Item 12.6 regarding the Airborne Radionuclide Concentration Calculation included in Section 12.A.1 of the STP COL FSAR.

The applicant provides additional information in Subsection 12.3.7.2 to address the resolution of DCD COL License Information Item 12.6, which states:

> The COL applicant will provide the calculations of the expected concentrations of the airborne radionuclide for the requisitioned ABWR plant design.

In Subsection 12.3.7.1 of the COL FSAR, the applicant states:

> Calculations of the expected airborne radionuclide concentrations will be performed, as part of the plant inspections, tests, analyses and acceptance criteria (ITAAC Tier 1, Table 3.2b), to verify the adequacy of the ventilation system prior to fuel load.

As discussed in Section 12.2.1 of NUREG-1503, almost all airborne radioactivity within the plant results from equipment leakage. Since leakage of contaminated fluids from equipment could not be quantified, Design Acceptance Criteria (DAC) were included in Table 3.2b of the ABWR DCD Tier 1 ITAAC to calculate the airborne source term in each room and operating area of the plant prior to fuel load. The purpose of the analysis is to identify the plant areas that may require additional airborne radioactivity monitoring. Because the confirmatory calculations can only be performed after construction, the calculations may be inspected NRC staff, when they become available, as part of the ITAAC inspection program. Based on the above discussion and ITAAC to complete the calculations to determine additional airborne radioactivity monitoring requirements, the staff found that the applicant has adequately addressed COL License Information Item 12.6.

- COL License Information Item 12.7 Operational Considerations

The applicant provides additional information in Subsection 12.3.7.2 to address the resolution of DCD COL License Information Item 12.7, which states:

> Area radiation monitoring operational considerations, such as monitor alarm setpoints, listed in RG 1.70 are the COL applicant's responsibility. Airborne radiation monitoring operational considerations such as the procedures for operations and calibration of the monitors, as well as the placement of the portable monitors, are also the COL applicant's responsibility.

NRC staff reviewed COL License Information Item 12.7 regarding ARM operational considerations included in Section 12.5S of the STP COL FSAR. The COL applicant states that ARM alarm setpoints are established based on design background radiation levels, which are then confirmed during the Startup Test Program. ARM system preoperational tests are included in ABWR DCD Subsection 14.2.12.1.24, which is incorporated by reference in COL FSAR Section 14.2. Preoperational testing will check for proper calibration of the detectors; proper functioning of alarms (local and remote, audible and visual); and protective features including alarm setpoints as well as the proper response to various loss of power conditions. The staff issued RAI 3021–Question 12.03-12.04-4 requesting the applicant to provide additional information on the calibration methods and frequency that will be used for the STP Units 3 and 4 fixed area and airborne monitors. The applicant's response (letter U7-C-STP-NRC-090121 dated August 26, 2009) references the ARM preoperational testing in Subsection 14.2.12.1.24 of the ABWR DCD and states that calibration procedures for preoperational testing will be in accordance with ANSI/ANS-HPSSC-6.8.1-1981, "location and design criteria for area radiation monitoring systems for light water nuclear reactors" and the vendor's instructions. The applicant proposes a future COL FSAR revision to COL Subsection 12.3.7.2 for clarification. The staff found the response to be incomplete, and the staff issued supplemental RAI 3982–Question 12.03-12.04-13 requesting the applicant to provide additional information concerning the ARM and airborne monitor calibration methods and frequencies that will be utilized during operations of STP Units 3 and 4. This RAI is being tracked as **Open Item 12.03-12.04-2**.

The staff reviewed COL License Information Item 12.7 regarding airborne radiation monitoring operational considerations included in Section 12.5S of the STP COL FSAR. The COL

applicant states that the airborne radioactivity monitors are classified as nonsafety-related. Although airborne radioactivity monitors are classified as nonsafety-related, as discussed below the applicant must show compliance with 10 CFR 20.1501.

The COL applicant states that operational considerations and portable monitor placement are discussed in COL Section 12.5S. COL Section 12.5S references NEI 07-03, "Generic FSAR Template Guidance for Radiation Protection Program Description." The staff reviewed and completed a safety evaluation of NEI 07-03, as documented in Section 12.1.4 above. NEI 07-03 describes various monitoring instruments that will be maintained and used at the facility, including the following:

- High- and low-volume air samplers used to take grab samples to assess airborne radioactivity concentrations to determine respiratory protection measures
- Continuous air monitors to observe trends in airborne radioactivity concentrations and to alert personnel of sudden changes in airborne radioactivity concentrations
- Portable air sampling and analysis system to determine airborne radioiodine concentrations during and following an accident
- Portable sampling and onsite analysis capability to assess airborne radio-halogens and particulates released during and following an accident

Subsection 12.5.4.1 of NEI 07-03 describes the operational considerations of these monitors. The template states that airborne radioactivity levels are surveyed by using continuous air monitors and by taking grab samples using portable high- and low-volume air samplers. The continuous air monitor alarm setpoints are set at a fraction of the concentration values in 10 CFR Part 20, Appendix B, Table 1 (Column 3) for radionuclides expected to be encountered.

Subsection 12.5.4.1 of NEI 07-03 also describes calibration frequency and requirements for operating procedures for airborne monitors. The template states that continuous air monitors will have daily operational checks to test function or response. All monitors used to perform surveys are calibrated before initial use, after maintenance or repairs that might affect the calibration, and at least annually. In addition, emergency and special-use monitors will have operational checks on a regular schedule, as specified in written procedures.

Subsection 12.5.3.2 of the NEI 07-03 Template states that continuous air monitors equipped with local alarm capability are used in occupied areas where needed to alert personnel to sudden changes in airborne radioactivity concentrations. This section also states that radiation monitoring instrumentation and equipment will provide the appropriate detection capabilities, ranges, sensitivities, and accuracies required for the types and levels of radiation anticipated in the plant and in the environs during routine operations; major outages; abnormal occurrences; and postulated accident conditions. The staff issued RAI 3021–Question 12.03-12.04-4 requesting the applicant to provide additional information on the calibration methods and frequency that will be used for the STP Units 3 and 4 fixed area and airborne monitors. As previously discussed, the staff found the applicant's response incomplete and unresolved. The staff issued supplemental RAI 3982–Question 12.03-12.04-13 requesting the applicant to provide additional information concerning the ARM and airborne monitor calibration methods and frequencies. (See **Open Item 12.03-12.04-2.**)

- COL License Information Item 12.8 Requirements of 10 CFR 70.24

The applicant provides additional information in Subsection 12.3.7.3 to address the resolution of COL License Information Item 12.8, which states:

> COL applicants will provide information showing that their plant meets the requirements of 10 CFR 70.24 or request an exemption from this 10 CFR 70.24 requirement.

NRC staff reviewed COL License Information Item 12.8 regarding criticality accident monitoring requirements of 10 CFR 70.24 included in Subsection 12.3.7.3 of the COL FSAR. The COL applicant commits in COM 12.3-1, included in the initial COL Application (letter ABR-AE-07000004, dated 20 September, 2007 (ML072830407)), to provide information demonstrating that the plant meets the criticality accident monitoring requirements of 10 CFR 70.24. The applicant has indicated that they will submit the information as an amendment to the FSAR in accordance with 10 CFR 50.71(e) or will request an exemption from this 10 CFR 70.24 requirement at least 6 months before fuel loading**.** The staff notes that an exemption from the criticality accident monitoring requirements of 10 CFR 70.24 would require that the applicant comply with the criticality accident monitoring requirements of 10 CFR 50.68 (b) in lieu of 10 CFR 70.24. Before a Part 52 license can be issued, the applicant must demonstrate compliance with the criticality accident monitoring requirements of 10 CFR 70.24, or possess an exemption from the 10 CFR 70.24 requirements. Accordingly, the staff issued RAI 4286–Question 12.03-12.04-15 requesting the applicant to demonstrate compliance with the criticality accident monitoring requirements of 10 CFR 70.24, or request and receive an exemption from the 10 CFR 70.24 requirements. This RAI is being tracked as **Open Item 12.03-12.04-3**.

- COL License Information Item 12.3.7.4 Material Selection

The applicant provides additional information in Subsection 12.3.1.1.2 to address the resolution of COL License Information Item 12.3.7.4, which states:

> The COL applicant shall address state-of-the-art developments in material selection option for maintaining exposure ALARA.

NRC staff reviewed COL License Information Item 12.3.7.4 regarding material selection for maintaining exposure ALARA. Based on the information provided and the discussion below, the staff found that the applicant has adequately addressed COL License Information Item 12.3.7.4.

The applicant states that a graded approach will be used to reduce the levels of cobalt in the primary systems, as discussed in FSAR Subsection 12.3.1.1.2.

The following additional information addressing the use of state-of-the-art developments for maintaining exposure ALARA in the COL FSAR that were identified by the staff:

<u>Radiation Shielding Computer Codes</u>

During an audit of the radwaste system departures completed by the NRC staff during the review of Chapter 11 (ML092510426 dated 16 October, 2009), the staff raised a concern about the radiation shielding computer codes being used to verify the STP 3 and 4 radwaste system design changes. As a result, the staff issued **RAI 3519–Question 12.03-12.04-10** requesting the applicant to provide additional information about any radiation shielding computer codes being used to verify STP Units 3 and 4 radiation shielding that are not identified in the ABWR

DCD. The applicant's response and supplement to Question 12.03-12.04-10 (letter U7-C-STP-NRC-090186 dated October 26, 2009) (letter U7-C-STP-NRC-090223 dated December 9, 2009) identified several radiation shielding computer codes used to verify the STP 3 and 4 radwaste system design changes that are not identified in the ABWR DCD. The applicant provided supplemental information about how the radiation shielding computer codes are being used proposed including the information in the COL FSAR in a future COL application revision. Based on the review of the applicant's information, and the applicant's commitment to include the supplemental computer code information in the FSAR, the staff found this response acceptable. Accordingly, Question 12.02-10 is resolved. However, because the COL FSAR has not yet been revised to include the proposed radiation shielding computer code information, this RAI is being tracked as **Confirmatory Item 12.03-12.04-2**.

Zinc Injection

The applicant states that FSAR Section 9.3, "Process Auxiliaries," incorporates by reference the information in ABWR DCD Section 9.3. Section 9.3.11 of the ABWR DCD states that "provisions are made to permit installation of a system for adding a zinc solution to the feedwater." The COL FSAR does not discuss zinc injection. One of the benefits of utilizing a zinc injection system to inject depleted zinc oxide in the feedwater is to suppress cobalt plate-out on reactor building piping. Minimizing the plate-out of radioactive cobalt on reactor building piping can lead to potentially lower dose rates in the vicinity of this piping and result in correspondingly lower doses to personnel in this portion of the plant. NRC staff (CIB2) issued **RAI 2780–Question 01-11** requesting the applicant to provide additional information as to whether or not the zinc injection system will be utilized in STP Units 3 and 4. The applicant's response (letter U7-C-STP-NRC-090098 dated August 12, 2009) confirms that a zinc injection system will not be installed in STP Units 3 and 4. However, piping connections to allow for the future installation and operation of a zinc injection system will be installed, with the possibility that operational experience could indicate a zinc injection system would be beneficial. The staff found that the provision to allow for the future use of zinc injection acceptable based on the applicant's commitment to maintain the worker dose ALARA in COL Section 12.1 and on the contingencies to implement zinc injection in the future. The safety-related evaluation of the acceptability of the applicant's response to Question 01-11 is included in Section 9.3.11 of this SER.

Supplemental Information

- Radiation Exposure to Construction Workers During Plant Construction

The applicant includes an evaluation and discussion of the different phases of construction for the two-unit site and the doses associated with the operation of STP Units 1 and 2 and the preoperational testing of Unit 3 during the construction of Unit 4. Additionally, the applicant states in FSAR Section 12.3.8 that (1) the STP Units 3 and 4 site will be continually monitored during the construction period; (2) appropriate actions will be taken to ensure that doses to the construction workers remain ALARA; and (3) the Operational Radiation Protection Program will be in place while Unit 3 is operating with Unit 4 still under construction to provide oversight to ensure that doses to construction workers remain ALARA during the construction period.

RG 1.206, Section C.I.12.3.5 requests an applicant to provide (a) estimates of annual doses to construction workers in a new unit construction area, as a result of radiation from onsite sources from the existing operating plant(s); and (b) bases, models, assumptions, and input data. The applicant provided a description of the potential sources of exposure to construction workers and comparisons of the annual calculated construction worker doses to the limits in 10 CFR

20.1301 and 40 CFR 190.10 for members of the public. However, the COL FSAR does not contain the bases, models, and assumptions used to calculate construction worker doses. The staff issued **RAI 3101–Question 12.03-12.04-9** requesting the applicant to provide additional information concerning construction worker doses. The applicant's response (letter U7-C-STP-NRC-090125 dated September 3, 2009) includes a summary of construction activities and bases for dose calculations; a table containing the calculated person-Sievert dose for each unit; and referenced Sections 3.9S, 3.10S, and 4.5 of the COL application, Part 3 (the STP Units 3 and 4 Environmental Report) as containing additional information. The staff found the applicant's response incomplete and unresolved. Accordingly, Question 12.03-12.04-9 was closed as unresolved. The staff issued supplemental **RAI 3981–Question 12.03-12.04-14** requesting the applicant to provide additional information to be included in the FSAR concerning the bases, models, assumptions, and input data used in the assessment and calculation of construction worker doses. This RAI is being tracked as **Open Item 12.03-12.04-5**.

- 10 CFR 20.1406 Minimization of Contamination to Facilitate Decommissioning

STP Units 3 and 4 utilize the certified ABWR design per 10 CFR Part 50, Appendix A. In accordance with 10 CFR 20.1406(a), the COL applicant is responsible for documenting in the application how the facility design and procedures for operation (1) will minimize, to the extent practicable, contamination of the facility and the environment; (2) will facilitate eventual decommissioning; and (3) will minimize, to the extent practicable, the generation of radioactive waste. NRC staff reviewed STP Units 3 and 4 COL FSAR Chapters 9, 11 and 12 in order to determine whether the applicant adequately describes how the facility design and procedures for operation (a) will minimize, to the extent practicable, contamination of the facility and the environment; (b) will facilitate eventual decommissioning; and (c) will minimize, to the extent practicable, the generation of radioactive waste.

The applicant provides information in FSAR Subsection 11.2.1.2.4 related to compliance of the radwaste system design features with 10 CFR 20.1406, in regards to the minimization of contamination to facilitate decommissioning and referencing NEI 07-03 in FSAR Section 12.5S. NEI 07-03 identifies some of the programmatic considerations for implementing 10 CFR 20.1406(a). However, the COL application, the ABWR DCD, and NEI 07-03 do not address operational programs to the level of detail that is described in RG 4.21, "Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning." The COL does not contain any discussion about or take any credit for approved ABWR facility design features that may address compliance with 10 CFR 20.1406. To determine conformance with the guidance in RG 4.21, the staff issued **RAI 2784–Question 12.03-12.04-3**. The applicant's response (letter U7-C-STP-NRC-090121 dated August 26, 2009) states that 10 CFR 20.1406 was issued after the ABWR Design Certification Rule in 1997, and 10 CFR 20.1406(b) is not applicable to the ABWR DCD. The applicant also provides a discussion of how the STP Units 3 and 4 radwaste system departures address the requirements of 10 CFR 20.1406, noting that NEI 08-08, "Generic FSAR Template Guidance for Life-Cycle Minimization of Contamination," provides guidance in developing operational programs to address 10 CFR 20.1406. The applicant also states that the NEI 08-08 guidance will be used, to the extent practicable, in the development of STP Units 3 and 4 programs and procedures. The applicant's response also states that all piping will be located in pipe tunnels or in accessible surface trenches, and FSAR Subsection 11.2.1.2.4 will be revised to clarify that there is no piping buried in soils. The staff found the response incomplete in that the applicant does not fully commit to using NEI 08-08 or fully describe the operational programs and procedures to address 10 CFR 20.1406. Accordingly, Question 12.03-12.04-3 was closed as unresolved. The staff issued supplemental **RAI 3855–Question 12.03-12.04-11** requesting the applicant to provide additional information concerning

(1) operational programs and operating procedures that STP Units 3 and 4 will utilize to address the requirements of 10 CFR 20.1406; and (2) clarifying whether only the radwaste system piping or all piping will be located in tunnels or in accessible surface trenches. This RAI is being tracked as **Open Item 12.03-12.04-4**.

The staff issued additional RAIs related to 10 CFR 20.1406 compliance while reviewing ventilation systems in Chapter 9 (**RAI 3108–Question 09.04.01-1**) and radioactive waste systems in Chapter 11 (**RAI 3256–Question 11.03-4** and **RAI 3676–Question 11.02-8**). As discussed in the staff's evaluations in SER Chapters 9 and 11, the applicant resolved Question 09.04.01-1 and Question 11.03-4, and those questions are closed. However, Question 11.02-8, which relates to questions about the condensate storage tank and associated piping, remains an open item that is being tracked in Chapter 11. The condensate storage tank is located outside the reactor building and contains a large volume of low-level radioactive water. The staff's review of the RAIs is in Section 9 and Section 11 of this SER.

12.3.5 Post Combined License Activities

There are no post COL activities related to this section.

12.3.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to "Radiation Protection." With the exception of **Open Items 01-1, 12.03-12.04-1, 12.03-12.04-2, 12.03-12.04-3, and 12.03-12.04-4**, and Confirmatory Items **12.03-12.04-1 and 12.03-12.04-2**, there is no outstanding information expected to be addressed in the COL FSAR related to this section. As a result of these open and confirmatory items, the staff was unable to finalize its conclusions concerning radiation sources in accordance with NRC the requirements.

12.4 Dose Assessment

12.4.1 Introduction

This section of the FSAR addresses the issues related to estimating the annual personal doses associated with operations, normal maintenance, radwaste handling, refueling, in-service inspection, and special maintenance (e.g., maintenance that goes beyond routine scheduled maintenance such as the modification of equipment to upgrade the plant, or repairs to failed components).

12.4.2 Summary of Application

Section 12.4 of the COL FSAR incorporates by reference Section 12.4 of the certified ABWR DCD (Revision 4) referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 12.4, the applicant provides the following:

Tier 2 Departures Not Requiring Prior NRC Approval

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

This departure contains numerous design revisions of Fuel Storage and Handling Equipment, including clarifying spent fuel storage rack minimum storage capacity, updating the

corresponding COL license information item, adding a stand-alone section describing new fuel storage, and adding supplemental and clarifying information throughout Section 9.1 of the FSAR.

- STD DEP 11.2-1 Liquid Radwaste Process Equipment

The applicant completely replaces (except for Piping and Instrumentation Diagrams) Tier 2 Section 11.2 of the certified ABWR DCD, including all subsections, figures, and tables. This departure includes the use of mobile technology and deletes the forced-circulation concentrator system and other permanently installed liquid radwaste processing equipment, as identified with Tier 2 Departure STD DEP 11.2-1. Thus, no part of ABWR DCD Section 11.2 is incorporated by reference. This departure resulted in a complete revision of Section 12.4.3, "Radwaste Building Dose," of the ABWR DCD.

Administrative Departure

- STD DEP Admin

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

Supplemental Information

- Occupational Dose

The applicant revises the basic ABWR DCD information in FSAR Sections 12.4.1, 12.4.2, 12.4.3, and 12.4.5 for occupational exposure dose calculations in the drywell, in the reactor building, and in the RW/B; and during "Work at Power." The changes are due to revised dose estimates based on a reduction in the number of work hours due to equipment modifications.

12.4.3 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 "Dose Assessment" and the associated acceptance criteria are in Section 12.3-12.4 of NUREG–0800.

The regulatory basis for accepting that radiation protection equipment and design features will ensure radiation exposure to occupational workers and members of the public will be kept ALARA, and in compliance with the limits identified in 10 CFR 20.1201 and 10 CFR 20.1301, is based on meeting the requirements of 10 CFR 20.1101. Specifically, that there is a policy formulated in accordance with the ALARA provisions of 10 CFR 20.1101(b) to ensure that occupational radiation exposure will be ALARA.

The regulatory basis for accepting that the facility design and procedures for operation will, in accordance with 10 CFR 20.1406, minimize contamination of the facility and the environment and the generation of radioactive waste, to the extent practicable, and facilitate the eventual decommissioning of the facility.

In addition, the regulatory basis for accepting the resolution to the COL supplemental information is satisfied based on meeting the applicable requirements of 10 CFR Part 20 and following the guidance in RG 1.206.

In addition, in accordance with Section VIII, Process for Changes and Departures, of Appendix A to Part 52—Design Certification Rule for the ABWR Design, the applicant identified Tier 2 departure(s) that do not require prior Commission approval. These departures are subject to the requirements of Section VIII, which are similar to the requirements in 10 CFR 50.59.

12.4.4 Technical Evaluation

As documented in NUREG–1503, NRC staff reviewed the approved Section 12.4 of the certified ABWR DCD. The staff reviewed Section 12.4 of the STP Units 3 and 4 COL FSAR. The staff also checked the referenced ABWR DCD to ensure that the combination of information in the COL FSAR and information in the ABWR DCD 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 dose assessment.

The staff's review confirmed that the information in the application and the information incorporated by reference address the relevant information related to SRP Section 12.3-12.4, "Radiation Protection Design Features." In addition, the staff reviewed the applicant's supplemental item included under Section 12.4 of the STP COL. In the review, the staff used the applicable sections in the SRP (NUREG–0800) and RG 1.206 as guidance.

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 the other sections of this SER accordingly. For more information, please refer to COLA Part 07, Section 5.0 for a listing of all FSAR sections affected by these departures.

- STD DEP 9.1-1 Update of Fuel Storage and Handling Equipment
- STD DEP 11.2-1 Liquid Radwaste Process Equipment

Administrative Departure

- STD DEP Admin

The applicant defines administrative departures as minor corrections, such as editorial or administrative errors in the referenced ABWR DCD (i.e., misspellings, incorrect references, table headings, etc.). NRC staff found that this administrative departure does not affect the presentation of any design discussion or qualification of design margin and is acceptable.

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII, Item B5 determined that these departures do not require prior NRC approval. The staff found it reasonable that these departures do not require prior NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

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

Compliance with 10 CFR Part 20 for Tier 2 Departures Not Requiring Prior NRC Approval

Although the applicant has identified the following Tier 2 Departures as Not Requiring Prior NRC Approval, the NRC staff found it necessary to evaluate these departures within the scope of compliance with the requirements of 10 CFR Part 20 in order to make a determination of reasonable assurance that the departures did not result in any changes to radiation protection equipment and design features identified in the ABWR DCD that ensure occupational and public radiation exposures are ALARA, and that STP 3 and 4 will be constructed and operated in compliance with the Part 20 requirements.

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

In a departure from Section 12.4.2, "Reactor Building Dose," of the ABWR DCD the applicant changes the nomenclature from "automated refueling bridge" to "automated refueling machine"; deletes a reference to the "enclosed automation center"; and includes a reference to Subsection 9.1.4.2.7.1 for the description of the refueling machine. The estimate of person-hours and effective dose rate for refueling activities remains unchanged at 4,000 hours and 2 μGy/h. However, in FSAR Section 12.5S.2.4, the applicant states that the normal radiation level on the refueling bridge is expected to be less than 5 mrem/hr.

NRC staff issued **RAI 3025–Question 12.03-12.04-1** requesting the applicant to provide additional information concerning dose calculations for refueling activities and to correct the units used for exposure rates. The applicant's response to the RAI (letter U7-C-STP-NRC-090103 dated August 12, 2009) clarifies that the effective dose rate for refueling operations will be less than 2 μGy/h (2 μSv/h) and proposes a future FSAR revision that will change the units from μGy/h to μSv/h, as applicable throughout Chapter 12. Based on the additional information from the applicant and the proposed FSAR revision, the staff found this departure reasonable regarding compliance with the requirements of 10 CFR Part 20. However, the staff cannot consider Question 12.03-12.04-1 closed until the COL FSAR is revised to reflect the proposed revision. This RAI is being tracked as **Confirmatory Item 12.03-12.04-3**.

- STD DEP 11.2-1 Liquid Radwaste Process Equipment

In a departure from Section 12.4.3, "Radwaste Building Dose," of the ABWR DCD the applicant replaces Section 12.4.3 of the ABWR DCD. The applicant provides a general description of the radwaste processes and work activities that would result in occupational exposure to workers. FSAR Table 12.4-1 includes an estimate of the total hours and average exposure rate for the operation and maintenance of the RW/B. The number of hours is reduced by more than a factor of four from 4,200 hours to 1,000 hours. However, the FSAR does not contain any information concerning the bases, models, and assumptions used to calculate the revised RW/B dose. NRC staff issued **RAI 3025–Question 12.03-12.04-2** requesting the applicant to provide additional information concerning RW/B dose calculations. The applicant's response (letter U7-C-STP-NRC-090103 dated August 12, 2009) provides additional information concerning the bases for the reduced RW/B operating hours. The applicant also proposes a future FSAR revision that summarizes the bases and adds an additional industry reference. Based on the additional information from the applicant and the proposed FSAR revision, the staff found this departure reasonable regarding compliance with the requirements of 10 CFR Part 20. However, the staff cannot consider Question 12.03-12.04-2 closed until the COL FSAR is revised to reflect the proposed revision. This RAI is being tracked as **Confirmatory Item 12.03-12.04-4**.

Supplemental Information

- Occupational Dose

In Section 12.4, the applicant revises the occupational dose rate and estimated occupancy time information for the drywell, the reactor building, and the RW/B to address STD DEP 9.1-1 and STD DEP 11.2-1. Based on the information in Table 12.4-1, "Projected Annual Radiation Exposure," the revised per unit annual estimated radiation exposure is reduced by approximately 8 percent—from the ABWR DCD estimate of 989 person-mSv/year to 909 person-mSv/year (90.9 person-rem/yr). This corresponds to an approximate 41 percent reduction in the average annual radiation exposure when compared to the average annual BWR radiation exposure of 1.54 person-Sv/yr (154 person-rem/yr) in NUREG–0713 Volume 29, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 2007." The reduction in the annual estimated exposure is based entirely on reduced exposure estimates for operating the RW/B. As noted above, NRC staff issued **RAI 3025–Question 12.03-12.04-2** requesting the applicant to provide additional information concerning RW/B dose calculations. As discussed above, the staff found the response acceptable. However, the staff cannot consider Question 12.03-12.04-2 closed until the COL FSAR is revised to reflect the proposed revision. (See **Confirmatory Item 12.03-12.04-4**.)

12.4.5 Post Combined License Activities

There are no post COL activities related to this section.

12.4.6 Conclusion

NRC staff reviewed the COL application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to "Dose Assessment". With the exception of **Confirmatory Items 12.03-12.04-3 and 12.03-12.04-4**, no outstanding information is expected to be addressed in the COL FSAR related to this section.

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

In addition, the staff concluded that the relevant information in the COL FSAR is acceptable and meets the requirements 10 CFR Part 20. The staff based its conclusion on the following:

- The applicant identifies STD DEP 9.1-1, which describes updates of fuel storage and handling equipment. The staff found it reasonable that the departure does not require prior NRC approval.
- The applicant identifies STD DEP 11.2-1, which describes the replacement of Tier 2 Section 11.4.3, "Radwaste Building Dose," of the certified ABWR DCD. The staff found it reasonable that the departure does not require prior NRC approval.
- The applicant identifies STD DEP Administrative Departures for this section. The staff found that these administrative departures do not affect the presentation of any design discussion or the qualification of any design margin. The staff found it reasonable that the departure does not require prior NRC approval.

- Supplemental information provided by the applicant to address occupational dose, remains a confirmatory item, because the COL FSAR has not yet been revised by the applicant to reflect the proposed revision.

12.5 Operational Radiation Protection Program

12.5.1 Introduction

This section of the FSAR addresses the Operational Radiation Protection Program, which is designed to maintain occupational and public doses below regulatory limits and ALARA. The Operational Radiation Protection Program is designed with the following objectives.

- Providing the capability for administrative control of the activities of plant personnel to limit personnel exposure to radiation and to radioactive materials ALARA and within the guidelines of 10 CFR Part 20.
- Providing the capability for administrative control of effluent releases from the plant to maintain the releases ALARA and within the limits of 10 CFR Part 20 and the plant Technical Specifications.

12.5.2 Summary of Application

Section 12.5 of the STP Units 3 and 4 COL FSAR incorporates by reference Section 12.5 of the certified ABWR DCD (Revision 4) referenced in 10 CFR Part 52, Appendix A. No departures from the certified design are identified in the DCD. In addition, in FSAR Section 12.5, the applicant provides the following:

COL License Information Items

- COL License Information Item 12.9 Radiation Protection Program

This COL license information item requires the applicant to provide a description of the operational Radiation Protection Program. The applicant references FSAR Section 12.5S, which in turn references NEI 07-03, as a means to address the needs of this DCD COL license information item.

- COL License Information Item 12.10 Compliance with Paragraph 50.34(f)(2)(xxvii) of 10 CFR Part 50 and NUREG-0737 Item III.D.3.3

COL License Information Item 12.10 describes portable instruments to measure radioiodine concentrations under accident conditions. The applicant is responsible to provide portable instruments to measure radioiodine concentrations in compliance with the requirements of 10 CFR Part 50.34(f)(2)(xxvii) and the guidance in NUREG–0737, Item III.D.3.3. In Subsection 12.5.3.2, the applicant identifies the number of instruments currently available, and states that personnel have been trained, and procedures have been developed to measure radioiodine concentrations.

Supplemental Information

- Access Control

The applicant identifies Very High Radiation Areas (VHRAs) in the facility and provides information concerning the physical and administrative controls to be used for accessing the areas.

12.5.3 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 "Operational Radiation Protection Program" and the associated acceptance criteria are in Section 12.5 of NUREG–0800.

COL License Information Item 12.9 is based on meeting the requirements of 10 CFR Part 20 and the guidelines in RGs 1.70 (Revision 3). Moreover, COL License Information Item 12.9 is satisfied based on following the guidance of RGs 1.8, 1.97, 8.2, 8.8, and 8.10.

COL License Information Item 12.10 is based on meeting the requirements of the mentioned documents. Moreover, COL License Information Item 12.10 is satisfied based on following the guidance of RGs 1.8, 1.33, 8.2, 8.7, 8.8, and 8.10.

12.5.4 Technical Evaluation

As documented in NUREG–1503, NRC staff reviewed the approved Section 12.5 of the certified ABWR DCD. NRC staff reviewed Section 12.5 and 12.5S of the STP Units 3 and 4 COL FSAR. The staff also checked the referenced ABWR DCD to ensure that the combination of information in the COL FSAR and information in the ABWR DCD represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to the operational radiation protection program.

The staff reviewed Sections 12.5 and 12.5S of the COL FSAR, which incorporates by reference the corresponding sections of the referenced DCD. The staff's review confirmed that the information in the application and the information incorporated by reference address the relevant information related to SRP Section 12.5, "Operational Radiation Protection Program."

In addition, the staff reviewed the applicant's proposed resolution to the following COL license information items included under Section 12.5 of the STP COL. In the review, the staff used the applicable sections in the SRP (NUREG–0800) and in RG 1.206 as guidance.

The staff reviewed the information in the STP COL FSAR:

COL License Information Items

- COL License Information Item 12.9 Radiation Protection Program

The applicant provides additional information in Subsection 12.5.3.1 to address the resolution of DCD COL License Information Item 12.9, which states:

[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 applicants will provide, to the level of detail required by RG 1.70, the implementation of a radiation protection program for operational considerations.

FSAR Subsection 12.5.3.1 states that this COL license information item is addressed in FSAR Section 12.5S. Section 12.5S incorporates by reference NEI Template 07-03, with site-specific supplements included in the section, as the operational Radiation Protection Program. NRC staff completed the review and safety evaluation of NEI 07-03, as documented in "Safety Evaluation Regarding the Nuclear Energy Institute Technical Report 07-03 "Generic FSAR Template Guidance For Radiation Protection Program Description" Revision 7.". The template thoroughly describes the Operational Radiation Protection Program including radiation protection facilities, monitoring instrumentation, and equipment to be included in the program.

The generic Radiation Protection Program Description in the NEI 07-03 Template commits an applicant to NRC regulatory requirements and guidance and to acceptance criteria listed in RG 1.206 and Section 12.5 of NUREG–0800. The staff reviewed the final version of NEI Template 07-03 with respect to the operating philosophy for maintaining occupational radiation exposures ALARA, that the management of the licensed facility should be committed to maintaining exposures ALARA, and the personnel responsible for radiation protection should be continually vigilant for means to reduce exposures. NEI Template 07-03 states that the plant management will establish a written policy on radiation protection that is consistent with the guidance in RG 8.10. The radiation protection responsibilities of the Radiation Protection Manager will be consistent with the guidance in RG 8.10 and will include establishing, implementing, and enforcing the Radiation Protection Program. In addition, management is committed to assuring that each individual working at the facility understands and accepts the responsibility to follow radiation protection procedures and instructions provided by radiation protection staff and to maintain his or her dose ALARA. The final accepted version was published by NEI in May 2009 as NEI 07-03A (Revision 0), "Generic FSAR Template Guidance for Radiation Protection Program Description," which is documented in ADAMS document number ML091490684.

The Radiation Protection Program components described in the template include a radiochemistry laboratory, personnel and equipment decontamination facilities, an access control facility, radiation protection offices, portable instrument calibration and respirator facilities, storage and issue areas for contaminated tools and equipment, a machine shop for activated/contaminated components and equipment, a radioactive materials storage area, a facility for dosimetry processing and bioassay, and a laundry facility. The ABWR DCD provides additional information for the personnel decontamination area, radiation protection offices, and a portable instrument calibration facility that is consistent with the template. Equipment to be used for radiation protection purposes includes portable radiation survey instruments, personnel monitoring equipment, fixed and portable area and airborne radioactivity monitors, laboratory equipment, air samplers, respiratory protective equipment, and protective clothing.

The applicant provides implementation schedules and milestones to address Operational Program #10, which is associated with the Radiation Protection Program as required by 10 CFR 20.1101. In Table 13.4S-1 of the STP Units 3 and 4 FSAR, the applicant lists four milestones for the Radiation Protection Program implementation:

(1) before the initial receipt of byproduct, source, or special nuclear materials

(2) before fuel receipt onsite

(3) before fuel loading

(4) before the first shipment of radioactive waste

The Radiation Protection Program is composed of a number of elements that are described in NEI Template 07-03. Because these elements are not specifically mentioned in FSAR Table 13.4S-1, the staff issued **RAI 3013–Question 12.05-2** requesting the applicant to ascertain at which implementation milestone each program element will be implemented. The applicant's response to Question 12.05-2 (letter U7-C-STP-NRC-090113 dated August 20, 2009) states that the corresponding Operational Radiation Protection Program and supporting procedures, as described in Section 12.5 of NEI 07-03, will be in place before the milestones identified in FSAR Table 13.4S-1. The staff found this methodology acceptable. Accordingly, Question 12.05-2 is closed.

The staff issued **RAI 3013–Question 12.05-3** requesting the applicant to provide additional information concerning specific procedures to be developed before each radiation protection milestone. The applicant's response (letter U7-C-STP-NRC-090113 dated August 20, 2009) states that the corresponding operational Radiation Protection Programs and supporting procedures, as described in NEI Template 07-03, will be in place before the milestones identified in FSAR Table 13.4S-1. The staff found this methodology acceptable. Accordingly, Question 12.05-3 is closed.

The staff found that the applicant has adequately described the operational Radiation Protection Program, plant health physics equipment, instrumentation, and facilities to resolve COL License Information Item 12.9. However, the staff cannot find the applicant's reference to this NEI template acceptable until the applicant updates the FSAR to reference the final version of the template. As discussed in Section 12.1, the staff requested a commitment from the applicant in RAI 3013-Question 12.05-4 to update the FSAR by referencing the final version of this template when it is approved by the staff. In response to the staff's request, the applicant has committed to add the accepted version of NEI 07-03 to a future COL application revision. Because the template addresses the applicant's commitment to 10 CFR Part 20 and the guidelines of RG 1.70, the staff cannot consider COL License Information Item 12.9 resolved until the COL FSAR is revised to reflect the accepted version of NEI 07-03. This commitment is being tracked as **Confirmatory Item 12.01-1**.

- COL License Information Item 12.10 Compliance with Paragraph 50.34(f)(2)(xxvii) of 10 CFR Part 50 and NUREG-0737 Item III.D.3.3

The applicant provides additional information in FSAR Subsection 12.5.3.2 to address the resolution of DCD COL License Information Item 12.10, which states:

> COL applicants will provide the portable instruments in operating reactors that accurately measure radio-iodine concentrations in plant areas under accident conditions and will provide training and procedures on the use of these instruments in compliance with Paragraph 50.34 (f) (xxvii) of 10CFR50 and NUREG-0737 Item III.D.3.3.

In addition to COL License Information Item 12.10, equivalent information is required to be provided per COM 1A-3 included in FSAR Section 1A3.3.

The applicant states in Subsection 12.5.3.2 the number of instruments currently available, that personnel have been trained to operate the equipment, and that procedures have been developed to measure radioiodine concentrations. NRC staff issued **RAI 4151–Question**

12.05-6 requesting the applicant to explain the statement that equipment, procedures, and trained personnel are already available when the STP Units 3 and 4 Radiation Protection Program is not yet in place, and equipment acquisition has not yet occurred. This RAI is being tracked as **Open Item 12.05-1**.

Section 12.5S of the COL FSAR references NEI Template 07-03. The staff completed the review and safety evaluation of NEI 07-03 as documented above. In order to address this COL license information item, the licensee must show compliance with 10 CFR 50.34(f)(2)(xxvii) and Item III.D.3.3 of NUREG–0737; 10 CFR 50.34(f)(2)(xxvii) (as supplemented by the criteria in Item III.D.3.3 of NUREG–0737) requires the licensee to provide equipment and associated training and procedures for accurately determining the airborne iodine concentration in areas within the facility where plant personnel may be present during an accident. NEI 07-03 discusses procedures to be used to collect and analyze samples to detect and measure radioiodine. This template states that radiation protection technicians will be trained and qualified under a program established in accordance with 10 CFR 50.120. This training, along with the procedures on radiological surveillance described in NEI 07-03, will ensure that the radiation protection technicians will have the capability of determining the airborne iodine concentrations in areas within the facility, where personnel may be present during an accident and for a broad range of routine conditions. Milestone 1.c. of NEI 07-03 ensures that an adequate number of instruments will be available to provide appropriate detection capabilities and to conduct radiation surveys in accordance with 10 CFR 20.1501 and 10 CFR 20.1502, including the capability to determine the airborne iodine concentration in areas within the facility, where plant personnel may be present during an accident.

The staff found that the applicant provides an adequate description of (a) the portable instruments that accurately measure radioiodine concentrations in plant areas under accident conditions; and (b) the training and procedures provided on the use of these instruments. However, the staff cannot find the applicant's reference to this NEI template acceptable until the applicant updates the FSAR to reference the final version of the template. As discussed above and in Section 12.1, the staff requested a commitment from the applicant in RAI 3013–Question 12.05-4 to update the FSAR by referencing the final version of this template. In response to the staff's request, the applicant has committed to add the accepted version of NEI 07-03 to a future COL application revision. Because the template addresses the applicant's commitment to 10 CFR Part 20 and 10 CFR 50.120, the staff cannot consider COL License Information Item 12.10 resolved until the COL FSAR is revised to reflect the accepted version of NEI 07-03. This commitment is being tracked as **Confirmatory Item 12.01-1**.

In addition, the staff cannot conclude that COL License Information Item 12.10 is resolved until the applicant provides a response to Question 12.05-6. (See **Open Item 12.05-1**.)

Supplemental Information

- Access Control

The COL applicant identifies three VHRAs in COL Subsection 12.5S.4.4 that require additional administrative controls for access. The applicant also references plant layout drawings located in FSAR Section 12.3. Additionally, COL Section 12.5S references NEI 07-03. Subsection 12.5.4.4 of NEI 07-03 describes access control to ensure compliance with 10 CFR 20.1902, 10 CFR 20.1903, 10 CFR 20.1601, and 10 CFR 20.1602. Subsection 12.5.4.4 of NEI 07-03 identifies additional site-specific information to be included in the COL:

(1) anticipated frequency of accessing each VHRA

(2) detailed drawings for each VHRA that indicate physical barriers

The COL does not contain information about anticipated frequency of access or detailed drawings that provide sufficient information to fully assess the physical barriers. NRC staff issued **RAI 2820–Question 12.05-1** requesting the applicant to provide additional information about VHRA access control. The applicant's response (letter U7-C-STP-NRC-090103 dated August 12, 2009) provides generic information concerning expected VHRA access control, describes physical barriers to preclude personnel access, and references NEI 07-03A. According to NEI 07-03A, access control guidelines will be consistent with the guidelines of RG 8.38, "Control of Access to High and Very High Radiation Areas in Nuclear Power Plants." However, the applicant does not propose an FSAR revision to include the information in the COL. Accordingly, Question 12.05-1 was closed as unresolved and the staff issued supplemental **RAI 3856–Question 12.05-5** requesting the applicant to provide additional information**.** This RAI is being tracked as **Open Item 12.05-2**.

The staff's review of this section noted that illustrative examples of facility vital area access paths, identification of source locations, and associated mission doses for post-accident access are not included in the COL FSAR or the ABWR DCD. The staff issued **RAI 3119–Question 12.03-04-8** requesting the applicant to provide additional information about post-accident vital area access paths and mission doses. The applicant's response (letter U7-C-STP-NRC-090122 dated August 26, 2009) reiterates that the information is in NUREG–1503 Volume 1 Section 12.2.2, Subsection 12.3.5.1, Section 12.3.6, and Subsection 14.3.3.2 concerning Plant Shielding DAC. The applicant also referenced the ABWR DCD ITAAC included in Tier 1 Table 3.2a, "Plant Shielding Design." ABWR DCD ITAAC Tier 1, Table 3.2a is incorporated by reference in the STP 3 and 4 FSAR. The table identifies the confirmatory shielding analyses and evaluations that must be completed to verify that the final plant design provides radiation shielding commensurate with the occupancy requirements for routine and AOO conditions, as well as permits plant personnel to perform required safety functions in vital areas of the plant, including access and egress of the areas under accident conditions. Based on the applicant's response, and on additional staff review of the radiation zone maps, post-accident access information, and Tier 1 Table 3.2a DAC in NUREG–1503, the staff found that the applicant has adequately addressed post-accident vital area access. Accordingly, Question 12.03-12.04-8 is closed.

12.5.5 Post Combined License Activities

There are no post COL activities related to this section.

12.5.6 Conclusion

The NRC staff's finding related to information incorporated by reference is in NUREG–1503. NRC staff reviewed the COL application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to "Operational Radiation Protection Program." With the exception of **Open Items 12.05-1 and 12.05-2 and Confirmatory Item 12.01-1**, no outstanding information is expected to be addressed in the COL FSAR related to this section. As a result of these open and confirmatory items, the staff is unable to finalize the conclusions relating to "Operational Radiation Protection Program" in accordance with NRC requirements.