12.0 RADIATION PROTECTION

This chapter provides information on radiation protection methods and estimated occupational radiation exposures of operating and construction personnel during normal operation and anticipated operational occurrences (AOOs). AOOs may include refueling; fuel handling and storage; radioactive material handling, processing, use, storage, and disposal; maintenance; routine operational surveillance; inservice inspection (ISI); and calibration. Specifically, this chapter provides information on facility and equipment design, planning and procedures programs, and techniques and practices employed by the applicant to meet the radiation protection standards set forth in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20, "Standards for protection against radiation," and to be consistent with the guidance given in the appropriate regulatory guides (RGs), where the practices set forth in such guides are used to implement Nuclear Regulatory Commission (NRC) regulations.

12.1 Assuring That Occupational Radiation Exposures Are As-Low-As-Reasonably Achievable (ALARA) (Related to RG 1.206, Section C.III.1, Chapter 12, C.I.12.1, "Ensuring that Occupational Radiation Exposures are As Low As Is Reasonably Achievable")

12.1.1 Introduction

Section 12.1 addresses policy and design considerations to ensure that the occupational radiation exposure (ORE) to personnel will be kept ALARA. The ALARA program is addressed in this section and in Appendix 12AA of the Vogtle Electric Generating Plant (VEGP) combined license (COL) Final Safety Analysis Report (FSAR).

12.1.2 Summary of Application

Section 12.1 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 12.1 of the AP1000 Design Control Document (DCD), Revision 19.

In addition, in VEGP COL FSAR Section 12.1, the applicant provided the following:

AP1000 COL Information Item

- STD COL 12.1-1

The applicant provided additional information in Standard (STD) COL 12.1-1 to resolve COL Information Item 12.1-1 (COL Action Item 12.2.1-1), which addresses ALARA and operational policies and compliance with RGs. The applicant provided additional information to incorporate Nuclear Energy Institute (NEI) 07-08A, "Generic FSAR Template Guidance for Ensuring That Occupational Radiation Exposures Are As Low As Is Reasonably Achievable (ALARA)," Revision 0, into VEGP COL FSAR Section 12.1 and NEI 07-03A, "Generic FSAR Template Guidance for Radiation Protection Program Description," in Appendix 12AA.

Supplemental Information

- STD SUP 12.1-1

The applicant provided supplemental (SUP) information by addressing equipment layout at the end of AP1000 DCD Section 12.1.2.4.

12.1.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design."

In addition, the acceptance criteria associated with the relevant requirements of Commission regulations for ALARA are given in Section 12.1 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants."

The applicable regulatory requirements and guidance for STD COL 12.1-1 and STD SUP 12.1-1 are as follows:

- 10 CFR Part 20
- 10 CFR 20.1101, "Radiation protection programs"
- 10 CFR 19.12, "Instructions to workers"
- RG 1.8, "Qualification and Training of Personnel for Nuclear Power Plants," Revision 3
- RG 1.33, "Quality Assurance Program Requirements (Operation)," Revision 2
- RG 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," Revision 4
- RG 8.8, "Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be ALARA," Revision 3
- RG 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposures ALARA," Revision 1-R
- NUREG-1736, "Consolidated Guidance: 10 CFR Part 20 – Standards for Protection Against Radiation"

12.1.4 Technical Evaluation

The NRC staff reviewed Section 12.1 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required

[1] See Section 1.2.2 for a discussion of the staff's review related to verification of the scope of information to be included in a COL application that references a design certification (DC).

information relating to ensuring that the ORE to personnel will be kept ALARA. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this safety evaluation report (SER) provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the Bellefonte Nuclear Plant (BLN), Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from requests for additional information (RAIs) and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was a confirmatory item (Confirmatory Item 12.1-1) and an open item (Open Item 12.1-1) related to the standard content in the BLN SER. The resolutions are addressed in this SER.

The following portion of this technical evaluation section is reproduced from Section 12.1.4 of the BLN SER:

AP1000 COL Information Item

- *STD COL 12.1-1*

The applicant provided additional information in STD COL 12.1-1, related to ALARA and Operational Policies, to resolve COL Information Item 12.1-1. COL Information Item 12.1-1 states:

> *Operational considerations of ALARA, as well as operational policies and continued compliance with 10 CFR 20 and RGs 1.8, 8.8, and 8.10, will be addressed by the Combined Operating License applicant. In addition, the Combined Operating License applicant will address operational considerations of the Standard Review Plan to the level of detail provided in RG 1.70. RGs that will be addressed include: 8.2, 8.7, 8.9, 8.13, 8.15, 8.20, 8.25, 8.26, 8.27, 8.28, 8.29, 8.34, 8.35, 8.36, and 8.38.*

The commitment was also captured as COL Action Item 12.2.1-1 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

The COL applicant will review all plant procedures and modification plans that involve personnel radiation exposure to ensure that the ALARA policy is applied. In addition, a COL applicant referencing the AP1000 certified design will address operational ALARA concerns and will submit an operational ALARA policy which conforms to the requirements of 10 CFR Part 20 and the recommendations of Revision 2 to RG 1.8, RG 8.8, and Revision 1-R to RG 8.10.

In response to COL Action Item 12.2.1-1, in the BLN COL FSAR (Revision 1) as STD COL 12.1-1:

This section incorporates by reference [Nuclear Energy Institute] NEI 07-08 "Generic FSAR Template Guidance for Ensuring That Occupational Radiation Exposures Are As Low As Is Reasonably Achievable (ALARA)," Revision 2, which is currently under review by the NRC staff. See Table 1.6-201. ALARA practices are developed in a phased milestone approach as part of the procedures necessary to support the Radiation Protection Program. Table 13.4-201 describes the major milestones for ALARA procedures development and implementation.

STD COL 12.1-1 includes a commitment to the use of a "Generic FSAR Template Guidance for Ensuring That Occupational Radiation Exposures Are as Low as Is Reasonably Achievable (ALARA)," as an operational program document, based on draft NEI Template 07-08, Revision 2. The NEI template presents the functional elements of an ALARA program, which, if met, would demonstrate compliance with 10 CFR 20.1101 and 10 CFR 19.12. Accordingly, BLN FSAR Section 12.1, STD COL 12.1-1 needs to be updated as to its commitment to the final NEI ALARA template if it is accepted by the NRC staff. Therefore, the staff cannot find the applicant's reference to the NEI 07-08 template to be acceptable until the staff completes its review of this template as a method to meet the regulatory requirements of an ALARA program, and the BLN FSAR is updated to reference the final version of this template. This is identified as ***Open Item 12.1-1****.*

The NRC staff review finds that BLN FSAR Section 12.1 and Appendix 12AA describe programs and procedures that ensure ORE will be ALARA in accordance with the training requirements in 10 CFR 19.12 and the ALARA provisions of 10 CFR 20.1101(b). The ALARA policy will be described, displayed, and implemented in accordance with the provisions of RG 8.8 (Regulatory Position C.1) and RG 8.10 (Regulatory Position C.1) and NUREG-1736, as it relates to maintaining doses ALARA.

According to BLN FSAR Appendix 12AA, NEI 07-03, NEI 07-08, and Chapter 13, "Conduct of Operations," specific individual(s) will be designated and assigned responsibility and authority for implementing ALARA policy at the BLN site. The Functional Manager in charge of Radiation Protection and the Radiation Protection staff periodically will review, update, and modify as appropriate, plant design features and changes, as well as all operating and maintenance features,

using exposure data and experience gained from operating nuclear power plants to ensure that occupational exposures will be kept ALARA in accordance with RG 8.8 guidance.

Using the guidance of Section 12.1 of NUREG-0800, the staff finds BLN FSAR Section 12.1 and Appendix 12AA are in accordance with the ALARA provisions of 10 CFR 20.1101(b) and RG 8.8 (Regulatory Position C.2) and will include incorporation of measures for reducing the need for time spent in radiological areas; measures to control access to radiological areas; measures to reduce the production, distribution, and retention of activated corrosion products throughout the primary system; measures for assuring that ORE during decommissioning will be ALARA; reviews of design modifications by competent radiation protection personnel; instructions to engineers regarding ALARA design; experience from operating plants and past designs; and continuing facility design reviews.

Using the guidance of Section 12.1 of NUREG-0800, the staff finds that BLN COL FSAR Section 12.1 and Appendix 12AA describe an acceptable program to develop plans and procedures in accordance with RGs 1.33, 1.8, 8.8, and 8.10 that can incorporate the experiences obtained from facility operation into facility and equipment design and operations planning and that will implement specific exposure control techniques.

Initially, it was not clear to the NRC staff when the appropriate ALARA program and planning procedures would be implemented as described in the proposed License Conditions (Part 10 of the BLN, Units 3 and 4 COL application). Therefore, the staff issued request for additional information (RAI) 12.1-1. In a letter dated September 22, 2008, the applicant stated that ALARA focused procedures are developed in conjunction with the Radiation Protection Program (RPP) and thus will follow the RPP milestones for implementation found in FSAR Table 13.4-201. The applicant stated that FSAR Section 12.1, STD COL 12.1-1 text will be updated as to its commitment to the final ALARA program implementation. The NRC staff finds the RAI response acceptable because it clearly identified that ALARA practices will be in place at the same time as the RPP. The NRC staff verified that Revision 1 of the BLN COL FSAR adequately incorporates the above. As a result, RAI 12.1-1 is closed. For a discussion related to the proposed license condition related to the RPP, which includes ALARA practices, refer to SER Section 12.5.5.

In accordance with 10 CFR 20.1101(b), the staff finds that overall facility operations, as well as the RPP as described in BLN COL FSAR Section 12.5, Appendix 12AA, and NEI 07-03 will integrate the procedures necessary to ensure that radiation doses are ALARA, including work scheduling, work planning, design modifications, and radiological considerations. Operating and maintenance personnel will follow specific plans and procedures to ensure that goals related to keeping exposures ALARA are achieved in the operation of the plant. Engineering controls for the protection of personnel will be optimized. Operations involving high person-sievert (person-rem) exposures will be carefully preplanned and carried out by personnel who are well trained in radiation protection and using proper equipment. During maintenance activities, in

radiological areas, personnel will be monitored for exposure to radiation and contamination. Their radiation exposures will be reviewed and used to make changes in future job procedures and techniques.

The BLN FSAR states that COL information item, STD COL 12.1-1 is addressed in NEI 07-08, and Appendix 12AA of the BLN COL FSAR, which references NEI 07-03. The staff has reviewed the current version of NEI 07-03 and NEI 07-08 with respect to compliance with RG 1.8. The NEI 07-03 template states that the Radiation Protection Manager, Radiation Protection Technicians, and Radiation Protection Supervisory and Technical Staff will be trained and qualified in accordance with the guidance of RG 1.8. In a letter dated March 18, 2009 (ML090510379), the NRC accepted NEI 07-03, Revision 7. Specifically, the NRC staff indicated that for COL applications, NEI 07-03, Revision 7 provides an acceptable template for assuring that the RPP meets the applicable NRC regulations and guidance. Since the BLN COL FSAR has not yet adopted the approved version of the NEI template, this is identified as ***Confirmatory Item 12.1-1****. At present, the NRC has not accepted NEI-07-08 as an acceptable template to be used by the COL applicants. As a result, this is identified as* ***Open Item 12.1-1****.*

Supplemental Information

- *STD SUP 12.1-1*

The applicant added the following text to the end of Section 12.1.2.3, "Facility Layout General Design Considerations for ALARA," of the DCD included in the DC amendment:

> *A video record of the equipment layout in areas where radiation fields are expected to be high following operations may be used to assist in ALARA planning and to facilitate decommissioning.*

The NRC staff acknowledges STD SUP 12.1-1 as a statement of fact not requiring NRC review.

Resolution of Standard Content Open Item 12.1-1 and Confirmatory Item 12.1-1

The NRC staff compared the VEGP and BLN COL applications and found them to be essentially identical, with two exceptions: first, the application material under STD COL 12.1-1 in Section 12.1 of the VEGP application references NEI 07-08A and the application material under STD COL 12.1-1 in Section 12.1 of the BLN application references NEI 07-08, Revision 2; and second, the VEGP FSAR Appendix 12AA references NEI 07-03A and the BLN FSAR Appendix 12AA references Revision 3 of NEI 07-03. Regarding these exceptions, the differing material associated with STD COL 12.1-1 in the VEGP FSAR is associated with adopting NEI 07-08A and NEI 07-03A, which are evaluated below as part of resolving Open Item 12.1-1 and Confirmatory Item 12.1-1.

In a letter from NEI to NRC dated October 29, 2009, NEI submitted NEI 07-08A to the NRC, which is the version of NEI 07-08 that has been accepted by the NRC. Accordingly, Open Item 12.1-1 is resolved for VEGP.

Confirmatory Item 12.1-1 is resolved for VEGP because the applicant has adopted the approved version of NEI 07-03 (i.e., NEI 07-03A [see paragraph below]).

In Revision 2 of the VEGP COL FSAR, the applicant modified parts of FSAR Chapter 12, Appendix 12.AA that relate to STD COL 12.1-1. Specifically, in the FSAR, Revision 2, NEI 07-03A, is referenced. Accordingly, because NEI 07-03A is the approved version of NEI 07-03, the above conclusions regarding Confirmatory Item 12.1-1 are not affected by the changes to Revision 2 of the FSAR. One other change is the modification of a reference at the end of Appendix 12AA where the reference to RG 1.97 is changed from Revision 4 to Revision 3. The staff found the change acceptable, since Revision 3 provides for a more comprehensive version of the RG and also provides for portable radiation monitoring equipment. Revision 4 of RG 1.97 indicates that partial implementation is not recommended.

12.1.5 Post Combined License Activities

The post-COL activities related to ALARA practices (part of the RPP) are discussed in Section 12.5.5 of this SER.

12.1.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to ALARA, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Since Open Item 12.1-1 and Confirmatory Item 12.1-1 have been resolved, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable based on the relevant acceptance criteria provided in Section 12.1 of NUREG-0800. The staff based its conclusion on the following:

- STD COL 12.1-1, relating to ALARA and operational policies and compliance with relevant regulatory guidance, is acceptable because the applicant has incorporated approved references NEI 07-03A and NEI 07-08A into the VEGP FSAR and has demonstrated conformance with the applicable regulatory requirements and guidance specified in Sections 12.1.3 and 12.1.4 of this SER.

- STD SUP 12.1-1, relating to the use of video recording of equipment layout in areas where radiation fields are expected to be high, is acknowledged as acceptable because it is a statement of fact not requiring NRC approval.

12.2 Radiation Sources

12.2.1 Introduction

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

12.2.2 Summary of Application

Section 12.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 12.2 of the AP1000 DCD, Revision 19.

In addition, in VEGP COL FSAR Section 12.2, the applicant provided the following:

AP1000 COL Information Item

- STD COL 12.2-1

The applicant provided additional information in STD COL 12.2-1 to resolve COL Information Item 12.2-1 (COL Action Item 12.3.1-1), which addresses miscellaneous sources.

12.2.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the radiation sources are given in Section 12.2 of NUREG-0800.

The applicable regulatory requirements for STD COL 12.2-1 are as follows:

- 10 CFR 20.1801, "Security of stored material"
- 10 CFR 20.1802, "Control of material not in storage"
- 10 CFR Part 50, "Domestic licensing of production and utilization facilities," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 61, "Fuel Storage and Handling and Radioactivity Control"

12.2.4 Technical Evaluation

The NRC staff reviewed Section 12.2 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to radiation sources. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was a confirmatory item (Confirmatory Item 12.1-1) related to the standard content in the BLN SER. Its resolution is addressed in this SER.

The following portion of this technical evaluation section is reproduced from Section 12.2.4 of the BLN SER:

AP1000 COL Information Item

- *STD COL 12.2-1*

The applicant provided additional information in STD COL 12.2-1, related to miscellaneous sources, to resolve COL Information Item 12.2-1. COL Information Item 12.1-1 states:

> *The Combined License applicant will address any additional contained radiation sources not identified in subsection 12.2.1, including radiation sources used for instrument calibration or radiography.*

The same commitment was also captured as COL Action Item 12.3.1-1 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793).

The applicant provided additional information in the BLN COL FSAR to address the plant STD COL 12.2-1 dealing with miscellaneous sources. The applicant stated that licensed sources containing byproduct, source and special nuclear material that warrant shielding consideration will meet the applicable requirements of 10 CFR Parts 20, 30, 31, 32, 33, 34, 40, 50 and 70. The applicant indicated that there are byproducts and source materials with known isotopes and activity manufactured for the purpose of measuring, checking, calibrating, or controlling processes quantitatively or qualitatively. Accordingly,

written procedures will be established and implemented that address procurement, receipt, inventory, labeling, leak testing, surveillance, control, transfer, disposal, storage, issuance and use of these radioactive sources. Also, the applicant indicated that sources maintained on-site for instrument calibration purposes will be shielded while in storage to keep personnel exposure ALARA.

The regulatory requirements cited in the above paragraph address the requirements applicable to sources that would likely be used in conjunction with construction, preoperational, and initial testing. The applicant will implement the practices for radioactive material control as described in NEI 07-03, Section 12.5.4.10, "Radioactive Material Control." In a letter dated March 18, 2009 (ML090510379), the NRC accepted NEI 07-03, Revision 7. Specifically, the NRC staff indicated that for COL applications, NEI 07-03, Revision 7 provides an acceptable template for assuring that the RPP meets the applicable NRC regulations and guidance. Since the BLN FSAR has not adopted the approved version of the NEI template, this is identified as ***Confirmatory Item 12.1-1****.*

The staff concludes that the information provided by the applicant with respect to radiation sources is acceptable and meets the requirements of 10 CFR Sections 20.1801 and 20.1802 and GDC 61. This conclusion is based on the applicant's commitment to the NEI 07-03 administrative controls to meet the regulatory requirements. These controls apply to the additional contained radiation sources discussed in the COL item. The staff notes that its review did not encompass the entire set of regulatory requirements cited by the applicant (10 CFR Parts 20, 30, 31, 32, 33, 34, 40, 50 and 70), since the staff's review is focused on radiation protection requirements on sources used in conjunction with the RPP.

Resolution of Standard Content Confirmatory Item 12.1-1

The NRC staff compared the VEGP and BLN COL applications regarding STD COL 12.2-1, and found them to be essentially identical, with the exception that VEGP FSAR Appendix 12AA references NEI 07-03A, whereas, the BLN FSAR references NEI 07-03, Revision 3. As indicated in Section 12.1.4 above, Confirmatory Item 12.1-1, is resolved for VEGP because the applicant has adopted the approved version of NEI 07-03, which is now designated as NEI 07-03A.

12.2.5 Post Combined License Activities

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

12.2.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to radiation sources, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Since Confirmatory Item 12.1-1 has been resolved, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable based on the relevant acceptance criteria provided in Section 12.2 of NUREG-0800. The staff based its conclusion on the following:

- STD COL 12.2-1, which addresses miscellaneous sources, is acceptable because the applicant has incorporated the approved reference NEI 07-03A into the VEGP FSAR and has demonstrated conformance with the requirements of 10 CFR 20.1801; 10 CFR 20.1802; and GDC 61.

12.3 Radiation Protection Design Features

Section 12.3, "Radiation Protection Design Features" and the following Section 12.4, "Dose Assessment," are treated as separate sections in the SER (as well as in the AP1000 DCD). However, these two sections are listed as a single section, Section 12.3-12.4, "Radiation Protection Design Features," in both RG 1.206 and NUREG-0800, with the material discussed under the section "Dose Assessment" included in a section at the end of Section 12.3.

12.3.1 Introduction

This section addresses the issues related to radiation protection equipment and design features used to ensure that occupational radiation exposures are ALARA. It takes into account design dose rates, AOOs, and accident conditions. These issues include the facility design features, shielding, ventilation, area radiation and airborne radioactivity monitoring instrumentation, and dose assessment.

12.3.2 Summary of Application

Section 12.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 12.3 of the AP1000 DCD, Revision 19.

In addition, in VEGP COL FSAR Section 12.3, the applicant provided the following:

Tier 2 Departure

- VEGP DEP 18.8-1

The applicant described the following Tier 2 departure (DEP) from the AP1000 DCD. The applicant proposed revising several DCD figures in Section 12.3 to reflect the relocation of the Operations Support Center (OSC). This Tier 2 departure is evaluated in Section 12.5 of this SER.

AP1000 COL Information Items

- STD COL 12.3-1

The applicant provided additional information in STD COL 12.3-1 to resolve COL Information Item 12.3-1 (COL Action Item 12.4.2-1), which addresses the administrative controls for use of the design features provided to control access to radiological restricted areas.

- STD COL 12.3-2

The applicant provided additional information in STD COL 12.3-2 to resolve COL Information Item 12.3-2 (COL Action Item 12.4.4-1), which addresses the criteria and methods for obtaining representative measurement of radiological conditions, including airborne radioactivity concentrations in work areas.

- STD COL 12.3-3

The applicant provided additional information in STD COL 12.3-3 to resolve COL Information Item 12.3-3, which addresses the groundwater monitoring program beyond the normal radioactive effluent monitoring program.

- STD COL 12.3-4

The applicant provided additional information in STD COL 12.3-4 to resolve COL Information Item 12.3-4, which addresses the program to ensure documentation of operational events deemed to be of interest for decommissioning.

In Section 11.2.4 of this SER, the staff states that the following item in VEGP COL FSAR Section 11.2 is evaluated in this SER section:

Supplemental Information

- VEGP SUP 11.2-1

The applicant provided supplemental information in VEGP COL FSAR Section 11.2.1.2.4 regarding the exterior radwaste discharge piping. This item is addressed by the staff as part of its evaluation of STD COL 12.3-3.

12.3.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of Commission regulations for radiation protection design features are given in Section 12.3 of NUREG-0800.

The applicable regulatory requirements and guidance for STD COL 12.3-1 are as follows:

- 10 CFR Part 20

- RG 1.8

- RG 8.9, “Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program,” Revision 1

- RG 8.38, “Control of Access to High and Very High Radiation Areas in Nuclear Power Plants,” Revision 1

- NUREG-1736

The applicable regulatory requirements and guidance for STD COL 12.3-2 are as follows:

- 10 CFR Part 19, “Notices, instructions and reports to workers: inspection and investigations”

- 10 CFR Part 20

- 10 CFR Part 50

- NUREG-0737, ”Clarification of TMI Action Plan Requirements,” Item III.D.3.3

- RG 1.8

- RG 8.2, “Guide for Administrative Practices in Radiation Monitoring”

- RG 8.8

- RG 8.10

- RG 1.21, “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,” Revision 1, “Measuring Radioactive Materials in Liquid and Gaseous Effluents and Solid Waste,” Appendix A

- RG 1.97

The applicable regulatory requirements and guidance for STD COL 12.3-3, STD COL 12.3-4, and VEGP SUP 11.2-1 are as follows:

- 10 CFR 20.1406, “Minimization of contamination”

- 10 CFR 50.75, “Reporting and recordkeeping for decommissioning planning”

- RG 4.21, “Minimization of Contamination and Radioactive Waste Generation: Life Cycle Planning”

12.3.4 Technical Evaluation

The NRC staff reviewed Section 12.3 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff’s review confirmed that the information in the application and incorporated by reference addresses the required information relating to radiation protection design features. The results of the NRC staff’s evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff's review of this application included the following COL information and supplementary items:

- STD COL 12.3-1, Administrative Controls for Radiological Protection
- STD COL 12.3-2, Criteria and Methods for Radiological Protection
- STD COL 12.3-3, Groundwater Monitoring Program
- VEGP SUP 11.2-1, Supplemental Information on Exterior Radwaste Discharge Piping
- STD COL 12.3-4, Record of Operational Events of Interest for Decommissioning

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.
- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.
- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were two confirmatory items (Confirmatory Items 12.1-1 and 12.3-1) and one open item (Open Item 12.3-1) related to the standard content in the BLN SER. The resolutions are addressed in this SER.

The following portion of this technical evaluation section is reproduced from Section 12.3.4 of the BLN SER:

AP1000 COL Information Items

- *STD COL 12.3-1*

The applicant provided additional information in STD COL 12.3-1, related to the administrative controls for radiological protection, to resolve COL Information Item 12.3-1. COL Information Item 12.3-1 states:

> *The Combined License applicant will address the administrative controls for use of the design features provided to control access to radiologically restricted areas, including potentially very high radiation areas, such as the fuel transfer tube during refueling operations and to the reactor cavity.*

The commitment was also captured as COL Action Item 12.4.2-1 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The COL applicant will address the administrative controls for use of the design features provided to control access to radiologically restricted areas, including potentially very high radiation areas, such as the reactor cavity and the fuel transfer canal during refueling operations. The hatch to the spent fuel transfer canal will be treated as an entrance to a very high radiation area under 10 CFR Part 20 and will be locked during spent fuel transfer operations.*

The applicant addressed this STD COL item in BLN COL FSAR, Appendix 12AA. This appendix incorporates by reference NEI 07-03, Revision 7 [sic]. *The NEI template directs COL applicants to describe the site-specific plant information for areas requiring administrative controls for very high radiation areas. To supplement NEI 07-03, Section 12.5.4.4, "Access Control," the applicant provided additional measures in Appendix 12AA for access controls such as signs, locks, plant manager (or designee) approval for entry, and radiation protection personnel accompaniment and exposure control for entry into very high radiation areas. The applicant also stated that a closed circuit television system may be installed in high radiation areas to allow remote monitoring of individuals entering high radiation areas by personnel qualified in radiation protection procedures.*

The COL applicant will apply the administrative controls for the use of the design features to control access to very high radiation areas, such as the fuel transfer tube during refueling and to the reactor cavity during operations, and other radiologically restricted areas to comply with 10 CFR Sections 20.1601 and 20.1602. The opening of the fuel transfer hatch is administratively controlled, treated as an entrance to a very high radiation area, and is in place during spent fuel transfer operation.

The staff finds the applicant's approach meets the requirements of 10 CFR Sections 20.1601 and 20.1602, and is consistent with RG 8.38, Regulatory Position C1 and C3, which will ensure that an individual is unable to gain unauthorized or inadvertent access to such areas.

In a letter dated March 18, 2009 (ML090510379), the NRC accepted NEI 07-03, Revision 7. Specifically, the NRC staff indicated that for COL applications, NEI 07-03, Revision 7 provides an acceptable template for assuring that the RPP meets the applicable NRC regulations and guidance. Since the BLN FSAR has not adopted the approved version of the NEI template, this is identified as ***Confirmatory Item 12.1-1****.*

The NRC staff reviewed STD COL 12.3-1 dealing with administrative controls for radiological protection, using the text added in Appendix 12AA. The BLN COL FSAR Appendix 12AA, incorporates by reference NEI 07-03.

In Appendix 12AA, the applicant has taken exception to NEI 07-03, Section 12.5 to not conform to the guidance of the following regulatory guides:

> *RG 8.20, "Applications for Bioassay for I-125 and I-131"*
> *RG 8.26* [sic]*, "Bioassay at Uranium Mills"*
> *RG 8.32, "Criteria for Establishing a Tritium Bioassay Program"*

The guidance documents were identified as outdated regulatory guidance in NUREG-1736, Consolidated Guidance: 10 CFR Part 20, "Standards for Protection Against Radiation," October 2001. NUREG-1736 describes that in conjunction with 10 CFR 20.1502(b), which requires licensees to monitor for likely intakes; 10 CFR 20.1204(a) and (b) prescribe how information obtained through monitoring is to be used when assessing exposures to workers from intakes. The NUREG recommends that licensees (and therefore applicants) consider the methods described in RG 8.9, "Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program," for estimating intakes of radionuclides and determining the frequency of bioassay measurements. RG 8.9 provides updated methods and guidance that was previously contained in positions of the three RGs above. The applicant's commitment to RG 8.9 is sufficient to assure proper monitoring for intake of radionuclides.

In BLN COL FSAR, Appendix 12AA, the applicant took exception to the first paragraph of NEI 07-03, Section 12.5.2 to describe the equivalent key radiological protection positions for the BLN site. The description of organizational positions with specific radiation protection responsibilities is in BLN COL FSAR Section 13.1. BLN COL FSAR Section 13.1, "Organizational Structure of the Applicant," provides specific radiation protection responsibilities for key positions within the plant organization and the plant organization overall. Managers and supervisors within the plant operating organization are responsible for establishing goals and expectations for their organization and to reinforce behaviors that promote radiation protection. BLN COL FSAR Section 13.1.1, "Management and Technical Support Organization," and Section 13.1.2, "Operating Organization," provide the responsibilities of the organizations and positions to assure that radiological safety goals and expectations are adhered to.

The staff finds that the applicant's exception to NEI 07-03, Section 12.5.2 is acceptable because BLN COL FSAR Section 13.1 provides the key radiological safety responsibilities and organization consistent with RG 1.8.

Correction of Errors in the Standard Content Evaluation Text

The NRC staff identified an error in the text reproduced above from the BLN SER, Section 12.3.4, that requires correction. The BLN SER states that Appendix 12AA of the BLN COL FSAR incorporates by reference NEI 07-03, Revision 7. The appendix actually incorporates by reference NEI 07-03, Revision 3. The NRC staff also identified an error in the text reproduced above from the BLN SER, Section 12.3.4 regarding the reference to RG 8.22, which was incorrectly referred to as RG 8.26.

Resolution of Standard Content Confirmatory Item 12.1-1

The NRC staff compared the VEGP and BLN COL applications regarding STD COL 12.3-1, and found them to be essentially identical, with the exception that VEGP FSAR Appendix 12AA references NEI 07-03A and BLN FSAR Appendix 12AA references Revision 3 of NEI 07-03. Additional clarifying information has been added to the VEGP FSAR regarding STD COL 12.3-1, which is discussed below. As indicated in Section 12.1.4 above, Confirmatory Item 12.1-1, is resolved for VEGP because the applicant has adopted the approved version of NEI 07-03, which is now designated as NEI 07-03A.

In addition, changes have been made in Revision 2 of the VEGP FSAR Chapter 12 that relate to STD COL 12.3-1. The changes are as follows:

1. A new Table 12AA-201 has been added to Appendix 12AA that provides information concerning access to very high radiation areas (VHRA). The table provides VHRA locations, DCD cross references, radiation sources in the locations and other conditions and restrictions.

2. In FSAR Appendix 12AA, new text was added to Section 12.5.4.4 of NEI 07-03A. The text references new Table 12AA-201 and describes the information in it, discusses removal of the primary sources of radiation from the VHRA areas, and discusses verification walk downs of VHRA to ensure consistency with RG 8.38. In addition to the changes to Appendix 12AA discussed above, the applicant has also added text to Section 12.5.4 regarding the possible use of closed circuit television system to allow remote monitoring of individuals entering high radiation areas.

These items (i.e., the addition of the table, reference to it and discussion of walk downs, and the closed circuit television system) are acceptable because they provide additional clarity and site-specific information regarding controls to VHRAs and more completely describe features that address STD COL 12.3-1.

The following portion of this technical evaluation section is reproduced from Section 12.3.4 of the BLN SER:

- *STD COL 12.3-2*

The applicant provided additional information in STD COL 12.3-2, related to the criteria and methods for radiological protection, to resolve COL Information Item 12.3-2. COL Information Item 12.3-2 states:

> *The Combined License applicant will address the criteria and methods for obtaining representative measurement of radiological conditions, including airborne radioactivity concentrations in work areas. The Combined License applicant will also address the use of portable instruments, and the associated training and procedures, to accurately determine the airborne iodine concentration in areas within the facility where plant personnel may be present during an accident.*

The same commitment was also captured as COL Action Item 12.4.4-1 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793).

The staff reviewed STD COL 12.3-2, dealing with criteria and methods for radiological protection. In BLN COL FSAR Section 12.3.4, the applicant presented the procedure detailing the criteria and methods for obtaining representative measurement of radiological conditions, including in-plant airborne radioactivity concentrations in accordance with applicable portions of 10 CFR Part 20 and consistent with the guidance in RGs 1.21, Appendix A, 8.2, 8.8, and 8.10.

The applicant also discussed the surveillance requirements and the frequency of scheduled surveillance that are consistent with the operational philosophy in RG 8.10. In Section 12.3.4, "Area Radiation and Airborne Radioactivity Monitoring Instrumentation," the applicant described the typical survey frequencies and varieties of surveys. The surveys described in general terms include radiation, contamination, airborne radioactivity, and job coverage surveys for occupational radiation workers during normal and off-normal conditions.

Appendix 12AA also describes qualification and training criteria for site personnel consistent with the guidance in RG 1.8 and as described in FSAR Chapter 13. Section 13.2, "Training," incorporates NEI 06-13A, "Template for an Industry Training Program Description." NEI 06-13A, Section 1.2.7, provides training for the use of survey instruments, use of analytical equipment, radiation protection procedures and emergency plan procedures.

The applicant discussed a portable iodine monitoring system used to determine the airborne iodine concentration in areas where plant personnel may be present routinely and during an accident which meets the guidance of NUREG-0737, Item III.D.3.3 and complies with 10 CFR Part 50, Appendix A. The applicant will incorporate the use of this sampling system into the emergency plan implementing procedures.

The NRC staff reviewed BLN COL FSAR Section 12.3.4 and Appendix 12AA, dealing with standards applied to the calibration and maintenance of portable radiation survey instruments. The applicant describes Area and Airborne Radioactivity Monitoring Instrumentation in BLN COL FSAR Section 12.3.4 and also in Section 14.2.9.4.27, "Portable Personnel Monitors and Radiation Survey Instruments."

The portable personnel monitor and radiation survey instrument testing verifies that the devices operate in accordance with their intended function in support of the RPP as described in Chapter 12. The applicant stated as a prerequisite that the monitors, instruments and certified test sources are on site. The applicant also stated that the general test method and acceptance criteria for the monitors and instruments would be source checked and tested in accordance with the manufactures' recommendations. The NRC staff determined that additional information should be provided in addition to the use of manufacturers' recommendations. Additional standards such as American National Standards Institute (ANSI) N42.17A-1989, as it relates to the accuracy and overall performance of portable survey instruments, and ANSI N323A-1997, as it relates to the calibration and maintenance of portable radiation survey instruments should be provided. In response to RAI 12.3-12.4-5, in a letter from the applicant, dated September 22, 2008; the applicant stated that it intends to revise the BLN COL FSAR to include maintenance and calibration of survey instruments and to update the version of the ANSI standard in a future revision of the COL application. The NRC staff finds that Revision 1 of the BLN COL FSAR adequately addresses the above. As a result, RAI 12.3-12.4-5 is closed.

- *STD COL 12.3-3*

The applicant provided additional information in STD COL 12.3-3, related to the groundwater monitoring program, to resolve COL Information Item 12.3-3. COL Information Item 12.3-3 states:

> *The Combined License applicant will establish a groundwater monitoring program beyond the normal radioactive effluent monitoring program. If and as necessary to support this groundwater monitoring program, the Combined License applicant will install groundwater monitoring wells during the plant construction process. Areas of the site to be specifically considered in this groundwater monitoring program are as follows:*
>
> - *West of the auxiliary building in the area of the fuel transfer canal*
> - *West and south of the radwaste building*
> - *East of the auxiliary building rail bay and the radwaste building truck doors*

The applicant added text in BLN COL FSAR Appendix 12AA, Section 12AA.5.4.14 to the information incorporated from NEI 07-03 regarding the groundwater monitoring program.

The applicant stated that a groundwater monitoring program beyond the normal radioactive effluent monitoring program will be developed, if, and as necessary to support this groundwater monitoring program, design features will be installed during the plant construction process. The applicant discussed areas of the site to be specifically considered in this groundwater monitoring program.

The NRC staff evaluated the applicant's groundwater monitoring program to the criteria in 10 CFR 20.1406. 10 CFR 20.1406 requires the applicant to provide a description of how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment; facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of radioactive waste. The regulatory guidance which describes an acceptable method for meeting the regulation was published in June 2008, RG 4.21, Revision 0, "Minimization of Contamination and Radioactive Waste Generation: Life Cycle Planning."

The groundwater monitoring program as described in BLN COL FSAR Appendix 12AA included some implementation considerations, but the program lacked a description of the key components of the program such as, types and periodicity of routine samples, threshold activity to be detected, actions to be taken upon detection, and quality assurance practices to be used to ensure reasonable assurance of prompt identification of leakage into the groundwater (RAI 12.3-12.4-1 and RAI 12.3-12.4-2).

The applicant stated in a letter dated September 22, 2008, that it will adopt the NEI 08-08, "Generic FSAR Template Guidance for Life Cycle Minimization of Contamination," Revision 0 template. If approved by the NRC, the applicant will provide additional description of site specific design features and procedures for operation that minimize contamination of the facility, site, and environment. NEI 08-08 is currently under staff review. This is identified as ***Open Item 12.3-1****.*

As described in Section 11.2.1 2.4 [sic] *of the AP1000 DCD, Revision 17, the exterior monitored liquid effluent discharge pipe is engineered to preclude leakage by either enclosure within a guard pipe and leakage monitoring, or is accessible for visual inspection in total from the Radwaste Building to the licensed release point for dilution and discharge. No valves, vacuum breakers, or other fittings are incorporated outside of buildings. In a supplemental response dated December 16, 2008, to RAI 12.3-12.4-1, the applicant provided a proposed revision to the BLN COL FSAR to describe the site-specific design of the external radioactive waste discharge line. The staff agrees with the applicant that the site-specific design will minimize the potential for undetected leakage from this discharge to the environment at a non-licensed release point, and complies with 10 CFR 20.1406. The proposed change to the BLN COL FSAR is acceptable subject to a formal revision to the BLN COL FSAR. Accordingly, this is identified as* ***Confirmatory Item 12.3-1****.*

Resolution of Standard Content Open Item 12.3-1

Revision 2 of the FSAR references NEI 08-08A, which is the version of NEI 08-08 that has been accepted by NRC. Accordingly, Open Item 12.3-1 is resolved for VEGP.

Resolution of Standard Content Confirmatory Item 12.3-1

The NRC staff verified that Section 11.2.1.2.4 of the VEGP FSAR was updated to include the information identified in BLN Confirmatory Item 12.3-1; therefore, Confirmatory Item 12.3-1 is resolved for VEGP.

Supplemental Information

- VEGP SUP 11.2-1

In Section 11.2.4 of this SER, the staff states that VEGP SUP 11.2-1 is evaluated in SER Section 12.3. The applicant added additional information in VEGP COL FSAR Section 11.2.1.2.4 regarding the exterior radwaste discharge piping.

The last paragraph of the standard content evaluation, reproduced from Section 12.3.4 of the BLN SER above, provides the staff's evaluation of the exterior radwaste discharge piping. The VEGP applicant has endorsed the December 16, 2008, supplemental response to RAI 12.3-12.4-1, stating that, while the response is expected to be standard, it includes both standard and plant-specific changes. The plant-specific changes are addressed by VEGP SUP 11.2-1. The plant-specific information provided by the VEGP applicant in VEGP FSAR Section 11.2, in conjunction with the resolution of Standard Content Confirmatory Item 12.3-1, demonstrates that the design of the exterior monitored liquid effluent discharge pipe is in compliance with 10 CFR 20.1406.

Staff Evaluation of Additional Supplemental Information Related to VEGP SUP 11.2-1

In a letter dated September 10, 2010, the applicant proposed to add supplemental information (VEGP SUP 11.2-1) at the end of VEGP COL FSAR Section 11.2.1.2.4 regarding the design of both the liquid radwaste system (WLS) discharge piping exiting the Radwaste Building and the waste water system (WWS) plant outfall pipe running to the plant outfall on the Savannah River. In the proposed supplemental information, the applicant stated that the WLS discharge piping from the Units 3 and 4 Radwaste Building would be stainless steel, enclosed within a guard pipe, and monitored for leakage to comply with 10 CFR 20.1406. The WWS blowdown line to the plant outfall at the Savannah River would be buried, high density polyethylene single-walled pipe. The wastewater would gravity drain from the blowdown sump to the diffuser at the plant outfall, and there would be no valves, vacuum breakers, or pumps along the WWS blowdown line between the point where WLS connects and the plant outfall. The applicant would evaluate the need to monitor for leakage of the WWS blowdown line and implement this monitoring, if necessary, as part of the Units 3 and 4 Groundwater Monitoring Program described in NEI 08-08A. RG 4.21 states that applicants should strive to minimize leaks and spills, provide containment in areas where such events might occur, and provide for detection that supports timely assessment and appropriate response. NEI 08-08A states that the COL applicant would establish an onsite groundwater monitoring program to ensure timely detection of inadvertent radiological releases to the groundwater. On the basis that VEGP SUP 11.2-1 states that the applicant would utilize double-walled piping or piping having no valves or vacuum breakers for piping described as buried underground and would implement a groundwater monitoring program for the WWS blowdown line piping running to the plant outfall at the Savannah River, the staff finds that the site-specific design will minimize the potential for undetected leakage from this discharge to the environment at a nonlicensed release point, and the information

provided in VEGP SUP 11.2-1 complies with the requirements of 10 CFR 20.1406 and is, therefore, acceptable. The staff confirmed that the applicant incorporated the proposed supplemental information into the VEGP COL FSAR.

The following portion of this technical evaluation section is reproduced from Section 12.3.4 of the BLN SER:

- *STD COL 12.3-4*

The applicant provided additional information in STD COL 12.3-4, related to the record of operational events of interest for decommissioning, to resolve COL Information Item 12.3-4. COL Information Item 12.3-4 states:

> *The Combined License applicant will establish a program to ensure documentation of operational events deemed to be of interest for decommissioning, beyond that required by 10 CFR 50.75. This or another program will include remediation of any leaks that have the potential to contaminate groundwater.*

The applicant added text in Appendix 12AA, Section 12AA.5.4.15 to the information incorporated from NEI 07-03 dealing with a record of operational events of interest for decommissioning. The applicant discussed procedures established to document the operational events that are deemed of interest for decommissioning, beyond that required by 10 CFR 50.75. These documented operational events assist in developing a historical assessment of the nuclear facilities, thereby reducing time, effort, and hazards to personnel during decommissioning planning. This documentation will include identification of the remediation of any leaks, which have the potential to contaminate groundwater. The procedures that govern retention of these records, and the records themselves, should specify the retention period required to assure availability when they may be required (e.g., life of facility plus 30 years). The NRC staff requested in RAI 12.3-12.4-3 that the applicant include the operational and design COL information items that fully meet the objectives of RG 4.21, Revision 0 and hence the requirements of 10 CFR 20.1406, 'Minimization of Contamination."

In response to the RAI, in a letter dated September 22, 2008, the applicant stated that it intended to adopt NEI 08-08. This document is intended to provide the description of additional site procedures for decommissioning records which will demonstrate compliance with 10 CFR 20.1406. This is identified as ***Open Item 12.3-1****.*

Resolution of Standard Content Open Item 12.3-1

Revision 2 of the FSAR references NEI 08-08A, which is the version of NEI 08-08 that has been accepted by NRC. Accordingly, Open Item 12.3-1 is resolved for VEGP.

12.3.5 Post Combined License Activities

The post-COL activities related to the RPP are discussed in SER Section 12.5.5.

12.3.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to radiation protection design features and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Since Open Item 12.3-1 and Confirmatory Items 12.1-1 and 12.3-1 have been resolved, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable based on the relevant acceptance criteria provided in Section 12.3 of NUREG-0800. The staff based its conclusion on the following:

- STD COL 12.3-1, which addresses the administrative controls for use of the design features provided to control access to radiological restricted areas, is acceptable because the applicant has incorporated the approved reference NEI 07-03A into the VEGP FSAR and has demonstrated conformance with the applicable regulatory requirements and guidance specified in Sections 12.3.3 and 12.3.4 of this SER.

- STD COL 12.3-2, which addresses the criteria and methods for obtaining representative measurement of radiological conditions, including airborne radioactivity concentrations in work areas, is acceptable because the applicant has demonstrated compliance with the applicable regulatory requirements and guidance specified in Sections 12.3.3 and 12.3.4 of this SER.

- STD COL 12.3-3, which addresses the groundwater monitoring program beyond the normal radioactive effluent monitoring program, is acceptable because the applicant has incorporated the approved reference NEI 08-08A into the VEGP FSAR and has demonstrated conformance with the applicable regulatory requirements and guidance specified in Sections 12.3.3 and 12.3.4 of this SER.

- STD COL 12.3-4, which addresses the program to ensure documentation of operational events deemed to be of interest for decommissioning, is acceptable because the applicant has incorporated the approved reference NEI 08-08A into the VEGP FSAR and has demonstrated conformance with the applicable regulatory requirements and guidance specified in Sections 12.3.3 and 12.3.4 of this SER.

- VEGP SUP 11.2-1 and the associated DCD related to the description of the monitored radwaste discharge pipeline are acceptable because the plant-specific information provided by the VEGP applicant in VEGP FSAR Section 11.2, in conjunction with the resolution of Standard Content Confirmatory Item 12.3-1, demonstrates that the design of the exterior monitored liquid effluent discharge pipe is in compliance with 10 CFR 20.1406.

12.4 Dose Assessment

12.4.1 Introduction

This section addresses the issues related to estimating the annual personal doses associated with operation, normal maintenance, radwaste handling, refueling, ISI, and special maintenance (e.g., maintenance that goes beyond routine scheduled maintenance, modification of equipment to upgrade the plant, and repairs to failed components).

12.4.2 Summary of Application

Section 12.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 12.4 of the AP1000 DCD, Revision 19.

In addition, in VEGP COL FSAR Section 12.4, the applicant provided the following:

Supplemental Information

- VEGP SUP 12.4-1

The applicant provided supplemental information to address dose to construction workers by adding new sections after DCD Section 12.4.1.8.

- STD SUP 12.4-1

The applicant provided supplemental information regarding conduct of radiological surveys in unrestricted and controlled areas and for radioactive materials in effluents discharged to unrestricted and controlled areas.

12.4.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the dose assessment are given in Section 12.4 of NUREG-0800.

The applicable regulatory requirements for VEGP SUP 12.4-1 are as follows:

- 10 CFR 20.1101
- 10 CFR 20.1301, “Dose limits for individual members of the public”
- 10 CFR 20.1302, “Compliance with dose limits for individual members of the public”

12.4.4 Technical Evaluation

The NRC staff reviewed Section 12.4 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff’s review confirmed that the information in the application and incorporated by reference addresses the required

information relating to dose assessment. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the information in the VEGP COL FSAR:

Supplemental Information

- VEGP SUP 12.4-1

The applicant provided supplemental information regarding the dose to construction workers in VEGP COL FSAR Section 12.4.1.9 (Sections 12.4.1.9.1 through 12.4.1.9.4), "Radiation Exposure to Construction Workers." Section 12.4.1.9.1 briefly describes the site layout as depicted in Figure 1.1-202 of the VEGP FSAR. The sources of radiation exposure are described in Section 12.4.1.9.2 and include the sources of direct exposure (Units 1 and 2 as well as an anticipated but yet to be proposed independent spent fuel storage installation [ISFSI]), the gaseous effluent releases and the small amounts of liquid effluents released into the Savannah River. Section 12.4.1.9.3 includes the calculations for annual total exposure rates, and Section 12.4.1.9.4 includes the calculations for actual exposure that a construction worker may receive. The applicant also added a new Section 12.4.4, "References," which includes reference to the Southern Nuclear Operating Company's VEGP Annual Radioactive Effluent Release Reports for years 2001 through 2003 and to the Offsite Dose Calculation Manual (ODCM).

In VEGP COL FSAR Sections 12.4.1.9.2.1 through 12.4.1.9.2.3, the applicant identified the sources of radiation that could be encountered by VEGP Units 3 and 4 construction workers. The information provided by the applicant includes the direct radiation sources and the sources and activity estimates of gaseous and liquid effluent releases.

In VEGP COL FSAR Section 12.4.1.9.3.1, the applicant evaluated the potential direct radiological dose impacts to construction workers at VEGP Units 3 and 4 resulting from the operation of VEGP Units 1 and 2. The applicant stated that the average 365-day dose from the six thermoluminescent dosimeters (TLDs) located on the Protected Area Fence closest to the construction area is 115.9 millirem (mrem). Their stated annual average background dose is 49 mrem. These two values are then used to arrive at an annual dose of 66.9 mrem per year (115.9 mrem minus 49 mrem), direct exposure, from VEGP Units 1 and 2. The assumed exposure contribution from the anticipated ISFSI is negligible. Unit 4 construction workers may receive higher exposure than Unit 3 construction workers, due to exposure from an operating Unit 3 reactor. Therefore, the total annual direct exposure component is increased by an additional 33.5 mrem (the approximate annual exposure from one operating VEGP unit) to a total of 100.4 mrem per year of continuous exposure for VEGP Unit 4 construction workers.

The staff has determined that the use of the average annual exposure of Protected Area Fence TLDs is an acceptable method for conservatively determining dose to construction workers who will not enter the VEGP Unit 1 or Unit 2 protected areas. Since Units 1 and 2 are closer to these TLDs than to where the construction workers would be, the TLD data conservatively approximate the dose to construction workers. The staff issued RAI 12.3-12.4-1 to obtain further information concerning the acceptability of the TLD data that were used for the calculations in this section. The staff also issued RAI 12.3-12.4-2 to obtain further information to support the conclusions for the direct radiation component of the construction worker dose as a result of Unit 3 operation and a proposed ISFSI. The additional information is evaluated in the

section below. Since NUREG-1872, “Final Environmental Impact Statement for an Early Site Permit (ESP) at the Vogtle Electric Generating Plant Site,” identified that TLDs placed at control locations approximately 10 miles from the VEGP site measured annual radiation exposures from 48.4 to 54.4 milliRad per year, the assumption of 49 mrem per year for background exposure is an acceptable approximation.

In VEGP COL FSAR Sections 12.4.1.9.3.2 and 12.4.1.9.3.3, the applicant discussed the potential radiological exposure from gaseous and liquid effluents to construction workers. The applicant assumed that the onsite construction worker would receive doses from these effluents as modeled for the offsite maximally exposed individual (MEI). The applicant used the codes XOQDOQ and GASPAR II to determine doses as a result of gaseous effluents, and used the Annual Radioactive Effluent Release Reports and the LADTAP code to determine doses resulting from liquid effluents. The applicant calculated the total body doses and maximally exposed organ and dose for each pathway.

VEGP COL FSAR Section 12.4.1.9.4, “Construction Worker Doses,” provides the assumptions used to calculate doses. This section includes the measured and calculated values used as a basis for each pathway that are used to provide estimates of total dose. The staff adjusted the annual doses for continuous exposure, as listed in Section 12.4.1.9.3, to reflect annual doses resulting from 2000 hours of assumed exposure. This results in a calculated 24.1 mrem total effective dose equivalent (TEDE) in a year.

VEGP COL FSAR Section 12.4.1.9.4.4 refers to tables at the end of the section for summaries of the annual exposures received by construction workers. Table 12.4-201 reflects gaseous effluent doses that would be received during a year of continuous exposure, not in the assumed 2000 hours. The other doses in the table, for direct radiation and liquid effluents, are for 2000 hours of exposure. This inconsistency in methodology results in a conservative reporting of the annual dose, and is considered acceptable.

Even though the liquid effluent dose assessment is not considered applicable for the calculation to the construction worker, as discussed below in the evaluation of the applicant’s response to RAI 12.3-12.4-3, its inclusion by the applicant in the overall dose to a construction worker adds conservatism to the assessment. The staff found all assumptions listed in VEGP COL FSAR Section 12.4.1.9 to be acceptable in providing a reasonable assessment of the construction worker dose since they are based on measured and calculated values for the existing facility.

The applicant provides in VEGP COL FSAR Table 12.4-203 a comparison for the members of the public dose assessment with environmental dose standards of 40 CFR Part 190. Most of the dose listed in the table (95 percent) is due to direct exposure from the facilities to the onsite construction workers rather than from radioactive materials introduced into the environment. The inclusion of the direct dose component when assessing compliance with 40 CFR Part 190 provides a conservative assessment. As stated in 40 CFR Part 190:

> The provisions of this part apply to radiation doses received by members of the public in the general environment and to radioactive materials introduced into the general environment as the result of operations which are part of a nuclear fuel cycle.

If access to the site and the construction area for Units 3 and 4 are controlled by the applicant, these areas would not be considered the general environment for purposes of 40 CFR Part 190 compliance; therefore, the staff concluded an assessment that demonstrates compliance with 40 CFR Part 190 for these areas results in a conservative evaluation.

The applicant states that, during construction of Units 3 and 4, the annual dose to construction workers would be less than the limit for members of the public as stated in 10 CFR 20.1301 and less than the environmental dose standard of 40 CFR Part 190. As a result, the staff can conclude that the construction workers would not be classified as radiation workers.

As a result of the staff's review of Section 12.4.1.9, three RAIs were issued, RAI 12.3-12.4-1, RAI 12.3-12.4-2 and RAI 12.3-12.4-3. Each RAI is discussed below:

RAI 12.3-12.4-1:

> In RAI 12.3-12.4-1, the staff questioned the adequacy of using a 2-year data set of TLD results for determining construction worker dose because the applicant provided no basis or evaluation to show that the 2-year data set was representative of the average annual dose that could be received by a worker for the Units 3 and 4 construction. In a letter dated January 16, 2009, the applicant responded to the RAI. The applicant stated that the TLD data from 2003 was used because it was the most complete at the time the ESP application was submitted. In addition, the data set from 2003 was believed to be representative because the plant capacity factor was 95 percent for that year. Further, the applicant stated that evaluations of more recent TLD data from 2006 yield similar results to the 2003 TLD data. The staff found this approach reasonable and acceptable. Over the long period of construction, the average capacity factor would likely be less than 95 percent and, as a result, the TLD data should provide a conservative estimate of construction worker direct dose. It should be noted that the TLD measurements would include the direct dose component from gaseous effluents; however, the applicant assessed this contribution separately, as discussed below, which had the effect of increasing the estimated dose to construction workers and resulted in a more conservative assessment result.
>
> RAI 12.3-12.4-1 also requested that the applicant provide error bounds for the estimated doses based on the TLD measurements. The applicant did not address the issue other than by stating that the 2003 and 2006 data were similar and that the TLD data are evaluated by a dosimetry processor in accordance with 10 CFR 20.1501(c). For the six TLD stations, the data for 2006 indicate an annual gross measurement (before background is subtracted out) between 111 mrem and 120 mrem, with an average of 115 mrem. Given that Units 1 and 2 are closer to the TLD locations than to where Unit 3 or 4 construction workers would be, the staff concluded that the potential error in measurement is offset by the additional conservatism in the location of the TLDs. The staff questioned the applicant's reference to 10 CFR 20.1501(c) for the dosimeter processing since this regulation is specific to the processing of personnel dosimeters, not environmental dosimeters where guidance is provided in RG 4.13, "Performance, Testing, and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Applications," Revision 1 and the referenced ANSI N545 (1975), "Performance, Testing, and Procedural Specification for TLD, Environmental Application." In a supplemental response dated November 20, 2009, the applicant removed the reference to 10 CFR 20.1501(c). In a second supplemental response dated January 29, 2010, the applicant stated that the TLDs will be processed and

evaluated according to the vendor's internal quality control program, procedures, and RG 4.13. The staff concluded that the information provided in response to RAI 12.3-12.4-1 is acceptable.

RAI 12.3-12.4-2:

The annual dose to construction workers working at Unit 4 is based on an assumption that Unit 3 produces an annual exposure equal to one-half of the dose from Units 1 and 2 (33.5 mrem) and then adding to this the total contribution from Units 1 and 2 of 66.9 mrem, yielding a total direct dose of 100.4 mrem per year of continuous exposure. In RAI 12.3-12.4-2, the staff questioned why the dose from Unit 3 to Unit 4 construction workers would be one-half of that from Units 1 and 2. In a letter dated January 16, 2009, the applicant responded to the RAI. The applicant stated that for Unit 3, the direct radiation exposure from containment and other plant buildings is negligible, in accordance with DCD Section 12.4.2. The applicant conservatively assumed a dose from Unit 3 to Unit 4 construction workers to be one-half that from Units 1 and 2 combined.

The COL applicant also stated that the direct radiation exposure to VEGP Unit 3 and Unit 4 construction workers is negligible from the anticipated VEGP onsite ISFSI. In RAI 12.3-12.4-2, the staff also asked the applicant to describe the basis used for estimating the dose contribution from the proposed ISFSI. According to the applicant's initial response to RAI 12.3-12.4-2, dated January 16, 2009, the ISFSI was planned to be constructed west of Unit 2 at a distance of approximately 300 feet (ft) from the Units 3 and 4 construction areas, resulting in construction worker exposures of 15 mrem per year. A supplemental response to this RAI, dated November 20, 2009, indicated that the planned location of the ISFSI had changed to east of VEGP Unit 1, which is more than 1,000 ft from the proposed VEGP Unit 3 and Unit 4. ISFSI exposure assessments were evaluated as part of the VEGP ESP, where it was concluded that the contributions to doses from the ISFSI at distances greater than 600 ft were negligible. The assumed location for the VEGP ISFSI, east of Unit 1, ensures that the Unit 3 and Unit 4 construction workers will be significantly further than 600 ft away from the installed ISFSI. A second supplemental response to this RAI, dated January 29, 2010, clarified some aspects of this ISFSI exposure assessment by identifying certain TLD results as representing background dose and referencing the response to the Environmental Report RAI E4.5.3-1 for further information. The staff has concluded that potential doses to construction workers from an anticipated ISFSI would be negligible based on the above assumptions.

Based on the above information, the staff agrees that assumptions and conclusions made by the applicant regarding construction worker exposures from direct radiation from Unit 3 and a proposed ISFSI are conservative and acceptable. Therefore, the response to RAI 12.3-12.4-2 is acceptable.

RAI 12.3-12.4-3, Items a, b and c:

Items a and b of RAI 12.3-12.4-3 requested additional information on the following two topics:

- The gaseous effluent exposure to construction workers was calculated using ODCM methodologies. Construction workers would be located within the site boundary, closer than normally calculated by the ODCM. Additional information was requested to confirm that the calculated doses are conservative.

- The liquid effluent calculations for construction workers used the same assumptions as those for offsite members of the public, and neglected to include any exposure for construction workers as a result of the interconnects between Unit 3 and Unit 4.

In a letter dated January 16, 2009, the applicant responded to the RAI. In summary, the applicant stated the following:

- For gaseous effluents, in the applicant's calculation the direction of maximum exposure to Unit 3 construction workers from Units 1 and 2 releases was 0.36 miles to the west-southwest, and 0.52 miles to the west for Units 1 and 2 releases to Unit 4 construction workers. The exposed Unit 4 construction workers from Unit 3 were taken to be 0.15 miles in the direction of maximum exposure. All releases and receptors were modeled as ground-level with no shielding. The source term was based on data for 2002, which was the maximum calculated dose year among the years 2001-2004. The annual total body dose to construction workers from gaseous effluents calculated by the applicant is summarized in VEGP COL FSAR Table 12.4-201 as 0.81 mrem. The staff determined that the directions and distances described above correctly model the actual distances, that ground-level modeling is conservative, and that the 0.81 mrem per year is consistent with the results presented in NUREG-1872, Appendix G, Table G-5, which describes the exclusion area boundary dose to the total body as 0.56 mrem per year.

- For liquid effluents, the applicant assumed the dose to construction workers would be equal to that of the MEI, as defined in 10 CFR Part 50, 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." The MEI is assumed to obtain drinking water and fish for consumption downstream of the liquid effluent release. The staff concluded that this is conservative because, in reality, the source of construction worker onsite drinking water is not from the river.

- Unit 3 and Unit 4 each has a dedicated liquid radwaste line that interconnect only at the outfall. Workers trained in the appropriate radiological controls will perform the required fit-up and construction. Operating procedures, radiation controls, and training would be used to control exposure when the interconnect is made.

The staff concluded that the information provided in response to RAI 12.3-12.4-3, Items a and b, as summarized in the above three bullets, is acceptable.

Item c of RAI 12.3-12.4-3 requested additional information with regard to the statement that dose calculations for construction workers from particulates are limited to those with half-lives greater than 8 days. The 8-day half-life is a 10 CFR Part 50, Appendix I criterion and is not

applicable to dose calculations for construction workers. In the letter dated January 16, 2009, the COL applicant responded to the RAI. The applicant stated that because of in-plant control measures, e.g., system holdups such as gaseous and solid waste storage (decay) tanks, short-lived (half-life less than 8 days) radionuclides are insignificant contributors to exposure. The applicant also stated that gaseous releases are typically five orders of magnitude less than applicable limits. The staff reviewed the applicant's response and several of the VEGP Annual Radiological Environmental Operating Reports and determined that, while the issue of disregarding radionuclides with half-lives less than 8 days should not be excluded from this assessment, the contribution would be negligible. The applicant's reports do indicate that the dose to construction workers from gaseous effluents would be negligible, and suggest that the estimated doses excluding the radionuclides with half-lives less than 8 days is reasonable and conservative. The staff concluded that the applicant's response to Item c of RAI 12.3-12.4-3 is acceptable.

In summary, the NRC staff determined that the information provided in VEGP SUP 12.4-1, regarding dose to construction workers, in the new Section 12.4.1.9, was acceptable. In accordance with the discussion in the above paragraphs, RAIs 12.3-12.4-1, 12.3-12.4-2, and 12.3-12.4-3 are resolved.

- STD SUP 12.4-1

The following portion of this technical evaluation section is reproduced from Section 12.4.4 of the BLN SER:

- *BLN SUP 12.4-1*

The applicant provided supplemental information regarding the dose to construction workers in the BLN COL FSAR. In this section, the applicant evaluated the potential radiological dose impacts to construction workers at the BLN, Units 3 and 4 resulting from the operation of Unit 3. Since a portion of the Unit 4 construction period overlaps operation of Unit 3, construction workers at Unit 4 would be exposed to direct radiation and gaseous radioactive effluents from Unit 3. Doses to construction workers during construction of Unit 3 are not evaluated since the only radiation sources prior to the start-up of Unit 3 are background sources. The applicant discussed, as part of the dose assessment, the site layout, radiation sources, construction worker dose estimates, compliance with dose regulations, and collective doses to Unit 4 workers.

The NRC staff reviewed BLN SUP 12.4-1, regarding dose to construction workers. The information provided in FSAR Sections 12.4.1.9 was not sufficient for the staff to validate and verify the estimated doses for Unit 4 construction workers. Without this information the staff could not verify that the applicant met the acceptance criteria in Section 12.3-12-4 of NUREG-0800 and complied with the dose limits in 10 CFR 20.1301 and 10 CFR 20.1302. The information provided should include the information necessary to reproduce the calculations or reference where the information was obtained and is available to the staff (RAI 12.3-12.4-4). In response to the RAI, in a letter dated September 22, 2008, the applicant provided additional information such that an independent assessment of the major aspects of the construction worker dose assessment could be conducted. The applicant provided the information and assumptions necessary to perform a GASPAR II calculation for the construction worker dose

when Unit 4 is under construction. The estimated maximum dose that is accessible to a construction worker is 0.071 mSv (7.1 mrem) per year. Collective dose to Unit 4 construction workers is estimated to be 0.0113 person-Sieverts (1.13 person-rem). BLN COL FSAR Section 12.4.1.9 and Table 12.4-201 documented compliance with 10 CFR 20.1301 and 10 CFR 20.1302. The staff's independent assessment based on the additional information provided by the applicant confirmed the BLN results. There is no BLN COL FSAR revision necessary. As a result, RAI 12.3-12.4-4 is closed.

Section 4.5 of Part 3, Environmental Report (ER), of the BLN COL application provides an analysis of the expected average annual dose that will be received by a construction worker at BLN Unit 4 during the construction period. Section 4.5.6 of the ER states that there will be a radiation protection and ALARA program for BLN Unit 4 construction workers that will meet the requirements of 10 CFR 20.1302. Section 4.6 of the ER Table 4.6-1 describes specific measures and controls. Contrary to the ER, BLN COL FSAR Section 12.4 does not contain any description of a construction worker program to address minimizing exposure during BLN Unit 4 construction. In RAI 12.3-12.4-6, the applicant was requested to describe the program that will ensure the construction workers will be monitored and that exposures will be minimized and maintained ALARA in accordance with 10 CFR 20.1101(b). This is identified as ***Open Item 12.4-1****.*

Resolution of Open Item 12.4-1

In a letter dated July 16, 2009, the applicant proposed to add supplemental information to Section 12.4.1.9.5 of the VEGP COL FSAR regarding conduct of radiological surveys in unrestricted and controlled areas and for radioactive materials in effluents discharged to unrestricted and controlled areas. The supplemental text states that these surveys are conducted by the operating unit for the purposes of implementing 10 CFR 20.1302 and to demonstrate compliance with the standards of 10 CFR 20.1301 for construction workers. This text is acceptable because it is consistent with applicable regulatory requirements. The staff confirmed that the VEGP COL FSAR was appropriately revised, and Open Item 12.4-1 is, therefore, closed.

12.4.5 Post Combined License Activities

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

12.4.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the dose assessment, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable based on the relevant acceptance criteria provided in Section 12.4 of NUREG-0800. The staff based its conclusion on the following:

- VEGP SUP 12.4-1, which provides supplemental information to address dose to construction workers, is acceptable, because the applicant has demonstrated compliance with 10 CFR 20.1101, 10 CFR 20.1301, and 10 CFR 20.1302.

- STD SUP 12.4-1, which provides supplemental information regarding conduct of radiological surveys in unrestricted and controlled areas and for radioactive materials in effluents discharged to unrestricted and controlled areas, is acceptable because the applicant has demonstrated compliance with 10 CFR 20.1301 and 10 CFR 20.1302.

12.5 Health Physics Facilities Design (Related to RG 1.206, Section C.III.1, Chapter 12, C.I.12.5, "Operational Radiation Protection Program")

12.5.1 Introduction

This section addresses the objectives and design of the health physics (HP) facilities. The HP facilities are designed with the objectives of:

- Providing capability for administrative control of the activities of plant personnel to limit personnel exposure to radiation and radioactive materials ALARA and within the requirements of 10 CFR Part 20.

- Providing capability for administrative control of effluent releases from the plant to maintain the releases ALARA and within the limits of 10 CFR Part 20 and the plant Technical Specifications.

12.5.2 Summary of Application

Section 12.5 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 12.5 of the AP1000 DCD, Revision 19.

In addition, in VEGP COL FSAR Section 12.5, the applicant provided the following:

Tier 2 Departure

- VEGP DEP 18.8-1

The applicant described the following Tier 2 departure from the AP1000 DCD. The applicant proposed revising the first sentence of AP1000 DCD Section 12.5.2.2, "Facilities," to state that the ALARA briefing room is located off the main corridor immediately beyond the main entry to the annex building. This change eliminates the DCD reference to the OSC being in that location. The applicant also proposed revising several DCD figures in FSAR Section 12.3 to reflect the relocation of the OSC.

AP1000 COL Information Item

- STD COL 12.5-1

The applicant provided additional information in STD COL 12.5-1 to resolve COL Information Item 12.5-1 (COL Action Item 12.6-1), which addresses the RPP description.

License Conditions

- Part 10, License Condition 3, Items C.1, D.2, G.4, and K.1

The actual milestones for the RPP are listed in Table 13.4-201.

- Part 10, License Condition 6, Operational Program Readiness

The applicant proposed a license condition to provide a schedule to support NRC inspection of operational programs including the RPP.

12.5.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the HP facilities design are given in Section 12.5 of NUREG-0800.

The applicable regulatory requirements and guidance for STD COL 12.5-1 and VEGP COL 12.5-1 are as follows:

- 10 CFR Part 20
- RG 8.2
- RG 8.4, "Direct Reading and Indirect Reading Pocket Dosimeters"
- RG 8.6, "Standard Test Procedures for Gieger-Muller Counters"
- RG 8.8
- RG 8.9
- RG 8.10
- RG 8.28, "Audible-Alarm Dosimeters"
- NUREG-1736

The applicable regulatory requirement for License Condition 3, Items C.1, D.2, G.4, and K.1 is as follows:

- 10 CFR 20.1101

12.5.4 Technical Evaluation

The NRC staff reviewed Section 12.5 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the HP facilities design. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard

content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were two confirmatory items (Confirmatory Items 12.1-1 and 12.5-1) related to the standard content in the BLN SER. The resolutions are addressed in this SER.

The staff reviewed the information in the VEGP COL FSAR:

Tier 2 Departure

- VEGP DEP 18.8-1

The applicant revised the first sentence of DCD Section 12.5.2.2 to read: "The ALARA briefing room is located off the main corridor immediately beyond the main entry to the annex building." This change results in a relocation of the stated location for the OSC. As reported in VEGP COL FSAR Section 12.3, this departure also results in replacing DCD Figure 12.3-1 (Sheet 11), DCD Figure 12.3-2 (Sheet 11) and DCD Figure 12.3-3 (Sheet 11) with VEGP COL FSAR Figure 12.3-201, Figure 12.3-202 and Figure 12.3-203, respectively. In addition, DCD Figure 9A-3 (Sheet 1) is replaced with VEGP COL FSAR Figure 9A-201 to reflect the relocation of the OSC. The staff's evaluation of this departure is found in Chapters 13 and 18 of this SER.

This departure does not have an impact on the radiation protection facilities design. Since the ALARA briefing room remains as stated in the DCD, there is no impact on radiation protection facilities, programs or functions. The location of the ALARA briefing room would allow for efficient and timely briefings and meets the requirements of RGs 8.8 and 8.10.

The following portion of this technical evaluation section is reproduced from Section 12.5.4 of the BLN SER:

> *AP1000 COL Information Item*
>
> - *STD COL 12.5-1*
>
> *The applicant provided additional information in STD COL 12.5-1, addressing the RPP description, to resolve COL Information Item 12.5-1. COL Information Item 12.5-1 states:*

The Combined License applicant will address the organization and procedures used for adequate radiological protection and to provide methods so that personnel radiation exposures will be maintained ALARA.

The same commitment was also captured as COL Action Item 12.6-1 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793). The applicant stated that STD COL 12.5-1 is addressed in Appendix 12AA of the BLN COL FSAR. This appendix incorporates by reference NEI 07-03, Revision 3. The applicant described revisions to NEI 07-03 and supplemental information in Appendix 12AA of the BLN COL FSAR. The staff evaluated the revised text and supplemental information provided in conjunction with the referenced NEI 07-03, Revision 3 template. These revisions and supplements address STD COL Items 12.1-1, 12.3-1, 12.3-3, 12.3-4, and 12.5-1. The applicant's proposed revisions and supplements are:

1. *Specific organizational positions were described in Chapter 13 of BLN COL FSAR; and Sections 12.5.2.1 through 12.5.2.5 are not incorporated in Appendix 12AA.*

2. *Facilities, as described in general terms in NEI 07-03, Revision 3 are not incorporated in BLN COL FSAR Appendix 12AA; facilities, instrumentation, and equipment are described in DCD Section 12.5.2.*

3. *Supplemental information was provided for NEI 07-03, Section 12.5.3.3 to describe compliance with 10 CFR 20.1703(b) and 10 CFR 20.1705 when National Institute for Occupational Safety and Health (U.S. Public Health Service) tested and certified respiratory protection equipment is not used.*

4. *The following headings and associated material that are described in general terms in NEI 07-03, Revision 3 are not incorporated in Appendix 12AA. Radwaste Handling, Spent Fuel Handling, Normal Operation, and Sampling are described in DCD Section 12.5.3.*

5. *Supplemental information was provided for NEI 07-03, Section 12.5.4.4* [sic] *to describe the use of a closed circuit television system to allow remote monitoring for high radiation areas access.*

6. *Supplemental information was provided for NEI 07-03, Section 12.5.4.4 to describe access control measures for very high radiation areas. Locations and radiological controls of the radiation zones are described on plant diagrams in DCD Section 12.5.3.*

7. *Appendix 12AA revised NEI 07-03, Section 12.5.4.7 to clarify the location of the COL applicant's management policy, organizational responsibility authorities for implementing an effective ALARA program, and the establishment and implementation of radiation protection.*

8. *The applicant revised the second bullet of NEI 07-03, Section 12.5.4.7 II to require that the functional manager in charge of radiation protection be*

responsible for defining the value for "Significant exposures" and the associated activities within written procedures. The example value described in NEI 07-03 includes activities that are estimated to involve greater than 1 person-rem of collective dose.

9. *The COL applicant added text after the last bullet of NEI 07-03, Section 12.5.4.8 to adopt NEI 08-08 that is currently under review by the NRC staff.*

10. *The COL applicant added information to NEI 07-03, Section 12AA.5.4.14 and Section 12AA.5.4.15* [sic] *to adopt NEI 08-08 that is currently under review by the NRC staff.*

The applicant describes the exceptions and supplemental information to NEI 07-03 that reference additional design and site-specific information necessary to clearly identify the source of the information addressed in the RPP as described in Appendix 12AA. The applicant's description provides sufficient detailed information supporting the exceptions or revisions such that the information described provides clear direction as to organizational structure, facilities, management policy for ALARA, and where the threshold for significant with exposures will be described. The NRC staff agrees that the applicant's exceptions to NEI 07-03, noted above are acceptable because these exceptions and the supplemental information satisfy the regulatory requirements of 10 CFR 20.1106 (b), the acceptance criteria of Sections 12.1 and 12.5 of NUREG-0800 and the regulatory guidance in RG 8.8, Position C.1.b, RG 8.9, and RG 8.10, Positions C.1.a, and C.2.

The applicant added Appendix 12AA, "Appendix 12AA, Radiation Protection Program Description," after Section 12.5 of the DCD. In this appendix the applicant incorporates by reference NEI 07-03, Revision 3. The applicant indicated that Table 13.4-201 provides milestones for radiation protection operational program implementation.

The NRC staff reviewed STD COL 12.5-1 dealing with the RPP description in BLN COL FSAR Appendix 12AA. The additional controls described in STD COL 12.5-1 are consistent with the discussion in NUREG-1736 regarding Bioassay programs for personnel monitoring and are consistent with the applicant's commitment to RG 8.9. The staff reviewed the threshold for determining significant exposures. The applicant stated that the functional manager in charge of radiation protection determines the threshold within procedures. Initially, the staff did not consider that the applicant exercised sufficient control related to maintaining ALARA (RAI 12.5-1).

In response to RAI 12.5-1, in a letter dated September 22, 2008, the applicant provided additional information that the final NEI 07-03 template (Revision 7) would be incorporated without departure concerning significant exposures. In a letter dated March 18, 2009 (ML090510379), the NRC accepted NEI 07-03, Revision 7. Specifically, the NRC staff indicated that for COL applications, NEI 07-03, Revision 7 provides an acceptable template for assuring that the RPP

meets the applicable regulations and guidance. Since the BLN COL FSAR has not yet adopted the approved version of the NEI template, this is identified as ***Confirmatory Item 12.1-1****.*

The NRC staff reviewed Revision 0 of the BLN COL FSAR Appendix 1AA, which listed the applicant's conformance with radiation protection related RGs. The applicant stated that it will conform in general to RG 8.28, "Audible Alarm Dosimeters," Revision 0, dated August 1981, and specifically stated that it conforms to ANSI N13.7-1981, which was reaffirmed in 1992. ANSI N13.7-1983 is the "American National Standard for Radiation Protection-Photographic Film Dosimeters Criteria for Performance." RG 8.28, Revision 0, endorsed ANSI N13.27-1981, "Performance Specifications for Pocket-Sized Alarming Dosimeters/Ratemeters." This discrepancy was identified in RAI 1-10. In response to RAI 1-10, the applicant stated that BLN COL FSAR Appendix 1AA would be revised to the correct reference of the ANSI standard in a future revision of the BLN COL FSAR. The NRC staff verified that Revision 1 of the BLN COL FSAR adequately addresses the proposed change. As a result, RAI 1-10 is closed.

The staff notes that the VEGP FSAR has not been updated to correct the discrepancy identified in RAI 1-10 regarding the reference to ANSI N13.27-1981. Revision 2 of the VEGP FSAR currently references the incorrect standard, ANSI N13.7-1981, under RG 8.28 in Appendix 1AA. Since the VEGP applicant has endorsed RAI 1-10, the staff expects this discrepancy to be corrected in a future revision of the VEGP FSAR. This is **VEGP Confirmatory Item 12.5-2**.

Correction of Error in the Standard Content Evaluation Text

The NRC staff identified two errors in the text reproduced above from the BLN SER, Section 12.5.4 that require correction. In the change numbered 5 above, the reference to "NEI 07-03, Section 12.5.4.4," is incorrect. The correct reference is to "NEI 07-03, Section 12.5.4.2." In the change numbered 10, above, the reference to "Section 12AA.5.4.14 and Section 12AA.5.4.15" is incorrect. The correct reference is to "Section 12.5.4.14 and Section 12.5.4.15."

Resolution of Standard Content Confirmatory Item 12.1-1

The NRC staff compared the VEGP and BLN COL applications regarding STD COL 12.5-1, and found them to be essentially identical, with the exception that VEGP FSAR Appendix 12AA references NEI 07-03A and BLN FSAR Appendix 12AA references Revision 3 of NEI 07-03. Additional clarifying information has been added to the VEGP FSAR regarding STD COL 12.5-1, which is discussed below. As indicated in Section 12.1.4 above, Confirmatory Item 12.1-1, is resolved for VEGP because the applicant has adopted the approved version of NEI 07-03, which is now designated as NEI 07-03A.

In Revision 2 of the FSAR, the applicant modified parts of FSAR Chapter 12, Appendix 12AA, that relate to STD COL 12.5-1. The changes are as follows:

1. Text describing a closed circuit television system associated with high radiation areas has been moved from Appendix 12AA to Section 12.5.2.2 (this text is associated with STD COL 12.3-1, and is evaluated in Section 12.3.4 of this SER).

2. References in NEI 07-03A have been revised to reflect the appropriate sections of the FSAR.

3. Proposed modifications to the second bullet of NEI 07-03, Section 12.5.4.7 have been withdrawn.

4. Bullet number 3 of NEI 07-03A, Section 12.5, has been revised to address aspects of the radiation program functional areas that must be in place at various milestones.

5. A cross reference to NEI 08-08A has been added in NEI 07-03A.

6. The first paragraph of Section 12.5.4.12 of NEI 07-03A has been revised to address 10 CFR 20.1101 and the Quality Assurance Program.

Items 1, 2, and 5 are acceptable because they are editorial and do not affect content. The change described in Item 3 is acceptable because NEI 07-03A is acceptable without modification. The changes described in Item 4 are acceptable because they are consistent with the milestones described in FSAR Table 13.4-201 and with applicable regulatory requirements. The changes described in Item 6 are acceptable because they are consistent with 10 CFR 20.1101 and the Quality Assurance Program described in FSAR Section 17.5.

Exceptions to RGs 8.2, 8.4, 8.6, and Section C.3.b of RG 8.8

The following portion of this technical evaluation section is reproduced from Section 12.5.4 of the BLN SER:

> *The applicant took exception to RG 8.2, "Guide for Administrative Practices in Radiation Monitoring," regarding a reference to a previous version of 10 CFR Part 20 (10 CFR 20.401), because it is no longer valid. The staff agrees with the applicant's exception.*
>
> *The applicant took exception to RG 8.4, "Direct Reading and Indirect Reading Pocket Dosimeters," regarding references to previous versions of 10 CFR Part 20 (10 CFR 20.202(a), and 10 CFR 20.401) because they are no longer valid. The staff agrees with the applicant's exception. The applicant also took exception to ANSI N13.5-1972 (R-1989), in that two performance criteria, accuracy and leakage, specified in the guidance, are to be met by acceptance standards in ANSI N322-1997, "ANSI Test, Construction, and Performance requirements for Direct Reading Electrostatic/Electroscope Type Dosimeters." The staff finds that by using ANSI N322-1997 for performance criteria, 10 CFR 20 requirements are still met, as the major change is the allowance of an additional one percent leakage over a comparable time period. Test and calibration intervals recommended by RG 8.4 are not affected.*
>
> *The applicant took exception to RG 8.6, "Standard Test Procedures for Geiger Mueller Counters," to reference an instrument calibration program based upon ANSI Criteria N323A-1997 (with 2004 Correction Sheet), "Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments." This methodology is acceptable over the previous program referenced in RG 8.6 because the ANSI standard reflects current industry practices. The staff agrees with the applicant's position.*

The applicant took exception to part of Position C.3.b in RG 8.8, "Information Relevant to Ensuring that Occupational Radiation Exposure at Nuclear Power Stations will be ALARA." This exception was to the reporting requirements associated with operating exposure. The applicant's basis for justifying the exception to RG 8.8, Position C.3.b, is that reporting of operating exposure information is no longer required. The staff agrees with the applicant's exception to RG 8.8, Position C3.b, because this specific reporting requirement has been superseded. All licensees are now required to report records of ionizing exposure to the NRC annually in accordance with 10 CFR 20.2206.

License Condition

- *License Condition 3, Items C.1, D.2, G.4, and K.1*

Implementation milestones were provided by the applicant to address the RPP required by 10 CFR 20.1101. A phased-in implementation should include appropriate milestones in the construction of the facility. Staffing levels, equipment, facilities, and procedures necessary to ensure radiation safety of the workers and public for each phase of implementation should be identified. In RAI 12.5-2, the staff requested that the applicant provide the specific programs to be implemented at each milestone identified in Table 13.4-201 of the BLN COL FSAR. In its response to the RAI, the applicant provided clarifying information regarding Table 13.4-201.

In a supplemental response to RAI 12.5-2, dated December 16, 2008, the applicant provided a proposed revision to BLN COL FSAR Table 13.4-201 to show the specific program(s) for each milestone and assignment of a Radiation Protection Manager and Supervisor. The proposed change to BLN COL FSAR Table 13.4-201 is acceptable subject to a formal revision to the BLN COL FSAR, based on the specific commitment to establish an individual responsible for each milestone. Accordingly, this is identified as ***Confirmatory Item 12.5-1****.*

Resolution of Standard Content Confirmatory Item 12.5-1

The NRC staff verified that the VEGP FSAR was updated to include the information identified in the initial and supplemental BLN response to RAI 12.5-2. Accordingly, Standard Content Confirmatory Item 12.5-1 is resolved for the VEGP COL FSAR.

Part 10, License Condition 6, Operational Program Readiness

The applicant proposed a license condition to provide a schedule to support NRC inspection of operational programs, including the RPP. The proposed license condition is consistent with the policy established in SECY-05-0197, "Review of Operational Programs in a Combined License Application and General Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria," and is acceptable.

12.5.5 Post Combined License Activities

For the reasons discussed in the technical evaluation section above, the staff proposes to include the following license conditions:

- License Condition (12-1) - The licensee shall implement the RPP including the ALARA principle (or applicable portions thereof) on or before the associated milestones identified below:

  – Receipt of Materials – Prior to initial receipt of byproduct, source, or special nuclear materials onsite (excluding exempt quantities as described in 10 CFR 30.18, “Exempt quantities”)

  – Fuel Receipt – Prior to initial receipt of fuel onsite

  – Fuel Loading – Prior to initial fuel load

  – Waste Shipment – Prior to initial radioactive waste shipment

- License Condition (12-2) – No later than 12 months after issuance of the COL, the licensee shall submit to the Director of the Office of New Reactors a schedule that supports planning for and conduct of NRC inspections of the operational program (RPP). The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until this operational program has been fully implemented.

12.5.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff’s review confirmed that the applicant addressed the required information relating to the HP facilities design, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff’s technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information, related to the reference in ANSI N13.27-1981, presented in the VEGP COL FSAR is acceptable. The staff based its conclusion on the following:

- VEGP DEP 18.1-1, which addresses the relocation of the stated location in the DCD for the OSC, is acceptable because this departure does not have an impact on the radiation protection facilities design. Since the ALARA briefing room remains as stated in the DCD, there would be no impact on radiation protection facilities, programs or functions. The location of the ALARA briefing room would allow for efficient and timely briefings, and meet the requirements of RGs 8.8 and 8.10.

- STD COL 12.5-1, which addresses the RPP description, is acceptable because the applicant has demonstrated compliance with the applicable regulatory requirements and guidance specified in Sections 12.5.3 and 12.5.4 of this SER.