

## 11.0 RADIOACTIVE WASTE MANAGEMENT

### 11.1 Source Terms

This section addresses the sources of radioactivity that are generated within the core and that have the potential to leak into the reactor coolant system during normal operations, including anticipated operational occurrences (AOOs), as a result of defects in the fuel cladding. The radioactive source terms are used to identify the potential dose to members of the public and plant operators as a result of normal plant operation. This discussion includes consideration of parameters used to determine the: (1) concentration of each isotope in the reactor coolant and steam, (2) fraction of fission product activity released into the reactor coolant, and (3) concentrations of all nonfission product radioactive isotopes in the reactor coolant.

Section 11.1 of the South Texas Project (STP) combined license (COL) Final Safety Analysis Report (FSAR) Revision 12, incorporates by reference Section 11.1, "Source Terms," of the certified Advanced Boiling-Water Reactor (ABWR) design control document (DCD) Revision 4, referenced in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," Appendix A, "Design Certification Rule for the U.S. Advanced Boiling Water Reactor," with one departure (STD DEP 10.1-3) and no supplements. The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remains for review.<sup>1</sup> The staff's review confirmed that there is no outstanding issue related to this section and one departure that does not require NRC approval. Pursuant to 10 CFR 52.63(a)(5) and 10 CFR Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the source terms have been resolved.

#### Tier 2 Departure Not Requiring Prior NRC Approval

- STD DEP 10.1-3 Rated Heat Balance

This departure corrects the heat balance resulting from the replacement of General Electric's turbine design by Toshiba's design. It increases the steam flow rate from 7.63E+06 kilograms per hour (kg/hr) (1.68E+07 pounds per hour [lb/hr]) to 7.65E+06 kg/hr (1.69E+07 lb/hr) (an increase of less than 0.3 percent) as described in Table 11.1-6, "Plant Parameters for Source Term Adjustment." This increase will have a negligible effect on the source term used in the design of the radwaste management systems.

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

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<sup>1</sup> 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.

## **11.2 Liquid Waste Management System**

### **11.2.1 Introduction**

The liquid waste management system (LWMS) controls, collects, processes, handles, stores, and disposes of liquid radioactive waste generated as the result of normal operation, including AOOs. The LWMS reduces and controls radioactive releases into the environment. The LWMS has four major subsystems where liquid wastes from various plant systems can be segregated and processed separately. The major subsystems of the LWMS are the following:

1. Equipment (low-conductivity) drain subsystem.
2. Floor (high-conductivity) drain subsystem.
3. Chemical drain subsystem.
4. Detergent drain subsystem.

The design basis of the various subsystems relies on mobile mixed bed demineralizers, charcoal beds and cartridge filters, reverse osmosis, and organic and neutralization treatments with specified minimum design objectives. Cross-connections between subsystems provide additional flexibility in processing wastes by using alternate methods and redundancy if one subsystem is inoperative. The LWMS normally operates on a batch basis. The system provides for: (1) sampling at several process points, (2) administrative controls, and (3) the detection and alarm of abnormal conditions against accidental discharges into the environment. The LWMS is located in the radwaste building (RWB). Airborne releases from LWMS components (e.g., tanks) and ventilation exhaust systems servicing radiologically controlled areas are directed through the RWB stack.

### **11.2.2 Summary of Application**

The applicant completely replaces Tier 2, Section 11.2 of the certified ABWR DCD, Revision 4, including all subsections, figures, and tables. In Section 11.2 of Revision 12 of the STP COL FSAR, the applicant provides the following:

#### 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 RWB below grade and the basement, are classified as Seismic Category I. This departure revises the seismic category of the RWB substructure from Seismic Category I to non-seismic.

This Tier 1 departure was not listed in Section 11.2 but changing the design of the RWB, which houses the solid and liquid radwaste processing systems, affects the review of Sections 11.2 and 11.4.

Tier 2 Departure Not Requiring Prior NRC Approval

- STD DEP 11.2-1 Liquid Radwaste Process Equipment

This departure changes the design of the LWMS from permanent liquid waste processing components to mobile liquid waste processing modules, along with a reduction in the number and capacities of the pumps and tanks. Thus, no part of ABWR DCD Section 11.2 is incorporated by reference.

COL License Information Item

- COL License Information Item 11.1 Plant-Specific Liquid Radwaste Information

This COL license information item addresses various components of the liquid radwaste system:

1. Compliance with 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents," and the guidelines in American National Standards Institute (ANSI) N13.1, "Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities"; Regulatory Guide (RG) 1.21, Revision 1, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants"; and RG 4.15, Revision 2, "Quality Assurance for Radiological Monitoring Programs (Normal Operation)—Effluent Streams and the Environment," shall be provided.
2. A radiation monitor in the discharge line that will automatically terminate liquid waste discharges from the low conductivity waste (LCW), high conductivity waste (HCW), or the detergent waste subsystem if radiation measurements exceed a predetermined level set by the COL applicant to meet 10 CFR Part 20, "Standards for Protection against Radiation," Sections 1001 through 2402, and 10 CFR Part 20, Appendix B, "Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage," Table 2, "Effluent Concentrations," Column 2 for the applicable subsystem shall be provided.
3. Specific administrative controls and liquid effluent source terms to limit the liquid wastes to 1 Curie/year (3,700 MBq/yr) (excluding tritium) shall be provided.
4. Procedures for demonstration of compliance with 10 CFR Part 50, Appendix I, Sections II and III shall be provided.
5. Administrative controls to limit the instantaneous discharge concentrations of the radionuclides in liquid effluents to an unrestricted area to within 10 times the limits in 10 CFR Part 20, Appendix B, Table 2, Column 2, shall be provided.
6. Quality assurance (operations) provisions of the liquid radwaste systems shall be provided.

### Supplemental Information

The applicant provides the following supplemental information:

- Subsection 11.2.1.2.4, “Minimization of Contamination and Radwaste Generation”

The applicant added Subsection 11.2.1.2.4, to address compliance with 10 CFR 20.1406, “Minimization of contamination.” The applicant also addresses the condensate storage tank design and conformance to IE Bulletin 80-10, “Contamination of Nonradioactive System and Resulting Potential for Unmonitored, Uncontrolled Release of Radioactivity to Environment,” and Branch Technical Position (BTP) 11-5, “Postulated Radioactive Releases Due to Liquid-Containing Tank Failures Review Responsibilities.”

- Pre-operational Tests:

The applicant adds Subsection 11.2.6, “Testing and Inspection Requirements” to the LWMS system. This includes a discussion of the preoperational test program and integrity test upon completion of the system.

### **11.2.3 Regulatory Basis**

The relevant requirements of the Commission regulations for the LWMS and associated acceptance criteria are in Section 11.2 of NUREG–0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, (LWR Edition)” (the Standard Review Plan (SRP)). In particular, the regulatory basis for reviewing and accepting the information for the LWMS is in:

- 10 CFR 20.1406
- 10 CFR 50.34a(d).
- General Design Criteria (GDC) 60, “Control of releases of radioactive materials to the environment.”
- GDC 61, “Fuel storage and handling and radioactivity control.”
- 10 CFR Part 50, Appendix I, Section IID.
- 10 CFR Part 71, “Packaging and Transportation of Radioactive Material.”
- Inspection and Enforcement (IE) Bulletin 80-10, “Contamination of Nonradioactive System and Resulting Potential for Unmonitored, Uncontrolled Release to Environment.”

SRP acceptance criteria include codes and standards listed in:

- RG 1.143, Revision 2, “Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants.”
- RG 1.109, Revision 1, “Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I.”

- RG 1.110, “Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors (for Comment),” issued March 1976.
- RG 1.112, Revision 1, “Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light-Water-Cooled Power Reactors.”
- RG 1.113, Revision 1, “Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I.”
- RG 4.21, “Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning.”
- BTP 11-6, in NUREG–0800, Revision 3, “Postulated Radioactive Releases Due to Liquid-Containing Tank Failures.”

RG 1.140, “Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants,” addresses the design considerations of ventilation systems described in FSAR Section 9.4, “Air Conditioning, Heating, Cooling and Ventilating Systems,” for building exhaust systems and venting tanks and vessels. SRP Section 11.2 (NUREG–0800), contains complete descriptions of the applicable regulatory and acceptance criteria.

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

#### **11.2.4 Technical Evaluation**

As documented in NUREG–1503, “Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design, Main Report,” the staff reviewed and approved Section 11.2 of the certified ABWR DCD. The staff reviewed Section 11.2 of the STP Units 3 and 4, COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.<sup>1</sup> The staff’s review confirmed that the information in the application addresses the required information relating to the LWMS.

The applicant provides new and revised information on the STP, Units 3 and 4, LWMS. The staff reviewed the application using the guidance of SRP Section 11.2 and RG 1.206, “Combined License Applications for Nuclear Power Plants (LWR Edition),” Regulatory Position C.I.11.2.

The staff reviewed the following information in the COL FSAR:

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

### Tier 1 Departure

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

Each STP unit has its dedicated RWB. This Tier 1 departure revises the seismic category of the RWB substructure from Seismic Category I to non-seismic. Because radioactive waste management structures, systems, and components are located inside the RWB, the design of the RWB will follow the guidance in RG 1.143, Revision 2.

RG 1.143 provides design guidance for the protection of radioactive waste management systems from natural and man-induced hazards. It also addresses the relationship between the liquid, gaseous, and solid radioactive waste systems described in FSAR Chapter 11, the radioactive waste structures described in Section 3.8.4, "Other Seismic category I Structures," and the Section 12.2 radiological source terms contained in these systems and structures. Because this RG covers all radioactive waste forms including liquid, gaseous, and solid radioactive waste and associated structures, systems, and components (SSCs) reviewed in various chapters in this safety evaluation report (SER), this section will encompass and discuss overall compliance for all the SSCs described in the RG. This section will be referred to in the related SER chapter discussions.

RG 1.143, Revision 2 allows for two different structural classifications (RW-IIa or RW-IIb) for buildings housing radwaste systems, and components based on the radiological inventories contained within the buildings. For any postulated unmitigated release of the maximum inventory from the building, if the dose to workers is less than or equal to 5 rem and the dose to members of the public (at the boundary of the protected area) is less than or equal to 100 mrem, then the radioactive waste building can be classified as RW-IIb (Note that RG 1.143, Revision 2 states that the public dose limit is 500 mrem, however, SRP Section 11.2 states that this value should be 100 mrem and not 500 mrem, in accordance with 10 CFR Part 20). If either the dose to the worker or the dose to a member of the public would exceed these values during an unmitigated release, the building should be classified as RW-IIa.

In Revision 4 of the STP, Units 3 and 4, COL FSAR, Appendix 3H, the applicant classified the RWB as RW-IIb, in accordance with RG 1.143, Revision 2. However, the applicant did not provide any justification for the RW-IIb building classification, as stated in RG 1.143. Therefore, the staff issued request for additional information (RAI) 03.08.04-37 requesting that the applicant demonstrate that the RW-IIb building classification was appropriate for the STP, Units 3 and 4, RWB. In its response to RAI 03.08.04-37 (ML11257A136), dated September 8, 2011, the applicant credited plant operating procedures and various building features in determining that doses to workers and members of the public would not exceed the dose limits provided in RG 1.143, Revision 2. The staff determined that this approach was unacceptable because the unmitigated dose calculation described in RG 1.143, Revision 2 is not intended to provide credit for dose mitigating features such as building design features or operational procedures.

Subsequently, the applicant provided supplemental calculations to assess the unmitigated doses to workers and members of the public. The staff performed a two-part audit of these calculations on November 9, 2011, and February 8, 2012. In reviewing the applicant's calculations, the staff determined that the applicant's calculations were unacceptable because they credited various passive building design features in determining the unmitigated dose to workers and members of the public. The staff's detailed audit findings can be found in "Nuclear

Regulatory Commission Staff Audit of the South Texas Project, Units 3 and 4, Regulatory Guide 1.143, Revision 2, Radioactive Waste Building Calculated Dose Rates” (ML120730602).

The applicant responded to the staff’s audit report by a letter dated April 25, 2011 (ML12121A378), which disputed several conclusions the staff reached in the audit report. The staff disagreed with many of the conclusions reached by the applicant in its response letter, including the applicant’s conclusion that the staff should accept the STP, Units 3 and 4, RWBs as RW-IIb, based on the information provided. Therefore, the staff issued RAI 03.08.04-39 requesting that the applicant either provide a calculation consistent with RG 1.143, Revision 2 guidance to justify a RW-IIb RWB classification or re-classify the RWBs as RW-IIa, and closed RAI 03.08.04-37.

In its response to RAI 03.08.04-39 (ML12289A111), dated October 8, 2012, the applicant committed to re-classify the STP RWBs as RW-IIa in Appendix 3H of the COL FSAR. The applicant did not provide an unmitigated dose calculation with its response. However, since RW-IIa is the most robust building classification provided in RG 1.143 Revision 2, the staff finds the response acceptable. In supplemental responses (ML13037A595 and ML13025A274), dated January 3, 2013 and January 22, 2013, respectively, the applicant provided additional information regarding the classification of individual systems and components in the RWB in Table 3.2-1, “Classification Summary,” of the FSAR. Systems and components were classified by comparing the Section 12.2 source terms for individual components to the  $A_1$  and  $A_2$  values in 10 CFR Part 71, “Packaging and Transportation of Radioactive Material,” as described in RG 1.143, Revision 2, Regulatory Position 5.3. The staff found that individual systems and components were classified appropriately, in accordance with the RG and confirmed that these proposed changes were implemented in Revision 9 of the FSAR. Therefore, RAI 03.08.04-39 is resolved and closed.

In conjunction with the review of the RWB structure classification issue, the staff discovered that the SSCs associated with the offgas system (OGS) (located in the turbine building) and the radwaste tunnel, were not classified in accordance with RG 1.143, Revision 2, even though RG 1.143, Revision 2 was referenced for these SSCs. Therefore, the staff issued RAI 03.08.04-38, requesting the applicant to classify these SSCs in accordance with RG 1.143, Revision 2, and provide a basis for these classifications. In its response to RAI 03.08.04-38 (ML12289A111), in combination with its response to RAI 03.08.04-39, dated October 8, 2012, the applicant classified the radwaste tunnels as RW-IIa in Appendix 3H of the COL FSAR.

In addition, the applicant provided a FSAR markup in Table 1.8-20, “NRC Regulatory Guides Applicable to ABWR,” that utilized Revision 1 of RG 1.143 for the OGS guidance. Since the ABWR DCD references Revision 1 of RG 1.143, the staff determined that it is acceptable for the COL applicant to reference Revision 1 of the RG for the offgas vault, provided that the applicant does not make changes to the SSCs that would affect compliance with RG 1.143, Revision 1. The staff reviewed Departure STD DEP 11.3-1 “Gaseous Waste Management System,” the only departure related to offgas SSCs, and determined that it does not significantly change the design of the offgas vault or change the source term associated with the offgas vault. Therefore, the departure did not affect compliance with RG 1.143, Revision 1. In addition, none of the other departures associated with the turbine building had any effect on the integrity or protection of the offgas vault. Because the ABWR DCD references Revision 1 of RG 1.143, it is acceptable for the COL applicant to reference Revision 1 of the RG for the offgas vault. The staff found the response to RAI 03.08.04-38 acceptable and confirmed that the proposed FSAR changes were implemented in Revision 9 of the FSAR. Therefore, RAI 03.08.04-38 is resolved and closed.

### Tier 2 Departure Not Requiring Prior NRC Approval

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

- STD DEP 11.2-1 Liquid Radwaste Process Equipment

This departure completely replaces the previously approved LWMS design in NUREG-1503. This replacement includes deleting liquid waste processing components, tanks, and pumps and using modular equipment. The applicant identified this departure as not requiring prior NRC review and approval. In Section 3 of Part 7, "Departures Report," of the COL application, the applicant indicated that this standard departure has been evaluated and determined to comply with the requirements of 10 CFR Part 52, Appendix A, Section VIII.B.5. However, the staff was not able to determine the acceptability of the applicant's evaluation in addressing Criteria (2) and (4) in 10 CFR Part 52, Appendix A, Section VIII.B.5.b.

Accordingly, the staff audited the applicant and conducted an independent evaluation to determine whether the applicant's evaluation of this departure complies with Section VIII of Appendix A to Part 52 (ML092510426). As a result of the audit, the staff issued RAI 11.02-5 requesting the applicant to re-evaluate the initial departure evaluations and to determine whether Departure STD DEP 11.2-1 "would" impact a system malfunction or cause a malfunction with a different result.

In its response to RAI 11.02-5, dated November 16, 2009 (ML093220188), the applicant provided sufficient design details to conclude that it evaluated the LWMS departure in accordance with 10 CFR Part 52. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections. The staff reviewed the applicant's response to RAI 11.02-5 and found that it meets the STP change procedure and addresses the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. Therefore, RAI 11.02-5 is resolved and closed.

### COL License Information Item

- COL License Information Item 11.1 Plant-Specific Liquid Radwaste Information

ABWR DCD Tier 2, Subsection 11.2.5.1, "COL License Information," states that the COL applicant shall provide several COL license information items that apply on a plant-specific basis. For the STP COL application, these COL license information items are addressed as follows:

The COL applicant shall provide the following items on a plant-specific basis:

1. DCD COL License Information Item 11.1, Item 1 states that the applicant shall "[c]ompl[y] with Appendix I to 10 CFR 50 and the guidelines given in ANSI Std. N13.1, 'Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities,' Regulatory Guide (RG) 1.21, 'Measuring and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants,' and RG 4.15, Revision 1, 'Quality Assurance for Radiological Monitoring Programs (Normal Operation)—"

Effluent Streams and the Environment.” The applicant’s conformance with this COL information item is described in FSAR Section 12.2.2.4 with the QA aspects described in FSAR Subsection 11.5.7S.

In Section 11.2.5, “COL License Information,” the applicant committed to comply with Appendix I to 10 CFR Part 50 and refers to DCD Subsection 12.2.2.4 to describe how this compliance will be accomplished for liquid and gaseous effluents. The staff’s review found that DCD Subsection 12.2.2.4 did not describe how compliance with Appendix I to 10 CFR Part 50 is accomplished. The staff also found that RG 4.15 is discussed in Section 11.2.5 of the FSAR but it was not listed in Section 1.9, “COL License Information,” or in Section 1.9S, “Conformance with Regulatory Criteria,” as a RG utilized in this FSAR. The staff requested the applicant to appropriately incorporate RG 4.15 into the FSAR.

The staff issued RAI 11.02-10 requesting the applicant to describe how compliance with Appendix I to 10 CFR Part 50 will be accomplished and how the applicant will reference RG 4.15 in the FSAR.

In its response to RAI 11.02-10, dated June 10, 2010 (ML101650103), the applicant stated that the reference to RG 4.15 Revision 1 would be inserted into Section 1.9S in the next revision of the FSAR as a utilized RG. The applicant also referred to revised Section 11.5.7S, “Additional Information,” concerning the use of RG 4.15 for sampling, analyzing, and testing radioactive effluent samples.

The applicant also changed the numbering of FSAR Subsection 12.2.2.2 to Subsection 12.2.2.4. Revised Sections 11.5.7S and 11.2.5 now refer to this subsection for compliance with 10 CFR Part 50, Appendix I. The staff confirmed that the proposed changes were incorporated in Revision 4 of the FSAR. Therefore, RAI 11.02-10 is resolved and closed.

### **Compliance with the Cost-Benefit Ratio in 10 CFR Part 50, Appendix I**

To assess compliance with the numerical guidance in Section II.D in Appendix I to 10 CFR Part 50, the staff evaluated the methodology used to determine the cost-benefit ratio against the guidance in RG 1.110. Because the staff was unable to determine whether the applicant conformed to the guidance in RG 1.110, the staff issued RAI 11.02-1. In its response to RAI 11.02-1, dated April 23, 2009 (ML091170081), the applicant stated that the required information is available for review. Therefore, RAI 11.02-1 was closed as unresolved. The staff issued supplemental RAI 11.02-6 and requested the same information requested in RAI 11.02-1. In its response to this RAI dated October 12, 2009 (ML092890082), the applicant provided all of the required information and calculations justifying the information in FSAR Section 11.2, concerning the LWMS cost-benefit analysis.

The results of the applicant’s analysis show that the lowest cost option for liquid radwaste treatment system augment is a 10,000 gallon hold-up tank, at a capital cost of \$14,343, to the LWMS effluent stream before entry into the discharge canal. Assuming that this tank will eliminate all radioactivity from the liquid effluent, the resulting benefit in terms of person-rem dose reduction was \$3 per total body dose. This benefit is below the \$14,343 cost to augment the radwaste

system with a 10,000 gallon hold-up tank, as calculated in accordance with RG 1.110. The applicant therefore concluded that the LWMS meets as low as reasonably achievable (ALARA) requirements and requires no augments.

The staff performed an independent assessment using the staff's calculated population doses (see safety evaluation report [SER] Section 12.2) and the guidance in RG 1.110 and arrived at the same conclusion. Because the staff's population doses differ from the applicant's doses, the staff obtained different but acceptable cost-benefit ratios for the addition of a 10,000 gallon hold-up tank to the LWMS effluent stream before entry into the discharge canal. SER Table 11.2-1, lists the costs and benefits calculated by the applicant and the staff for comparison. Accordingly, RAI 11.02-1 and RAI 11.02-6 are resolved and closed.

**Table 11.2-1 Comparison of Costs and Benefits to Augment the LWMS**

<b>Organ/Body</b>	<b>Applicant's Calculated Benefits *</b>	<b>Applicant's Calculated Costs</b>	<b>NRC's Calculated Benefits *</b>	<b>NRC's Calculated Costs</b>
Total Body	\$3	\$14,343	\$403	\$14,343
Thyroid	\$3	\$14,343	\$112	\$14,343

\* Based on liquid effluent population doses in SER Section 12.2.

2. DCD COL License Information Item 11.1, Item 2 states that "A radiation monitor in the discharge line automatically terminates liquid waste discharges from the sample tanks in the LCW, HCW or detergent waste subsystem if radiation measurements exceed a predetermined level set to meet 10 CFR Part 20, Sections 1001–2402 and Appendix B, Table 2, Column 2 for the applicable subsystem is provided."

In Section 11.5, "Process and Effluent Radiological Monitoring and Sampling Systems," the applicant stated that a radiation monitor in the discharge line is required for plant operations to monitor liquid discharges from the radwaste system and to alarm and initiate an automatic closure of the waste discharge valve on the affected treatment system. The operation limits for this monitor are specified in the Offsite Dose Calculation Manual (ODCM) as required by RG 1.21, Revision 1.

The staff found this information acceptable because having a monitor with automatic isolation capabilities is an acceptable method for meeting the requirements in 10 CFR 50.34a(d) and GDC 60 and 61. The monitoring system for process and effluent radiological monitoring and sampling systems are also addressed in Section 11.5 of the FSAR. Therefore, the applicant has adequately addressed COL License Information Item 11.1, Item 2.

3. DCD COL License Information Item 11.1, Item 3 states that “Specific administrative controls and liquid effluent source terms to limit the liquid wastes to 3700 MBq/yr (1 Curie/yr) (excluding tritium) shall be provided.”

In Section 11.2, the applicant stated that the ODCM will provide specific administrative controls and liquid effluent source terms to limit the liquid wastes to 3,700 MBq/yr (1 Curie/yr) (excluding tritium). The ODCM will be implemented per the schedule in Table 13.4S-1, “Operational Programs Required by NRC Regulation and Program Implementation.”

The staff found this information acceptable because this COL license information item is addressed in Section 11.2 and in FSAR Table 13.4S-1. Therefore, the applicant has adequately addressed COL License Information Item 11.1, Item 3.

4. DCD COL License Information Item 11.1, Item 4 states that “Procedures for demonstration of compliance with 10 CFR Part 50, Appendix I, Sections II and III shall be provided.”

The applicant stated that the Process and Effluent Monitoring and Sampling Program has specific procedures for complying with 10 CFR Part 50, Appendix I, Sections II and III. This program requires specific procedures for implementing the ODCM and the Radiological Environmental Monitoring Program (REMP). The requirements in these programs comply with 10 CFR Part 50, Appendix I and will be implemented per the schedule in Table 13.4S-1.

The staff found this information acceptable because this COL license information item is addressed in Section 11.5 and in FSAR Table 13.4S-1. Therefore, the applicant has adequately addressed COL License Information Item 11.1, Item 4.

5. DCD COL License Information Item 11.1, Item 5 states that there will be “Administrative controls to limit the instantaneous discharge concentrations of the radionuclides in liquid effluents to an unrestricted area to within 10 times the limits in 10 CFR Part 20, Appendix B, Table 2, Column 2.”

In Section 11.2, the applicant stated that the ODCM has administrative controls to limit the instantaneous discharge concentrations of the radionuclides in liquid effluents to an unrestricted area to within 10 times the limits in 10 CFR Part 20, Appendix B, Table 2, Column 2, and will be implemented per the schedule in FSAR Table 13.4S-1.

The staff evaluated this information item in SER Sections 11.5 and 13.4, “Review and Audit.”

6. DCD COL License Information Item 11.1, Item 6 states that “Quality assurance (operations) provisions of the liquid radwaste systems shall be provided.”

The applicant stated that the nonsafety-related SSC Quality Control Program for the LWMS is described in the STP, Units 3 and 4, Quality Assurance Program Description in FSAR Section 17.5S, “Quality Assurance Program Guidance.”

The staff evaluated this information item in SER Section 17.5S.

## Supplemental Information

### **Compliance with 10 CFR 20.1406**

FSAR Subsection 11.2.1.2.4, addresses general compliance with 10 CFR 20.1406 and RG 4.21, as they relate to facility design and operational procedures for permanently installed subsystems in minimizing the contamination of the facility and the generation of radioactive waste. In addition, the DCD commits the COL applicant to follow the guidance of IE Bulletin 80-10, "Contamination of Nonradioactive System and Resulting Potential for Unmonitored, Uncontrolled Release to Environment," to: (1) avoid the cross-contamination of nonradioactive systems, and (2) avoid unmonitored and uncontrolled radioactive releases into the environment.

The applicant also demonstrated compliance with the requirements of GDC 60 and 61 by addressing the guidelines of RG 1.143 in the design of the radioactive waste processing systems and the RWB that houses these systems (under Tier 1 departure STD DEP 2.15-1, "Re-classification of RWB Substructure from Seismic Category I to Non-Seismic"). Section 3.8.4 of this SER describes, in detail the evaluation of the RWB design described in this Tier 1 departure, including its design features to address natural phenomena hazards, internal and external hazards. In addition, the quality assurance provisions for radioactive waste management SSCs, as described in FSAR Sections 11.2 and 12.2 and FSAR Table 3.2-1, and confirming the installation of steel liners in cubicles where liquid radioactive waste tanks are located demonstrate that GDC 60 and 61 are met. These design commitments also fulfill the requirements of 10 CFR 20.1406 and the guidance of RG 4.21, in minimizing the contamination of the facility and the generation of radioactive waste, and ensure conformance with IE Bulletin 80-10 in avoiding the cross-contamination of nonradioactive systems and unmonitored and uncontrolled radioactive releases into the environment. The staff found this approach acceptable.

Chapter 12.3, "Radiation Protection," of this SER discusses the procedural and operational program aspect of compliance with 10 CFR 20.1406.

### **Conformance with IE Bulletin 80-10**

The guidance in IE Bulletin 80-10 includes information on the identification and restriction of non-contaminated systems that have the potential of becoming contaminated. In FSAR Subsection 11.2.1.2, "Design Criteria," the applicant committed to procedures ensuring that the guidance and information in IE Bulletin 80-10 are followed.

Subsection 11.2.1.2.4 addresses design requirements to: (1) minimize contamination of the facility and the environment, (2) facilitate decommissioning, and (3) minimize the generation of radioactive waste in compliance with 10 CFR 20.1406. The staff found the applicant's commitment to use the guidance in IE Bulletin 80-10 to prevent the contamination of nonradioactive systems, acceptable.

### **Condensate Storage Tank**

The staff reviewed various DCD sections and FSAR Sections 9.2.4, "Potable and Sanitary Water System," 9.2.9, "Makeup Water Condensate System," 11.2.1, "Design Basis," 11.2.2, "System description," and 11.2.3, "Estimated Releases," to determine the design, function, and relationship of the condensate storage tank (CST) with the LWMS and compliance with 10 CFR Part 20. The staff issued RAIs 11.02-7, 11.02-8, and 11.02-9, requesting the applicant to provide: (1) the CST radioactive source terms and volumes; (2) the actual location of the CST

and information that addresses 10 CFR 20.1406 concerns; and (3) the CST radioactive source term inventory addressing the concentration limits, the associated dose rates surrounding the tank, and data similar to all other tanks in the LWMS. The applicant responded to these RAIs in a letter dated December 30, 2009 (ML100050183). RAIs 11.02-7, 11.02-8, and 11.02-9 were tracked as open items in the SER with open items.

The staff reviewed the applicant's responses to RAIs 11.02-7 and 11.02-9. The applicant referred to its response to RAI 11.02-7 for both of these RAIs, and staff found the response unacceptable. Subsequently, RAI 12.02-18 was issued to track the open CST issue, which has been resolved in Section 12.2, "Radiation Sources," of this SER. Therefore, RAIs 11.02-7 and 11.02-9 are resolved and closed. The response to RAI 11.02-8 provided proposed changes to Subsection 11.2.1.2.4 of the FSAR concerning: (1) the CST location outdoors; (2) equipping the CST with alarms in the control room to monitor the liquid levels, all tank overflows, and drains and sample lines routed to the LWMS; and (3) providing a dike around the CST with a drain line routed to the LWMS from the surrounding dike. The staff found the proposed FSAR changes acceptable and confirmed that they were implemented in Revision 4 of the FSAR. Therefore, RAI 11.02-8 is resolved and closed.

### **Conformance with BTP 11-6**

The staff reviewed FSAR Subsection 15.7.3.1 in reference to BTP 11-6. The staff determined that the LWMS design includes the use of steel-lined compartments containing liquid radwastes up to a height capable of containing the release of all liquid radwastes into the LWMS compartment. Because of the design capabilities, the guidance in BTP 11-6 assumes that there will not be any major accident releasing liquid radwastes into the environment via the liquid pathway. The staff found that the consequences of an accidental failure of the LWMS would be mitigated by the design of the RWB. However, this analysis did not include an evaluation of the outdoor CST. The applicant addressed this evaluation in its RAI responses in FSAR Sections 11.2 and 2.4.13 and in part of the response to RAI 12.02-18, which is evaluated in Section 12.2 of this SER.

### **Preoperational Tests**

In COL FSAR Subsection 14.2.12.1.75, "Liquid and Solid Radwaste Systems Preoperational Tests," and in FSAR Subsection 14.2.12.2.38, "Liquid Radioactive Waste Management System Performance," the applicant stated that the LWMS will be tested during the Preoperational Test Program. The LWMS equipment will be performance tested to demonstrate conformance with design process capabilities. The LWMS shall be capable of collecting, processing, and controlling the liquid wastes as designed such that the release of radioactive liquid effluents remain within the limits specified by the plant technical specifications (TS) or license conditions. The staff found this testing acceptable because it conforms to the guidance in SRP Section 14.2 and SRP Section 11.2 and because these tests determine the correct installation and functional operability of the system equipment.

#### **11.2.5 Post Combined License Activities**

There are no post COL activities related to this section.

#### **11.2.6 Conclusion**

The staff reviewed the STP, Unit 3 and 4, COL FSAR and checked the referenced ABWR DCD. The staff's review confirmed that the application has addressed the required information relating

to this section. There is no additional outstanding information expected to be addressed in the COL FSAR related to this section.

In addition, the staff compared the information in the COL application to the relevant NRC regulations, and the guidance in Section 11.2 of NUREG-0800. The staff's review concluded that the applicant has provided sufficient information to satisfy NRC regulations. The staff found it reasonable that the identified Tier 2 departure is characterized as not requiring prior NRC approval per 10 CFR Part 52 Appendix A, Section VIII.B.5.

The staff evaluated the classification of the RWBs in Tier 1 STD DEP 2.15-1, and found the RW-IIa classification in accordance with RG 1.143, Revision 2, to be acceptable. The structural evaluation of this Tier 1 departure is in Section 3.8, "Seismic Category I Structures," of this SER.

The staff also concluded that the LWMS includes the equipment necessary to control releases of radioactive materials in liquid effluents in accordance with GDC 60 and 61 in Appendix I to 10 CFR Part 50 and the requirements of 10 CFR 50.34a(d). The staff concluded that the LWMS design is acceptable and meets the requirements of 10 CFR 20.1406, 10 CFR 50.34a(d), GDC 60 and 61, and 10 CFR Part 50, Appendix I, Section II.D.

These conclusions are based on the following considerations:

1. By preparing a plant-specific, cost-benefit analysis in accordance with RG 1.110, the applicant meets the requirements of 10 CFR Part 50, Appendix I, Section II.D with respect to meeting the ALARA criterion using site-specific conditions. The staff considered the potential effectiveness of augmenting the LWMS using items of reasonably demonstrated technology. The staff determined that further effluent treatment will not affect reductions in cumulative population doses reasonably expected within an 80-kilometer (km) (50-mile [mi]) radius of the reactor, at a cost of less than \$1,000 per total body person-rem or thyroid person-rem.
2. The applicant meets the requirements of GDCs 60 and 61 with respect to controlling releases of radioactive materials into the environment, by assuring that the LWMS design includes the equipment to monitor and control releases of radioactive materials in liquid effluents. A radiation monitor tracks all releases, and it will generate a signal to terminate liquid radwaste releases before the discharge concentration exceeds a predetermined setpoint. The COL applicant is required to identify appropriate operational setpoints for the LWMS radiation monitor in the plant-specific ODCM, as described in Section 11.2.5.
3. The applicant demonstrated compliance with the requirements of GDC 61 by meeting the guidelines of RG 1.143, as supported with additional commitments described in Subsection 11.2.1.2.4 and the installation of steel liners in cubicles where liquid radioactive waste tanks are located, as described in Subsection 11.2.1.2. These commitments also fulfill the requirements of 10 CFR 20.1406 and the guidance of RG 4.21, in minimizing the contamination of the facility and the generation of radioactive waste, and satisfies IE Bulletin 80-10 in avoiding the cross-contamination of nonradioactive systems and unmonitored and uncontrolled radioactive releases into the environment.
4. The staff reviewed the provisions incorporated in the applicant's design to:

- control the release of radioactive materials in liquids resulting from inadvertent tank overflows.
- avoid the contamination of nonradioactive systems.
- prevent uncontrolled and unmonitored releases of radioactive materials into the environment.
- avoid interconnections with potable and sanitary water systems.

The staff concluded that the measures proposed by the applicant are consistent with GDC 60 and 61, IE Bulletin 80-10, and the guidance of RGs 1.143 and 4.21 for liquids and liquid wastes produced during normal operations and AOOs.

### **11.3 Gaseous Waste Management System**

#### **11.3.1 Introduction**

The gaseous waste management system (GWMS) receives and processes radioactive gases and hydrogen bearing gases generated during process operation. There are two main sources of plant gaseous radioactive effluents. One source is from building ventilation systems servicing radiologically controlled areas, and the other source is from the power cycle OGS. The GWMS and its OGS are used to control, collect, process, hold for decay, and discharge gaseous radioactive wastes generated during normal operations, including AOOs. The major components of the OGS include preheaters; recombiners; cooler/condensers; dryers; activated charcoal beds (guard and delay); and associated valves, pumps, and instrumentation. The OGS is located in the turbine building. The gases removed from the condenser are radioactive and must be treated before being released into the environment to ensure that radioactivity levels are reduced to acceptable levels and ALARA. The GWMS is designed to reduce and control radioactive releases into the environment. Releases from the OGS are directed via the turbine building stack. Releases from building ventilation exhaust systems servicing radiologically controlled areas are directed through their respective buildings, the reactor/fuel building stack, the turbine building stack, and the RWB stack. The primary release point for an ABWR plant is the reactor building plant stack, which is a combined release point for the reactor building, turbine building, and RWB.

#### **11.3.2 Summary of Application**

Section 11.3 of the STP Units 3 and 4 COL FSAR Revision 12, incorporates by reference Section 11.3 of the certified ABWR DCD Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 11.3, the applicant provided the following:

##### *Tier 2 Departures Requiring Prior NRC Approval*

- STD DEP 10.4-5 Condensate and Feedwater System

STP, Units 3 and 4, COL applicant departs from the ABWR DCD condensate and feedwater system by adding condensate booster pumps, reactor feed pumps, heater drains, and miscellaneous other design changes. This departure makes the following changes to the GWMS:

- Changes the offgas recombiner from an integral unit to an independent pre-heater, recombiner, and condenser arranged in a recombiner train.

Although the condensate and feedwater system is not safety related, these changes affect Generic TS 3.3.4.2 Bases (Background). Thus, this departure requires prior NRC approval. In Section 11.3, this departure affects Table 11.3-3, "Equipment malfunction Analysis," Figure 11.3-1, "Offgas System PFD" Sheets 1-2, and Figure 11.3-2, "Offgas System PFD" Sheets 1-3, which relate to the following equipment item changes: recombiner to reheater, catalyst to recombiner, and recombiner condenser to condenser.

*Tier 2 Departures Not Requiring Prior NRC Approval*

- STP DEP 10.4-3 Main Condenser Evacuation System

This site-specific departure adds an additional mechanical vacuum pump, so the design now consists of two vacuum pumps, and changes the source of motive steam supplying the steam jet ejectors during power operation.

- STD DEP 11.3-1 Gaseous Waste Management System

This departure modifies the GWMS design approved in the ABWR DCD. The changes include deleting equipment, deleting tanks, maximizing charcoal efficiency, creating one pathway for gaseous treatment versus parallel lines, and adding an evacuation system to provide a stable offgas flow to the plant exhaust.

This departure makes the following specific changes to the GWMS:

- Adds an offgas evacuation system downstream of the high efficiency particulate air (HEPA) filter to stabilize the offgas flow to the plant exhaust.
- Revises the charcoal adsorber vault temperature to a tighter range that maximizes charcoal efficiency.
- Changes the number of charcoal adsorber vessels from nine (one guard bed and eight adsorbers) to five (one guard bed and four adsorbers).
- Changes the arrangement of the charcoal adsorbers from four parallel lines, each with two adsorbers in a series, to four larger adsorbers in a series.
- Revises the mass of charcoal in each of the charcoal adsorber vessels from 13,600 kg (29,982 lbs) (for the eight adsorbers) to 27,200 kg (59,965 lbs) (for the four larger adsorbers). The total charcoal mass in the adsorbers is unchanged. The accident analyses in FSAR Section 15.7, "Radioactive Release from Subsystems and Components," assume that the charcoal adsorbers downstream of the guard bed will be bypassed, so the accident analyses are unaffected.
- Changes the mass of charcoal in the guard bed from 4,500 kg to 4,721 kg (9920 lbs to 10,408 lbs) in Section 11.3, which is consistent with the accident analysis described in Section 15.7.1, "Radiological Consequences of a Radioactive Gas Waste System Leak or Failure."

### COL License Information Item

- COL License Information Item 11.2 Compliance with Appendix I to 10 CFR Part 50

DCD directs the COL applicant to demonstrate compliance with Appendix I to 10 CFR Part 50 numerical guidelines for offsite radiation doses as a result of gaseous or airborne radioactive effluents during normal plant operations, including AOOs shall be provided.

### Supplemental Information

- Compliance with 10 CFR 20.1406

In Revision 4 of the FSAR, the applicant inserted Subsection 11.3.2.1, "Offgas System Compliance with Part 20.1406," to describe how the STP, Units 3 and 4, OGS meets the requirements in 10 CFR 20.1406.

- Pre-operational Tests

In COL FSAR Subsection 14.2.12.1.35, "Gaseous Radwaste Management/Offgas Systems Preoperational Tests," the applicant stated that the GWMS will be tested as part of the preoperational test program.

### **11.3.3 Regulatory Basis**

The regulatory basis of the information incorporated by reference is in NUREG-1503. In addition, the relevant requirements of Commission regulations for the GWMS, and associated acceptance criteria, are in Section 11.3 of NUREG-0800.

In particular, the regulatory basis for accepting the supplementary information on GWMS is established in:

- 10 CFR 20.1406.
- 10 CFR 50.34a(d).
- GDC 60, and GDC 61.
- 10 CFR Part 50 Appendix I, Section II.D.
- 10 CFR 52.80(a).

SRP acceptance criteria include codes and standards listed in:

- RG 1.143, Table 1 and Regulatory Position C.1.1.
- RG 1.110.
- RG 1.112.
- RG 4.21.

- BTP 11-5, “Postulated Radioactive Releases Due to a Waste Gas System Leak or Failure.”

The guidance of RG 1.140 is in the descriptions of design considerations of ventilation systems in FSAR Section 9.4, for building exhaust systems and venting tanks and vessels. Complete descriptions of the applicable regulatory and acceptance criteria are in SRP Section 11.3.

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

### 11.3.4 Technical Evaluation

As documented in NUREG–1503, the staff reviewed and approved Section 11.3 of the certified ABWR DCD. The staff reviewed Section 11.3 of the STP, Units 3 and 4, COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.<sup>1</sup> The staff’s review confirmed that the information in the application and the information incorporated by reference address the required information relating to the GWMS.

The applicant provided new and revised information on the STP, Units 3 and 4, GWMS. The staff reviewed the application using the guidance of SRP Section 11.3 and RG 1.206, Regulatory Position C.I.11.3.

The staff reviewed the following information in the COL FSAR:

#### Tier 2 Departures Requiring Prior NRC Approval

- STD DEP 10.4-5 Condensate and Feedwater System

In Section 11.3, this departure affects Table 11.3-3, Figure 11.3-1, and Figure 11.3-2, which relate to the following equipment item changes: recombiner to reheater, catalyst to recombiner, and recombiner condenser to condenser.

During the review of Departure STD DEP 10.4-5, the staff identified areas in need of additional information to complete the evaluation. The staff noted that the description in FSAR Subsection 11.3.3.3, “Process Facility,” removes provisions for supplying an alternative source to cool the offgas condenser. The staff requested additional information in RAI 11.3-03 to confirm that the applicant has satisfied the guidance in SRP Section 11.3, “Gaseous Waste Management System.”

In RAI 11.3-03, the staff asked the applicant to provide in the FSAR an additional discussion on how the turbine building cooling water provides equivalent reliability and quality such as reactor condensate as a suitable coolant for the offgas condensers. In its response to RAI 11.3-03,

<sup>1</sup> 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.

dated September 3, 2009 (ML092510039), the applicant provided information confirming the reliability and water quality of the turbine cooling water (TCW). The applicant concluded that the TCW will at least be as reliable as the condensate system and the water will be of higher quality and cooler than the water in the condensate system. The staff found that this design change does not adversely affect the GWMS or change the safety conclusions stated in Section 11.3 of the SER for the referenced ABWR DCD. Therefore, RAI 11.03-3 is resolved and closed.

The evaluation for changes to Generic TS 3.3.4.2 (Bases) is in Subsection 16.4.6.8 of this SER.

### Tier 2 Departures Not Requiring Prior NRC Approval

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5, determines that the following departures do not require prior NRC approval. With respect to the impact of these departures on this section, 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.

- STP DEP 10.4-3 Main Condenser Evacuation System

This site-specific departure adds an additional mechanical vacuum pump, which changes the design to two vacuum pumps and changes the source of motive steam supplying the steam jet air ejectors during power operation.

This departure revises Table 11.3-2 and it does not require any further evaluation as it pertains to the review scope of this section. The main condenser vacuum releases continue to be processed through the monitored and sampled combined plant release point as designed. Additional discussion of this departure is in Section 10.4, "Other Features of Steam and Power Conversion System," of this SER. Within the review scope of this section, the staff found it reasonable that this departure does not require prior NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

- STD DEP 11.3-1 Gaseous Waste Management System

This departure makes the following changes to the GWMS:

- Adds an offgas evacuation system downstream of the HEPA filter to stabilize the offgas flow to the plant exhaust.
- Revises the charcoal adsorber vault temperature to a tighter range to maximize charcoal efficiency.
- Changes the number of charcoal adsorber vessels from nine (one guard bed and eight adsorbers) to five (one guard bed and four adsorbers). This departure also changes the arrangement of the charcoal adsorbers from four parallel lines, each with two adsorbers in a series, to four larger adsorbers in a series.
- Revises the mass of charcoal in each charcoal adsorber vessel from 13,600 kg (29,982 lbs) (for the eight adsorbers) to 27,200 kg (59,965 lbs) (for the four larger adsorbers); the total mass of charcoal in the adsorbers is unchanged. Note that the accident analyses in Section 15.7 assume the bypass of the charcoal adsorbers downstream of the guard bed, so the accident analyses are unaffected.

- Changes the mass of charcoal in the guard bed from 4,500 kg (9920 lbs) to 4,721 kg (10,408 lbs) in Section 11.3 to be consistent with the accident analyses described in Section 15.7.1.

During the review of the departure report (Part 7 of the application) regarding departure STD DEP 11.3-1, the staff could not determine if Criteria 2 and 4 in Paragraph VIII.B.5(b) of Appendix A to 10 CFR Part 52 were satisfied and identified areas in need of additional information to complete its evaluation. The staff noted that Table 11.3-3, "Equipment Malfunction Analysis," includes only the preheater, recombiner, and condenser. The staff also noted substantial changes in Figure 11.3-1, "Offgas System PFD," and Figure 11.3-2, "Offgas System P&ID," including the removal of notes and other design information. The staff requested additional information in RAI 11.03-04 to confirm the acceptability of the applicant's evaluation per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5.

In its response to this RAI, dated September 3, 2009 (ML092510039), the applicant stated that due to a redesigned OGS, the DCD piping and instrumentation diagrams (P&IDs) (including the notations) are not applicable. The staff found that the changes to the table and figures listed above do not conflict with the applicant's evaluation per the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5. Within the review scope of this section, the staff found it reasonable that this departure does not require prior NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

#### **Conformance with BTP 11-5 Postulated Radioactive Releases Due To a Waste Gas System Leak or Failure**

The staff evaluated conformance with BTP 11-5, which addresses the consequences of the waste gas system failure. The staff issued RAI 11.03-2, requesting the applicant to provide information and details on how the applicant performed this failure analysis. The staff also issued RAI 11.03-5, requesting the applicant to review the information and the data presented in Subsection 15.7.1.1 with the updated BTP 11-5, Revision 3. In its responses to these RAIs, dated September 3, 2009 (ML092510039), the applicant stated that there are no departures from Subsection 15.7.1.1 of the certified design. DCD Subsection 15.7.1.1 analyses are based on the inadvertent bypass of the downstream charcoal delay beds, and the analyses are identical to the STP COL 15.7.1.1 event and the event described in BTP 11-5. The staff's review determined that the analysis in Subsection 15.7.1.1 is identical to that described by BTP 11-5 and the information provided by the applicant is acceptable. Therefore, RAI 11.03-2 and RAI 11.03-5 are resolved and closed.

#### **COL License Information Item**

- COL License Information Item 11.2 Compliance with Appendix I to 10 CFR Part 50

COL License Information Item 11.2 states that the applicant shall demonstrate compliance with Appendix I to 10 CFR Part 50 numerical guidelines for offsite radiation doses resulting from gaseous or airborne radioactive effluents during normal plant operations, including AOOs. Subsection 11.3.11.1 of the FSAR states that all required information concerning this COL license information is in FSAR Subsection 12.2.2. Because Chapter 12 contains COL License Information Item 12.5, which also addresses compliance to Appendix I to 10 CFR Part 50, issues associated with radioactive source terms, doses from average releases, and annual airborne doses released to the environment in COL license information item 11.2 are addressed

in SER Section 12.2 under COL License Information Item 12.5. However, compliance with 10 CFR Part 50, Appendix I with respect to cost-benefit ratio is discussed below.

**Compliance with the Cost-Benefit Ratio in 10 CFR Part 50, Appendix I**

To assess compliance with the numeric guideline in 10 CFR Part 50, Appendix I, Section II.D, the staff evaluated the methodology used to determine the cost-benefit ratio against the guidance in RG 1.110. Because the staff was not able to determine whether the applicant is in conformance with the guidance in RG 1.110, the staff issued RAI 11.03-1. In its initial response to this RAI, dated May 21, 2009 (ML091460243), the applicant did not supply enough information and RAI 11.03-1 was closed as unresolved. The staff then issued supplemental RAI 11.03-7. In its response to RAI 11.03-7, dated October 12, 2009 (ML092890082), the applicant provided all essential information and the methodology used to determine the cost-benefit ratio as described in RG 1.110.

The results of the applicant’s analysis show that the lowest cost option for gaseous radwaste treatment system augments is an addition of one 3-ton charcoal adsorber to the GWMS effluent stream before entry into the plant vent line. Assuming that this augment will eliminate all radioactivity from the gaseous effluent, the resulting benefit in terms of person-rem dose reduction is \$580 for total body dose. This benefit is below the \$7,750 cost to augment the GWMS system with a 3-ton adsorber as calculated in accordance with RG 1.110. Thus, the applicant concluded that the GWMS meets ALARA requirements and no augments are necessary.

The staff performed an independent assessment using the population doses calculated by the staff (see SER Section 12.2) and the guidance in RG 1.110 and reached the same conclusion. Because the staff’s population doses were different from the applicant’s doses, the staff obtained different, but acceptable cost-benefit ratios for the addition of one 3-ton charcoal adsorber to the GWMS effluent stream prior to entry into the plant vent stack. SER Table 11.3-1 lists the costs calculated by the applicant and staff for comparison. Therefore, RAI 11.03-7 is resolved and closed.

**Table 11.3-1 Comparison of Costs and Benefits to Augment the GWMS**

<b>Organ/Body</b>	<b>Applicant’s Calculated Benefits*</b>	<b>Applicant’s Calculated Costs</b>	<b>NRC’s Calculated Benefits*</b>	<b>NRC’s Calculated Costs</b>
Total Body	\$580	\$7,750	\$746	\$7,755
Thyroid	\$2,380	\$7,750	\$924	\$7,755
* Based on gaseous emission population dose in SER Section 12.2.				

## Supplemental Information

### **Compliance with 10 CFR 20.1406**

In its response to RAI 11.03-04 (ML092510039) dated September 3, 2009, the applicant also included additional information pertaining to 10 CFR 20.1406 and proposes to add Subsection 11.3.2.1, "Offgas System Compliance with Part 20.1406," to the FSAR to confirm compliance with this regulation. 10 CFR 20.1406 requires the applicant to provide a description of how facility design and procedures for operations: (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 staff reviewed this information in the proposed Subsection 11.3.2.1 and the information regarding the minimization of radioactive waste generation and found it acceptable. The OGS is designed to minimize the generation of radioactive waste in that the charcoal in the carbon beds is not intended to be replaced during the entire plant life. The charcoal delay beds will not contribute to or be processed into solid radwaste, and removal will be at the end of plant life. The staff confirmed that this information has been added to Revision 4 of the FSAR. Therefore, the issue is resolved and RAI 11.03-4 is resolved and closed.

The applicant provides information in Section 11.2 related to compliance with 10 CFR 20.1406 to minimize contamination to facilitate decommissioning. The applicant lists several measures that will prevent the spread of contamination, including design features using engineering controls; criteria for selecting materials and equipment used in contaminated areas; the use of containments, catches, and enclosures to contain spills and releases; surveys of potentially contaminated systems, equipment, and components; and the use of temporary and permanent design modifications to prevent and limit the spread of contamination. Most of the items listed in Section 11.2 were taken from the list of practical measures to prevent the spread of contamination in Nuclear Energy Institute (NEI) 07-03A, "Generic FSAR Template Guidance for Radiation Protection Program Description." To establish conformance with the guidance in RG 4.21, FSAR Subsection 12.3.9 incorporates by reference NEI 08-08A, "Generic FSAR Template Guidance for Life Cycle Minimization of Contamination," which was developed to address the guidance in RG 4.21.

The applicant met the requirements in 10 CFR 20.1406 and the guidance of RG 4.21 by describing how facility design features and procedures for operations (described in FSAR Sections 11.2 and 12.3) will minimize, to the extent practicable, contamination of the facility and the environment; will facilitate eventual decommissioning; and will minimize, to the extent practicable, the generation of radioactive waste.

### **Preoperational Tests**

In COL FSAR Subsection 14.2.12.1.35, "Gaseous Radwaste Management/Offgas Systems Preoperational Tests," the applicant states that the GWMS is tested during the Preoperational Test Program. The GWMS equipment will be performance tested to demonstrate conformance with design process capabilities. An integrity test is performed on the system upon completion. The staff found that this item conforms to the guidance in SRP Section 14.2 because these tests will determine correct installation and functional operability of the system equipment.

### **Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)**

The ITAAC are all incorporated by reference with no changes.

### **11.3.5 Post Combined License Activities**

There are no post COL activities related to this section.

### **11.3.6 Conclusion**

The staff's finding related to information incorporated by reference is in NUREG-1503. The staff reviewed the STP, Unit 3 and 4, COL FSAR and checked the referenced DCD. The staff's review confirmed that the application has addressed the relevant information, and no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and 10 CFR Part 52, Appendix A, Section VI.B.1, all nuclear safety issues relating to the GWMS that were incorporated by reference have been resolved.

The staff compared the additional information in the COL application to the relevant NRC regulations, and the guidance in Section 11.3 of NUREG-0800. The staff's review concluded that the applicant has adequately addressed Tier 2 departure STD DEP 10.4-5 and its impact on generic TS, COL License Information Item 11.2, and the supplemental information in accordance with the guidance in Section 11.3 of NUREG-0800 and NRC regulations. The staff also found it reasonable that the identified Tier 2 departures are characterized as not requiring prior NRC approval per 10 CFR Part 52 Appendix A, Section VIII.B.5.

The staff also concluded that the GWMS (as a permanently installed system and in combination with other plant systems) includes the equipment necessary to control releases of radioactive materials in gaseous effluents in accordance with GDCs 60 and 61, and the requirements in 10 CFR 50.34a(d).

The staff concluded that the GWMS design is acceptable and meets the requirements of 10 CFR 20.1406; 10 CFR 50.34a(d); GDCs 60 and 61; and 10 CFR Part 50, Appendix I, Section II.D. This conclusion is based on the following:

1. The applicant meets the requirements of GDCs 60 and 61 with respect to controlling releases of radioactive materials into the environment, by assuring that the GWMS design includes the equipment to monitor and control releases of radioactive materials in gaseous effluents.
2. The applicant meets the requirements of 10 CFR Part 50, Appendix I, Section II.D, with respect to meeting the ALARA criterion using site-specific conditions. The staff considered the potential effectiveness of augmenting the GWMS using items of reasonably demonstrated technology. The staff determined that further effluent treatment will not affect reductions in cumulative population doses reasonably expected within an 80-km (50-mi) radius of the reactor, at a cost of less than \$1,000 per total body person-rem or per thyroid person-rem.
3. The applicant meets the requirements in 10 CFR 20.1406 and the guidance of RG 4.21 by describing how facility design features and procedures for operations (described in FSAR Sections 11.3 and 12.3) will minimize, to the extent practicable, contamination of the facility and the environment; will facilitate eventual decommissioning; and will minimize, to the extent practicable, the generation of radioactive waste.
4. The staff confirmed that the applicant has incorporated by reference Section 15.7 of DCD Tier 2, Revision 4, the results of the analysis of a waste gas system failure, and

that no changes to the results are necessary. ABWR DCD Revision 4, Section 15.7 demonstrates that the OGS design meets the applicable guidelines of SRP Section 11.3 and BTP 11-5.

## **11.4 Solid Waste Management System**

### **11.4.1 Introduction**

This section of the FSAR addresses how the solid waste management system (SWMS) manages radioactive wastes such as liquid, wet, and dry solid wastes produced during normal operations and AOOs. The review includes an evaluation of any additional equipment that may be necessary to process liquid, dry, and wet wastes and: (1) route them to the point of discharge from the SWMS; or (2) prepare them for shipment to authorized offsite disposal sites or licensed radioactive waste processors. The SWMS has no safety-related function. There is no liquid or gaseous plant discharge from the SWMS. A failure of any subsystem within the SWMS does not compromise any safety-related system or component or prevent a shutdown of the plant.

### **11.4.2 Summary of Application**

The applicant incorporates by reference Tier 1, Section 2.9, "Radioactive Waste System," of the certified ABWR DCD, Revision 4. The applicant completely replaces Tier 2, Section 11.4 of the certified ABWR DCD, Revision 4, including all subsections, figures, and tables. In Section 11.4 of Revision 12 of the STP COL FSAR, the applicant provides the following:

#### Tier 2 Departure Not Requiring Prior NRC Approval

- STD DEP 11.4-1 Radioactive Solid Waste Update

The applicant completely replaces the solid waste system design described in Tier 2, Section 11.4 of the certified ABWR DCD. This standard departure from the DCD SWMS design deletes the solidification, incineration, and compacting processes.

#### COL License Information Item

- COL License Information Item 11.3 Plant-Specific Solid Radwaste Information

DCD COL License Information Item 11.3 directs the COL applicant to provide the following six plant-specific items:

1. Description of the incinerator complete with the source of incinerator heat, heat source storage facility and specific fire protection features to prevent any undue fire hazard shall be provided.
2. Demonstration that the wet waste solidification process and the spent resin and sludge dewatering process will result in products that comply with 10 CFR 61.56 shall be provided.
3. Establishment and implementation of a process control program (PCP) for solidifying the evaporator concentrates, using an approved solidification agent, and the dewatering processing of the spent resins and filter sludges shall be provided.

4. Discussion of onsite storage of low-level waste beyond that discussed in Tier 2 shall be provided.
5. Demonstration that all radioactive waste shipping packages meet the requirements in 10 CFR Part 71 shall be provided.
6. Establishment of setpoints for the liquid discharge radiation monitor based on the as-built design.

#### Supplemental Information

- The applicant provided information in Subsection 11.4.1.2 related to compliance with 10 CFR 20.1406 to minimize contamination to facilitate decommissioning. In addition, the applicant also added Subsection 11.4.6, "Testing and Inspection Requirements", to address the preoperational test program, the performance test, and integrity test of the SWMS.

#### **11.4.3 Regulatory Basis**

The relevant requirements of the Commission regulations for the SWMS, and associated acceptance criteria, are in Section 11.4 of NUREG-0800. The regulatory basis includes:

- RG 1.143, Table 1 and Regulatory Positions C.3.2 and C3.3.
- RG 1.206, Combined License Applications for Nuclear Power Plants.
- 10 CFR Part 20.
- 10 CFR Part 50.
- 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."
- 49 CFR Part 173, "Shippers—General Requirements for Shipments and Packagings."
- Disposal site waste form requirements for burial at a low-level waste disposal site that is licensed in accordance with 10 CFR Part 61 "Licensing Requirements for Land Disposal of Radioactive Waste," or equivalent Agreement State regulations.
- Generic Letter (GL) 89-01, "Implementation of Programmatic and Procedural Controls for Radiological Effluent Technical Specifications."
- NUREG-1302, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors." April 1991, and NUREG-0132, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," issued October 1978.

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

#### 11.4.4 Technical Evaluation

As documented in NUREG–1503, the staff reviewed and approved Section 11.4 of the certified ABWR DCD. The staff reviewed Section 11.4 of the STP, Units 3 and 4, COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD represents the complete scope of information relating to this review topic.<sup>1</sup> The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to the SWMS.

The applicant provided new and revised information on the STP, Units 3 and 4, SWMS. The staff reviewed the application using the guidance of SRP Section 11.4 and RG 1.206, Regulatory Position C.I.11.4.

The staff reviewed the following information in the COL FSAR:

##### Tier 2 Departure Not Requiring Prior NRC Approval

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix A, Section VIII.B.5 determines that the following departure does not require prior NRC approval.

- STD DEP 11.4-1 Radioactive Solid Waste Update

In Departure STD DEP 11.4-1, the applicant completely replaces the SWMS design in the ABWR DCD. The changes include deleting equipment, adding tanks, and using modular equipment. Section 3 of the Departures Report indicates that this standard departure was evaluated and determined to comply with the requirements of 10 CFR Part 52, Appendix A, Section VIII.B.5. However, the staff was not able to find enough information in the COL application to determine that the applicant satisfied all the criteria in 10 CFR Part 52, Appendix A, Section VIII.B.5(b). The staff issued RAI 11.04-1 requesting the applicant to provide an evaluation confirming that the requirements in 10 CFR Part 52, Appendix A, Section VIII.B.5 are satisfied. In its response to this RAI, dated June 26, 2008 (ML081970231), the applicant revised and resubmitted the screening evaluations of 10 CFR Part 52, Appendix A, Section VIII.B.5. The staff found the applicant's response acceptable, and RAI 11.04-1 is resolved and closed.

In addition to issuing RAI 11.04-1, the staff also conducted an audit to determine whether the applicant had processed the Chapter 11 departures in accordance with the requirements in Paragraph VIII.B.5(b) in Appendix A to 10 CFR Part 52. The staff reviewed the applicant's evaluation procedures and processes and the bases for the applicant's determination that prior NRC approval is not required for this departure.

The staff conducted an audit of the 10 CFR Part 52, Appendix A, Section VIII.B.5 evaluation process (ML092510426). The staff then issued RAI 11.04-5, requesting the applicant to re-evaluate the initial departure evaluations to determine whether Departure STD DEP 11.4-1 "would" create a system malfunction or cause a malfunction with a different result. In its response to this RAI, dated October 12, 2009 (ML092890082), the applicant reevaluated

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<sup>1</sup> 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.

Departure STD DEP 11.4-1 and concluded that the changes to the SWMS will not increase the consequences of an equipment malfunction or cause a malfunction with a different result.

The staff reviewed the applicant's response to RAI 11.04-5 and found that it addressed the requirements of the STP procedures and 10 CFR Part 52, Appendix A, Section VIII.B.5. The response provided sufficient information to conclude that the applicant evaluated the SWMS departure in accordance with 10 CFR Part 52. The staff found the applicant's response acceptable, and RAIs 11.04-1 and 11.04-5 are resolved and closed.

With respect to the impact of this departure on this section, the staff found it reasonable that this departure does not require prior NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

### COL License Information Item

- COL License Information Item 11.3 Plant-Specific Solid Radwaste Information

ABWR DCD Tier 2, Section 11.4.3 states that the COL applicant shall address COL license information item 11.3 on a plant-specific basis. For the STP COL application, these items in COL license information item 11.3 are addressed as follows:

1. DCD COL License Information Item 11.3 Item 1 states, "A description of the incinerator complete with the source of incinerator heat, heat source storage facility, and specific fire protection features to prevent any undue fire hazard shall be provided."

The applicant states that this departure completely replaces the previously approved SWMS design in NUREG-1503 and deletes the incinerator process. Thus, the information requested in this COL license information item is no longer necessary or applicable.

2. DCD COL License Information Item 11.3, Item 2 states, "Demonstration that the wet waste solidification process and the spent resin and sludge dewatering process will result in products that comply with 10 CFR 61.56 shall be provided."

Departure STD DEP 11.4-1 in FSAR Section 11.4 deletes the solidification process, so that portion of the COL license information item is no longer necessary or applicable.

The staff determined that in the departure evaluation, the applicant has provided informative descriptions of the spent resin and sludge dewatering process and the mobile dewatering processing subsystem equipment, in sufficient detail to confirm compliance with 10 CFR 61.56. Therefore, the applicant has adequately addressed COL License Information Item 11.3, Item 2.

3. DCD COL License Information Item 11.3, Item 3 states, "Establishment and implementation of a process control program (PCP) for solidifying the evaporator concentrates, using an approved solidification agent, and the dewatering processing of the spent resins and filter sludges shall be provided."

The applicant points out that FSAR Table 13.4S-1 provides a milestone date for fuel loading to implement the PCP. The staff has identified the implementation of the PCP as a license condition.

The staff issued RAI 11.04-2, requesting the applicant to provide additional information concerning key elements of the program that are to be included in the PCP. In its response to RAI 11.04-2, dated June 26, 2008 (ML081970231), the applicant stated that the STP site PCP used by Units 1 and 2 will also be used by Units 3 and 4.

The staff issued RAI 11.04-4, requesting the applicant to address the PCP and the potential incorporation of the NEI 07–10A, “Generic FSAR Template Guidance for Process Control Program (PCP),” in the FSAR. In its response to this RAI, dated September 3, 2009 (ML092510039), the applicant modified Section 11.4.3 to state that the PCP will incorporate the guidance in NEI 07–10A. The staff confirmed that FSAR Revision 4 has incorporated the proposed change, therefore, RAI 11.04-2 and RAI 11.04-4 are resolved and closed. The applicant has adequately addressed COL License Information Item 11.3, Item 3.

4. DCD COL License Information Item 11.3, Item 4 states, “A discussion of onsite storage of low-level waste beyond that discussed in Tier 2 shall be provided.”

The applicant discusses onsite storage space for a six-month volume of packaged waste beyond that discussed in ABWR DCD Section 11.4.2. The applicant also provides estimates of expected Class A, B, and C radwaste volumes.

The staff issued RAI 11.04-3, requesting the applicant to provide additional information for the radwaste data already presented. The staff questioned whether the data represents one or both units. The staff also asked for clarification of the radwaste volume differences. In its response to RAI 11.04-3, dated May 21, 2009 (ML091460243), the applicant clarified the radwaste information and revises Subsection 11.4.2.2.6 of the FSAR. The staff found that the applicant’s response clarified the data and the waste volumes for each unit. The staff confirmed that this information has been incorporated into Revision 3 of the FSAR. Therefore, RAI 11.04-3 is resolved and closed. The applicant has adequately addressed COL License Information Item 11.3, Item 4.

5. DCD COL License Information Item 11.3, Item 5 states, “Demonstration that all radioactive waste shipping packages meet the requirements in 10 CFR Part 71 shall be provided.”

In COL FSAR Subsection 11.4.3.1, “Plant-Specific Solid Radwaste Information,” the applicant states that “Radioactive waste shipping packages meet the requirements in 10 CFR Part 71 for STP Units 3 and 4 as provided in the plant radiation protection program as described in Section 12.5.3.” Subsection 12.5.3.1 states that the operational Radiation Protection Program is described in Section 12.5S. Section 12.5S states that NEI 07–03A provides the Operational Radiation Protection Program for STP, Units 3 and 4. The program states, “Prior to initial transfer, transport, or disposal of radioactive materials, the organization, facilities, equipment, instrumentation, and procedures will be in place as necessary to assure compliance with 10 CFR Part 20, Subpart K, and applicable requirements in 10 CFR Part 71.”

The staff found this information sufficient to close this item, because the applicant has incorporated NEI 07–03A to provide the Radiation Protection Program guidance for compliance with 10 CFR Part 71 requirements. Therefore, the applicant has adequately addressed COL License Information Item 11.3, Item 5.

6. DCD COL License Information Item 11.3, Item 6 states, “Based on the as-built design, establish set points for the liquid discharge radiation monitor.” The applicant addressed this item in FSAR Section 11.5 by noting that the ODCM describes the establishment of the liquid discharge radiation monitor setpoints.

The staff issued RAI 11.04-6, requesting the applicant to clarify the tracking of COL license information items between DCD Table 1.9-1, “Summary of ABWR Standard Plant COL License Information,” and Section 11.4 and FSAR Section 11.4.3. In its response to this RAI, dated December 9, 2009 (ML093480068), the applicant committed to revising Subsections 11.2.5 and 11.4.3 as requested. The staff confirmed that the proposed changes have been incorporated in FSAR Revision 4. Therefore, RAI 11.04-6 is resolved and closed. The applicant has adequately addressed COL License Information Item 11.3, Item 6.

### Supplemental Information

#### **Compliance with 10 CFR 20.1406**

10 CFR 20.1406 requires the applicant to provide a description of how facility design and procedures for operations: (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 Subsection 11.4.1.2, related to compliance with 10 CFR 20.1406 to minimize contamination to facilitate decommissioning. The applicant lists several measures that will prevent the spread of contamination, including design features using engineering controls; criteria for selecting materials and equipment used in contaminated areas; the use of containments, catches, and enclosures to contain spills and releases; surveys of potentially contaminated systems, equipment, and components; and the use of temporary and permanent design modifications to prevent and limit the spread of contamination. Most of the items listed in Section 11.4 were taken from the list of practical measures to prevent the spread of contamination in NEI 07-03A, Revision 0, “Generic FSAR Template Guidance for Radiation Protection Program Description.” To establish conformance with the guidance in RG 4.21, FSAR Subsection 12.3.9 incorporates by reference NEI 08-08A, “Generic FSAR Template Guidance for Life Cycle Minimization of Contamination,” which was developed to address the guidance in RG 4.21.

The staff’s review determined that the applicant met the requirements in 10 CFR 20.1406 and the guidance of RG 4.21 by describing how the facility design features and procedures for operations (described in FSAR Sections 11.2, 11.4 and 12.3) will minimize, to the extent practicable, contamination of the facility and the environment; will facilitate eventual decommissioning; and will minimize, to the extent practicable, the generation of radioactive waste.

## **Preoperational Tests**

In COL FSAR Subsection 14.2.12.1.75, "Liquid and Solid Radwaste Systems Preoperational Tests," the applicant states that the SWMS is tested during the Preoperational Test Program. The SWMS equipment will be performance tested to demonstrate conformance with design process capabilities. An integrity test is performed on the system upon its completion. The staff found that this item conforms to the guidance in SRP Section 14.2.

## **ITAAC**

The ITAAC are all incorporated by reference with no changes.

### **11.4.5 Post Combined License Activities**

#### *License Condition for the PCP before Fuel Loading*

The staff is including the following two license conditions:

1. Prior to initial loading of fuel into the reactor, the licensee shall implement an operational program for process and effluent monitoring and sampling. The program shall include the following subprograms and documents:
  - a. Radiological Effluent Technical Specifications/Standard Radiological Effluent Controls.
  - b. ODCM.
  - c. REMP.
  - d. PCP.
2. The licensee shall submit to the NRC a schedule, no later than 12 months after the issuance of the combined license, that supports planning for the conduct of NRC inspections of the four operating programs and documents listed in the above license condition (number 1). The schedule shall be updated every 6 months until 12 months before scheduled initial fuel loading, at which point the schedule shall be updated every month thereafter until the four operational programs and documents have been fully implemented prior to initial fuel load.

### **11.4.6 Conclusion**

The staff compared the information in the COL application to the relevant NRC regulations, and the guidance in Section 11.4 of NUREG-0800. The staff's review confirmed that the applicant has adequately addressed COL License Information Item 11.3 and the supplemental information in accordance with the guidance in Section 11.4 of NUREG-0800 and NRC regulations. The staff found it reasonable that the identified Tier 2 departure is characterized as not requiring prior NRC approval per 10 CFR Part 52, Appendix A, Section VIII.B.5.

The staff also concluded that the SWMS, either as a permanently installed system or in combination with other plant systems such as the LWMS and GWMS, is acceptable and meets the guidance in Table 1, "Codes and Standards for the Design of SSC in Radwaste Facilities," of RG 1.143 and Regulatory Positions C.3.2 and C3.3 of RG 1.143; the requirements of 10 CFR

Parts 20, 50, and 71 and 49 CFR Part 173; and disposal site waste form requirements for burial at a low-level waste disposal site that is licensed in accordance with 10 CFR Part 61, or equivalent Agreement State regulations. The SWMS also meets the applicable SRP BTPs and RGs.

This conclusion is based on the following:

1. The applicant's proposed PCP for STP, Units 3 and 4, and the operating procedures as they relate to classifying, processing, and disposing of wastes, meets the requirements of 10 CFR Part 61; 10 CFR 20.2006, "Transfer for disposal and manifests"; 10 CFR 20.2007, "Compliance with environmental and health protection regulations"; and 10 CFR 20.2108, "Records of waste disposal." The staff concluded that the endorsement of NEI PCP Template 07-10A and the SWMS supplemental information in FSAR Section 11.4 are consistent with GL 89-01, the guidance in NUREG-1302 for boiling-water reactor (BWR) plants, and the guidance in NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants: A Guidance Manual for Users of Standard Technical Specifications."
2. The applicant meets 10 CFR 20.1406, IE Bulletin 80-10, and the guidance in RG 4.21 with respect to providing a description of how facility design features and procedures for operations described in FSAR Sections 11.4 and 12 will minimize, to the extent practicable, contamination of the facility and the environment; will facilitate eventual decommissioning; and will minimize, to the extent practicable, the generation of radioactive waste.
3. The applicant demonstrated compliance with the requirements of 10 CFR 52.80(a) for the SWMS. If the inspections, tests, and analyses are performed as required, and the respective acceptance criteria are met, there will be reasonable assurance that the SWMS has been constructed and will be operated in accordance with the license, the Atomic Energy Act of 1954, and NRC regulations.

## **11.5 Process and Effluent Radiological Monitoring Instrumentation and Sampling Systems**

### **11.5.1 Introduction**

The process radiation monitoring system (PRMS) is used to monitor liquid and gaseous process streams and effluents from the LWMS, GWMS, and SWMS during normal operations and AOOs and under post-accident conditions. Another objective is to alert control room operators of abnormal levels of radioactivity in process streams and liquid and gaseous effluents in order to activate signals that initiate automatic safety functions, isolate process streams, and terminate effluent discharges if predetermined radioactivity levels or release rates exceed established alarm setpoints. The PRMS generates signals to initiate the operation of certain safety-related equipment to control radioactive releases under normal and abnormal operations and accident conditions. Another function of the PRMS is to provide the means to collect samples from process and effluent streams for radiological analyses that assess compliance with NRC regulations.

The PRMS consists of skid-mounted and permanently installed sampling and monitoring equipment designed to indicate operational radiation levels and releases of radioactive materials, equipment or component failures, and system malfunctions or improper operations.

The PRMS includes beta and gamma radiation-sensitive detectors working in redundant channels, as required for each subsystem. The radiation detectors are capable of detecting the types and energies of radiation emitted from fuel, radioactive wastes, and process and effluent streams. Local readout and alarm modules are located in specific areas to provide information on the radiological status of plant systems and alert personnel to abnormal or accident conditions.

### **11.5.2 Summary of Application**

Section 11.5 of the STP, Units 3 and 4, COL FSAR Revision 12, incorporates by reference Section 11.5 of the certified ABWR DCD Revision 4, referenced in 10 CFR Part 52, Appendix A. In addition, in FSAR Section 11.5, the applicant provides the following:

#### Tier 1 Departures

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

This departure deletes the Scram and main steam isolation valve (MSIV) automatic closure on the high main steam line radiation monitor signal.

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

This departure updates the safety-related instrumentation and control (I&C) design architecture.

#### Tier 2 Departures Not Requiring Prior NRC Approval

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

This departure clarifies the references to setpoints and allowable values.

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

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

#### COL License Information Items

- COL License Information Item 11.4 Calculations of Radiation Release Rates

The COL applicant shall provide and describe in the operation and maintenance manual the procedures and/or methods for the conversion of the radiation measurements into release rates of gaseous discharge from the main plant stack (Section 11.5).

- COL License Information Item 11.5 Compliance with the Regulatory Shielding Design Basis

The COL applicant shall describe in the operation and maintenance manual the sampling system design of the standby gas treatment system (SGTS) and of the main stack effluent monitoring subsystems. Also, the applicant shall show compliance with the regulatory shielding requirements for low-radiation exposure under accident conditions as stipulated in NUREG-0737, "Clarification of TMI Action Plan requirements," Item II.F.1, "Additional Accident-

Monitoring Instrumentation,” Clarification 2 of Attachment 2. The requirement for the shielding design will be covered in the equipment design specifications (Section 11.5).

- COL License Information Item 11.6 Provisions for Isokinetic Sampling

The COL applicant shall describe, in the operation and maintenance manual, the sampling technique used for monitoring and sampling effluent gasses to assure that a representative gas sample is extracted and that the sampling system is capable of maintaining isokinetic conditions within 20 percent of the flow rate during and following an accident as stipulated in NUREG-0737 Item II.F.1, Clarification 3 of Attachment 2 (Section 11.5).

- COL License Information Item 11.7 Sampling of Radioactive Iodine and Particulates

The COL applicant shall describe, in the operation and maintenance manual, the collection technique used to extract representative samples of radioactive iodines and particulates during and following an accident. These measurements are used to determine the quantitative releases for dose calculations and assessments as stipulated in NUREG-0737, Table II.F.1-2, “High-Range Noble Gas Effluent Monitors,” (Section 11.5).

- COL License Information Item 11.8 Calibration Frequencies and Techniques

The COL applicant shall provide, in the operation and maintenance manual, for the system the calibration frequencies and techniques for the radiation sensors. This information shall be based on vendor data for the equipment (Section 11.5).

### Supplemental Information

The applicant provides supplemental information in Section 11.5.7S, to address the ODCM, per RG 1.206, Regulatory Position C.III.1.

### **11.5.3 Regulatory Basis**

The regulatory basis of the information incorporated by reference is in NUREG-1503. In addition, the relevant requirements of Commission regulations for the PRMS, and associated acceptance criteria, are in Section 11.5 of NUREG-0800.

In particular, the regulatory basis for accepting the supplementary information for the PRMS is established in:

- 10 CFR 20.1301, “Dose limits for individual members of the public.”
- 10 CFR 20.1301(e).
- 10 CFR 20.1302, “Compliance with dose limits for individual members of the public.”
- 10 CFR 20.1406.
- 10 CFR 50.34a(d).
- 10 CFR 50.36a.
- GDC 60.
- GDC 63, “Monitoring fuel and waste storage.”
- GDC 64, “Monitoring radioactivity releases.”
- 10 CFR Part 50 Appendix I, Sections II.A, II.B, II.C, and II.D.
- 10 CFR 52.80(a).
- GL 89-01.

Additional requirements include those of 10 CFR 50.34(f)(2)(xvii) and 10 CFR 50.34(f)(2)(xxvii) for monitoring gaseous effluents from potential accident release points, consistent with GDCs 63 and 64.

SRP acceptance criteria include the guidance in:

- RG 1.21.
- RG 1.33, Revision 2, “Quality Assurance Program Requirements (Operation).”
- RG 1.97, Revision 4, “Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants.”
- RG 4.1, Revision 2, “Radiological Environmental Monitoring for Nuclear Power Plants.”
- RG 4.8, “Environmental Technical Specifications for Nuclear Power Plants,” withdrawn June 2009.
- RG 4.15.
- Industry codes and standards including ANSI/HPS N13.1–1999, “Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities,” and ANSI N42.18-2004 “Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents.” (Reaffirmation of ANSI N42.18-1980) (Redesignation of ANSI N13.10-1974).
- BTP 7-10, Revision 5, “Guidance on Application of Regulatory Guide 1.97.”
- NUREG–1302 and NUREG–0133.

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

#### **11.5.4 Technical Evaluation**

As documented in NUREG–1503, the staff reviewed and approved Section 11.5 of the certified ABWR DCD. The staff reviewed Section 11.5 of the STP, Units 3 and 4, COL FSAR and checked the referenced ABWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ABWR DCD appropriately represents the complete scope of information relating to this review topic.<sup>1</sup> The staff’s review confirmed that the information in the application and the information incorporated by reference address the required information relating to the process and the effluent radiological monitoring instrumentation and sampling systems.

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

The staff reviewed the following information in the COL FSAR:

Tier 1 Departures

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

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

This departure deletes the Scram and MSIV automatic closure on the high main steam line radiation monitor (MSLRM) trip. With this safety function deleted, the main steam line tunnel area radiation monitoring is no longer required for safety and protection and can be moved from the list of radiation monitors required for safety and protection (Item [1] in FSAR Tier 2 Subsection 11.5.1.1.1) to functions required for plant operations (Item [g] in FSAR Tier 2 Subsection 11.5.1.1.2). In Part 7 Section 2.1, the applicant describes and evaluates this departure per the requirements of 10 CFR Part 52, Appendix A, Section VIII.A.4. In summary, the MSLRM high trip is not specifically credited in any ABWR safety analysis. This trip was originally designed to mitigate effects in the event of a control rod drop accident for BWRs. The ABWR has no basis for the control rod drop accident event to occur, as described in the DCD, Tier 2 Section 15.4.10. Furthermore, the U.S. BWRs have experienced spurious trips due to this MSLRM high trip. The trip setpoint must be set high enough to accommodate the normal high-radiation level during operations from the activated oxygen-16 (O-16) in the reactor producing radioactive nitrogen-16 (N-16) that is carried in the main steam line flow, but low enough to provide adequate protection. The MSLRM trip setpoints can be overwhelmed by minor variations in the N-16 flow that cause spurious trips. Therefore, within the review scope of this section, the staff found the Tier 1 departure acceptable because this design change represents an improvement in safety by reducing the probability of spurious scrams that induce unnecessary challenges to the plant and safety systems. SER Subsection 16.4.6.1 evaluates the changes to the plant-specific TS necessitated by this departure.

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

This departure is required because of the following five primary changes in the I&C architecture:

- Elimination of obsolete data communication technology.
- Elimination of unnecessary, inadvertent actuation prevention logic and equipment.
- Clarification of digital controls nomenclature and systems.
- Final selection of platforms (which changed the implementation architecture).
- Testing and surveillance changes for safety system logic and control (SSLC).

In Section 2.1 of Part 7, "Departures Report," the applicant describes and evaluates this departure per the requirements of 10 CFR Part 52, Appendix A, Section VIII.A.4. The radiation detectors and monitors and related system components of Section 11.5 are affected by one or more of these changes—especially in the data communications, platform selection, obsolete equipment and techniques, and human machine interfaces. This Tier 1 departure is evaluated in SER Chapter 7. SER Subsections 16.4.1.1 and 16.4.6.1 evaluate the changes to the plant-specific TS necessitated by this departure. However, it is not clear why the departure was applied to only three subsections. The staff issued RAI 11.05-06, requesting the applicant to



gaseous or liquid releases within the scope of the ODCM, in accordance with the ODCM. The applicant provided revised FSAR text to state that the setpoint procedure for the “ACF Trip” (as in automatic control function) in Table 11.5-1 for the reactor building vent exhaust, the fuel handling area air vent exhaust, and the radwaste liquid discharge is in the ODCM. The applicant also provided modified Departure STD DEP 7.1-1 in a similar manner. The staff found that all setpoints requiring ODCM determination were now correctly referenced to the ODCM, and the applicant’s response has adequately addressed the staff’s concerns. This also addresses COL License Information Item 11.3. The staff has confirmed that Revision 4 of the FSAR has been updated to reflect the above changes. Therefore, RAI 11.05-2 is resolved and closed.

With respect to the impact of STD DEP 7.1-1 on this section, the staff found it reasonable that this departure does not require prior NRC approval. The applicant’s process for evaluating departures and other changes to the DCD is subject to NRC inspections.

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

This departure includes a number of changes that affect numerous subsections of FSAR Section 11.5. These are discussed below.

**Table 11.5-1, Table 11.5-2, “Process and Effluent Radiation Monitoring Systems (Gaseous and Airborne Monitors),” and Table 11.5-3, “Process and Effluent Radiation Monitoring Systems (Liquid Monitors),” (replaced) and Table 11.5-7, “Radiological Analysis Summary of Gaseous Effluent Samples,” (revised)**

Section 5.0 of Part 7, “Departures Report,” contains tables showing departures and all affected sections, tables, and figures. This departure is classified by the applicant as not requiring prior NRC approval. In Section 3.0 of Part 7, the applicant describes and evaluates this departure against the requirements of 10 CFR Part 52, Appendix A, Section VIII.B.5. In the justification for this departure, the applicant states that the functional requirements set forth in the referenced ABWR DCD will be met, but the vendor determines the implementation of the design and specific equipment needs. The applicant states in Section 3.0 of Part 7, that the evaluation demonstrates that there is no impact on: (1) the probability or consequences of an accident, (2) the malfunction of an SSC important to safety, or (3) the likelihood or consequences of a severe accident. Based on the evaluation of the changes proposed in Departure STD DEP 11.5, the applicant states that prior NRC approval of these changes is not required.

**Deletion of References to Specific Types of Detectors**

The applicant deletes references to specific types of detectors such as the digital gamma-sensitive Geiger-Mueller, the ionization chamber, or scintillation detectors. The applicant states that specific types of detectors will be selected based on state-of-the-art and availability. Furthermore, the referenced ABWR DCD Tier 1, Section 2.3.1 and Table 2.3.1, “Process Radiation Monitoring System,” specifies the type of radioactivity that will be monitored in each system.

**Combination of Radiation Monitor Downscale (Low) Trip and the Inoperative Trip Function**

The downscale (low) trip and the inoperative trip have been combined into one trip function (downscale/inoperative), because both trips are used for the same purpose: to detect

equipment failure. Also, output signals from the radiation monitors will be expressed in units of Sievert rather than in units of Gray. Units of Sievert specifically give the absorbed radiation dose in human tissue, while units of Gray refer to the absorbed radiation dose in any material. An example of obsolete or changing technology is the removal of “recorders” for data recording and trending. This function is now performed by trending software in digital I&C systems.

### **Deletion of Incinerator for Burning Low-Level Radwaste**

STP, Units 3 and 4, will not have an incinerator for burning low-level radwaste. Therefore, subsections under FSAR Section 11.5 (i.e., Subsections 11.5.1.1.2, 11.5.2.2.11, 11.5.4.3, 11.5.5.2, and 11.5.5.2), that refer to the incinerator, have been modified. Thus, the incinerator stack discharge radiation monitor is not required. References to specific calibration techniques and maintenance procedures such as calibration reproducibility, error precision, and timeliness for maintenance have been removed. These techniques and methods are specific to site procedures that are often controlled by the ODCM or supplied by the equipment vendors.

### **Elimination of “Warning Alarm” and the “Detector Type” Columns**

The “Warning Alarm” column and the “Detector Type” column were eliminated in replacement Table 11.5-1. Warning alarms are not provided, included, discussed, listed, or just “in the text” of the specific entry for each radiation monitor. The “Warning Alarm” text in DCD Table 11.5-1 is vague. To retain the specific detector types found in DCD Table 11.5-1 could limit selection based on the state-of-the-art and availability. The “Sensitivity” column and the “Type” column were both eliminated in replacement Tables 11.5-2 and 11.5-3. Sensitivities are not included because they are vendor specific.

### **Correction of the Bypass Valve Closure Trip Function**

To be consistent with the DCD instrument electrical diagram (Figure 7.6-5, “Process Radiation Monitoring System IED”), the corrected bypass valve closure trip of the offgas post-treatment radiation monitor now states that it is initiated by the High-High Alarm. The High-High Alarm for the gland seal condenser exhaust was added to be consistent with DCD Figure 7.6-5.

### **Clarification of the Location of Radiation Monitors**

In FSAR Subsection 11.5.2.1.5, the departure retained the location of the radiation monitor in the control room for display, recording, and annunciation. In other subsections of Section 11.5, the departure deleted the specific location of the radiation monitor. Both SRP Section 11.5 and RG 1.206, provide guidance implying that the system description should include the location of equipment. Because of this discrepancy, the staff was unable to determine if the applicant’s evaluation satisfied Criterion 4 in 10 CFR Part 52, Appendix A, VIII.B.5(b). The staff issued RAI 11.05-3, requesting the applicant to provide the location of the radiation monitors and sufficient specific information for the staff to complete the evaluation.

In RAI 11.05-3, the staff asked the applicant to provide an independent confirmation of compliance with NRC regulations and guidance, or to justify the deletion of the radiation monitor location. In its response to this RAI, dated September 9, 2009 (ML092530686), the applicant deleted “in the control room” from FSAR Tier 2 Subsection 11.5.2.1.5 and added a footnote in Table 11.5-1 to clarify that although the radiation monitors are not in the control room, the alarms and indication for these radiation detectors are displayed locally and in the main control room. The staff noted that Table 11.5-1 also provides the location of the radiation detectors.

These modifications resolved the inconsistency. The staff confirmed that Revision 4 of the FSAR has been updated to reflect the above changes, and RAI 11.05-3 is resolved and closed.

### **Identification of the “main control inoperative room”**

Also in Subsection 11.5.2.2.4, the departure added the statement “These trip outputs are alarmed in the main control inoperative room.” The staff was unable to determine if the applicant’s evaluation satisfied Criteria 5 and 6 in 10 CFR Part 52, Appendix A, VIII.B.5(b). The staff issued RAI 11.05-4, requesting the applicant to identify where the “main control inoperative room” is located or to correct the text. In its response to this RAI, dated September 9, 2009, the applicant corrected the phrase by deleting the word “inoperative.” The staff confirmed that Revision 4 of the FSAR has been updated to reflect the above changes. Therefore, RAI-11.05-4 is resolved and closed.

### **Radiation Effluent Monitor Calibrations**

The applicant also stated in STD DEP 11.5-1 in FSAR Subsection 11.5.5.2, that liquid and gaseous radiation process monitors may be calibrated using two methods. The first method uses certified commercial radionuclide sources traceable to the National Institute of Standards and Technology (NIST). The second method analyzes particulate iodine or gaseous grab samples with lab instrumentation. The staff found it acceptable to calibrate radiation process monitors using traceable NIST radionuclide sources, but the staff was unable to conclude that the applicant’s evaluation of the use of grab samples with lab instrumentation satisfied Criterion 8 in 10 CFR Part 52, Appendix A, VIII.B.5(b). Therefore, the staff issued RAI 11-05, requesting the applicant to expand or revise FSAR Subsection 11.5.5.2, which discusses the calibration of radiation effluent process monitors.

In its response to this RAI, dated September 3, 2009 (ML092510039), the applicant clarified the intent to calibrate applicable radiation effluent monitors using applicable liquid or gaseous certified commercial radionuclide sources traceable to NIST. The applicant also stated that grab samples are used to support periodic in-service calibrations only and may only be used as a check on the calibration of a PRMS. The applicant further specified that grab samples do not suffice as an actual acceptable regulatory calibration per RGs 1.21 and 4.15 and includes a COL application change to this effect. The staff reviewed this response and determined that the change made to eliminate the applicant’s intent to use plant samples and plant analyses as calibrations is acceptable. The staff confirmed that Revision 4 of the FSAR has been updated to reflect the above changes. Therefore, this issue in RAI 11-05 is resolved and closed.

The applicant’s response to RAI 11-05 changes the calibration frequency of effluent radiation monitors during plant operations, during a plant shutdown, or during the refueling outage. The applicant changed the FSAR to state that “Each continuous monitor is calibrated during plant shutdown or during the refueling outage if the detector is not accessible during power operation.” The STP FSAR had stated “plant operation” and not plant shutdown. The staff issued RAI 11.05-7, requesting the applicant to clarify this change. In its response to this RAI, dated January 25, 2010 (ML100290012), the applicant modified Subsection 11.5.5.2, “Calibrations,” to state that it does not intend to use plant samples for calibrations, and calibrations of continuous radiation monitors will take place “during plant operation or during the refueling outage if the detector is not accessible during power operation.” The staff reviewed this response and found it acceptable. The staff confirmed that Revision 4 of the FSAR has been updated to reflect the above changes. Therefore, RAI 11.05-7 is resolved and closed.

With respect to the impact of STD DEP 11.5-1 on this section, the staff found it reasonable that this departure does not require prior NRC approval. The applicant's process for evaluating departures and other changes to the DCD is subject to NRC inspections.

### **Supplemental Information Section 11.5.7S**

Supplemental Information in Section 11.5.7S, states that an NRC-approved ODCM exists for the STP, Units 1 and 2, nuclear power plant on the same site. This supplement briefly summarizes the content of the STP, Units 1 and 2, ODCM. The applicant stated that the ODCM for STP, Units 3 and 4, will be integrated into the STP, Units 1 and 2, ODCM and will take into account the appropriate differences between the existing and the new units. The staff issued RAI 11.05-1 and RAI 11.05-5, requesting the applicant to provide additional details on the ODCM integration and whether it will be completed before fuel loading. In its September 3, 2009, response to RAI 11.05-1 (ML092510039), the applicant stated the intent to maintain a site-wide ODCM and where possible, the ODCM will be aligned with NEI 07-09A (Revision 0), "Generic FSAR Template Guidance for ODCM Program Description." The September 9, 2009, response to RAI 11.05-5 (ML092530686) refers to the response to RAI 11.05-1. Upon further discussion with the staff, in its supplemental response to RAI 11.05-1, dated November 16, 2009 (ML093220188), the applicant stated that STP, Units 3 and 4, will have their own ODCM and will incorporate NEI 07-09A template relating to BWR plants. The staff determined that because the applicant has committed to use NEI 07-9A, and because staff also confirmed that Revision 4 of the FSAR Subsection 11.5.7S has been updated to reflect the above changes, RAI 11.05-05 and RAI 11.05-1 are resolved and closed.

With respect to the coordination and control of liquid and gaseous effluent releases between STP, Units 1 and 2, and STP, Units 3 and 4, the applicant will apply administrative procedures, per the ODCM, to ensure that the resulting effluent releases and combined doses to members of the public are in compliance with the Environmental Protection Agency's environmental radiation standards under 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations," as implemented under 10 CFR 20.1301(e). The administrative procedures, as implemented through the ODCM, reflect the issuance of multiple licenses to Nuclear Innovation North America LLC (NINA) and STP Nuclear Operating Company (STPNOC) to construct, possess, use, and operate STP, Units 3 and 4. FSAR Revision 6, Part 1, Section 11.1, describes the issuance of multiple licenses and transitions of construction responsibilities from NINA to STPNOC for operational responsibilities. The staff has determined that there is reasonable assurance that the provisions of the licenses for STP, Units 3 and 4, and transfer of responsibilities between NINA and STPNOC, as the operator of STP, Units 1 and 2, and STP, Units 3 and 4, will ensure compliance with NRC regulations, as summarized above.

### COL License Information Items

- COL License Information Item 11.4 Calculation of Radiation Release Rates

ABWR DCD Tier 2, Subsection 11.5.6.1 states that the COL applicant shall provide the COL license information item that applies on a plant-specific basis. For the STP COL application, this COL license information item is addressed as follows:

DCD COL License Information Item 11.4 states, "The COL applicant shall provide and describe in the operation and maintenance manual the procedures and/or methods for the conversion of the radiation measurements into release rates of gaseous discharge from the main plant stack."

The applicant states that the ODCM contains the methodology and parameters used to calculate offsite doses resulting from gaseous and liquid effluents. The ODCM includes methods for converting radiation measurements of gaseous discharge from the main plant stack into release rates.

The staff found this information acceptable because the guidance in NEI 07-9A, (Revision 0), addresses this issue. Therefore, the applicant has adequately addressed COL License Information Item 11.4.

- COL License Information Item 11.5 Compliance with the Regulatory Shielding Design Basis

ABWR DCD Tier 2, Subsection 11.5.6.2 states that the COL applicant shall provide the COL license information item that applies on a plant-specific basis. For the STP COL application, this COL license information item is addressed as follows:

DCD COL License Information Item 11.5 states, "The COL applicant shall describe in the operation and maintenance manual the sampling system design of the SGTS and of the main stack effluent monitoring subsystems and show compliance with the regulatory shielding requirements for low-radiation exposure under accident conditions as stipulated in NUREG-0737, Item II.F.1, clarification 2 of Attachment 2. The requirement for the shielding design will be covered in the equipment design specifications."

The applicant committed (COM 11.5-1) to implement the operation of the sampling system for the SGTS and the operation of the main stack effluent monitoring using operation and maintenance procedures that demonstrate compliance with the regulatory shielding requirements for low-radiation exposure under accident conditions, as stipulated in NUREG-0737, "Clarification of TMI Action Plan Requirements," Item II.F.1, Clarification 2 of Attachment 2. The requirement for the shielding design will be covered in the equipment design and procurement specifications.

The staff found this commitment acceptable and COL License Information Item 11.5, adequately addressed because these operation and maintenance procedures will be based on recognized and proven quality guidance from NUREG-0737 that can be confirmed by both inspection of the procedures and observation of the system operations, with the results confirmed later by NRC inspections and audits.

- COL License Information Item 11.6 Provisions for Isokinetic Sampling

ABWR DCD Tier 2, Subsection 11.5.6.3, states that the COL applicant shall provide the COL license information item that applies on a plant-specific basis. For the STP COL application, this COL license information item is addressed as follows:

DCD COL License Information Item 11.6 states, "The COL applicant shall describe in the operation and maintenance manual the sampling technique used for monitoring and sampling of effluent gases to assure that a representative gas sample is extracted and that the sampling system is capable of maintaining isokinetic conditions within 20 percent of the flow rate during and following an accident as stipulated in NUREG-0737, Item II.F.1, clarification 3 of Attachment 2."

The applicant committed (COM 11.5-2) to develop procedures before fuel loading that include the collection techniques used to extract representative samples of radioactive iodine and

particulates under accident conditions. These collection and sampling procedures require a sampling system that is capable of maintaining isokinetic conditions within 20 percent of the flow rate during and following an accident, as stipulated in NUREG-0737 Item II.F.1, Clarification 3 of Attachment 2. These procedures will be developed in accordance with the plant operating procedure development plan in Section 13.5.

The staff found this commitment acceptable and COL License Information Item 11.6 adequately addressed because an identifiable time period is specified, and these collection and sampling procedures will be based on recognized and proven quality guidance from NUREG-0737, which can be confirmed by both inspection of the procedures and observation of the sampling system operations, with results confirmed later by NRC inspections and audits.

- COL License Information Item 11.7 Sampling of Radioactive Iodine and Particulates

ABWR DCD Tier 2, Subsection 11.5.6.4, states that the COL applicant shall provide the COL license information item that applies on a plant-specific basis. For the STP COL application, this COL license information item is addressed as follows:

DCD COL License Information Item 11.7 states, "The COL applicant shall describe in the operation and maintenance manual the collection technique used to extract representative samples of radioactive iodine and particulates during and following an accident. These measurements are used to determine the quantitative releases for dose calculations and assessment (as stipulated in NUREG-0737, Table II.F.1-2)."

The applicant committed (COM 11.5-3) to develop procedures before fuel loading that include the collection technique used to extract representative samples of radioactive iodines and particulates during and following an accident. These measurements are used to determine the quantitative releases for dose calculations and assessments (as stipulated in NUREG-0737, Table II.F.1-2). These procedures will be developed in accordance with the plant operating procedure development plan in Section 13.5.

The staff found this commitment acceptable and COL License Information Item 11.7 adequately addressed because an identifiable time period is specified, and these collection and sampling procedures will be based on recognized and proven quality guidance from NUREG-0737, which the NRC inspections and audits can confirm later by inspecting the procedures.

- COL License Information Item 11.8 Calibration Frequencies and Techniques

ABWR DCD Tier 2, Section 11.5.6.5, states that the COL applicant shall provide the COL license information item that applies on a plant-specific basis. For the STP COL application, this COL license information item is addressed as follows:

DCD COL License Information Item 11.8 states, "The COL applicant shall provide in the operation and maintenance manual for the system the calibration frequencies and techniques for the radiation sensors. This information shall be based on vendor data for the equipment."

The applicant committed (COM 11.5-4) to develop procedures before fuel loading that specify the calibration frequencies and techniques for the radiation sensors. This information is to be based on vendor data for the equipment. These procedures will be developed in accordance with the plant operating procedure development plan in Section 13.5.

The staff found this commitment acceptable and COL License Information Item 11.8 adequately addressed because an identifiable time period is specified and these operation, maintenance, and calibration procedures will be developed in accordance with the plant operating procedure development plan, which the NRC inspections and audits can confirm later by inspecting the procedures.

#### **11.5.5 Post Combined License Activities**

##### Verification of Compliance with Commitments (COM 11.5-1) through Commitment (COM 11.5-4)

The applicant identified Commitment (COM 11.5-1) through Commitment (COM 11.5-4) as addressing COL License Information Items 11.5 through 11.8, respectively.

#### **11.5.6 Conclusion**

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

The staff compared the additional information in the COL application to the relevant NRC regulations, and the guidance in Section 11.5 of NUREG-0800. The staff's review concluded that the applicant has adequately addressed the Tier 1 departures, COL License Information Items 11.4, 11.5, 11.6, 11.7, and 11.8, and the supplemental information in accordance with the guidance in Section 11.5 of NUREG-0800 and NRC regulations. The staff found it reasonable that the identified Tier 2 departures are characterized as not requiring prior NRC approval per 10 CFR Part 52, Appendix A, Section VIII.B.5.

The staff also concluded that the design and operation of the process and effluent radiological monitoring systems include the equipment necessary to monitor process and effluent streams and to control releases of radioactive materials associated with the operation of the LWMS, GWMS, and SWMS. The staff found that the process and effluent radiological monitoring system designs are acceptable and meet the applicable requirements of 10 CFR 20.1301, 10 CFR 20.1301(e), 10 CFR 20.1302, and 10 CFR 20.1406; 10 CFR 50.34a(d) and 10 CFR 50.36a; 10 CFR 50.34(f)(2)(xvii) and 10 CFR 50.34(f)(2)(xxvii); 10 CFR Part 50, Appendix I design objectives; and GDCs 60, 63, and 64.

This conclusion is based on the following:

1. The PRMS includes the instrumentation for monitoring and sampling radioactivity for contaminated liquid, gaseous, and solid waste process and effluent streams under a broad range of routine operations and AOOs. The staff evaluated the provisions proposed for sampling and monitoring all appropriate process streams and effluent release points, including nonradioactive systems that could become contaminated through interfaces with radioactive systems.
2. The applicant meets the requirements of GDCs 60 and 61 with respect to controlling releases of radioactive materials into the environment, and associated offsite doses to members of the public, by assuring that the PRMS design includes features to monitor and control releases of radioactive materials in liquid and gaseous effluents. As

demonstrated in FSAR Subsection 12.2.2.4 using site-specific conditions, all releases are conducted via the LWMS and GWMS and comply with the design objectives of 10 CFR Part 50, Appendix I and the requirements of 10 CFR 20.1301, 20.1301(e), and 20.1302.

3. The applicant meets the requirements of 10 CFR 50.34(f)(2)(xvii) and 10 CFR 50.34(f)(2)(xxvii), as they relate to monitoring gaseous effluents from all potential release points under a broad range of routine and accident conditions.
4. The applicant's proposed ODCM for STP, Units 3 and 4, and operating procedures as they relate to controlling and monitoring effluent releases and doses to members of the public, meet the requirements of 10 CFR Part 50, Appendix I, 10 CFR 20.1301, 10 CFR 20.1301(e), and 10 CFR 20.1302. The staff concluded that the endorsement of NEI 07-09A and the PRMS supplemental information in FSAR Section 11.5 are consistent with GL 89-01 and the guidance of NUREG-1302 for BWR plants; NUREG-0133; and RGs 1.21, 1.33, 4.1, 4.8, and 4.15.
5. The applicant demonstrated compliance with the requirements of 10 CFR 52.80(a) for the PRMS. If the inspections, tests, and analyses are performed as required, and the respective acceptance criteria are met, there will be reasonable assurance that the PRMS has been constructed and will be operated in accordance with the license, the Atomic Energy Act of 1954, and NRC regulations.