CONTENTS

LIST OF FIGURES

No Figures are included in this chapter.

LIST OF TABLES

No Tables are included in this chapter.

11 RADIOACTIVE WASTE MANAGEMENT

This chapter describes the results of the U.S. Nuclear Regulatory Commission (NRC) staff review of the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 design basis and average radioactive source terms, and radioactive waste management systems (RWMS). This chapter provides information on plant and site-specific design features, and operational programs used to meet the radiation protection standards of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20, "Standards for Protection Against Radiation," for members of the public, and 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents."

The design basis source term, addressed in combined license (COL) Final Safety Analysis Report (FSAR) Section 11.1, "Source Terms," is used to define the capability of the RWMS to process associated types of wastes and amounts of radioactivity, and establish operational requirements for the effluent radiation monitoring system to control and monitor liquid and gaseous effluent releases. This source term provides the basis for shielding analyses and assessment of occupational radiation exposures to plant workers. The average source term is used to represent conditions characterizing radionuclide concentrations in primary and secondary coolants under normal operating conditions. The average source term is used to assess doses to members of the public due to liquid and gaseous effluent releases.

The RWMS include the liquid waste management system (LWMS) as described in COL FSAR Section 11.2, gaseous waste management system (GWMS) as described in COL FSAR Section 11.3, solid waste management system (SWMS) as described in COL FSAR Section 11.4, and process and effluent radiological monitoring and sampling systems (PERMSS) as described in COL FSAR Section 11.5. The systems include the instrumentation used to monitor, control, and sample releases of radioactive effluents and wastes. The systems are designed for normal operations, including refueling outages, containment purges, routine maintenance, and anticipated operational occurrences (AOOs). As operational events, AOOs include unplanned releases of radioactive materials with radiological consequences that are not considered accident conditions associated with equipment failures, operator errors, and administrative errors.

11.1 Source Terms

One of the elements required for the review of radioactive waste management systems is the types and quantities of radioactive materials that are input to these systems for treatment of liquid and gaseous wastes. This source term review includes consideration of parameters used to determine the concentration of each radioactive isotope in the reactor coolant, fraction of fission product activity released to the reactor coolant, and the concentrations of all non-fission product radioactive isotopes in the reactor coolant. The source term analysis also determines bounding values of parameters to be used in evaluating radioactive waste system capacities and effluent monitoring systems and in analyzing the consequences of certain postulated accidents.

COL FSAR, Section 11.1 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 11.1, "Source Terms."

The staff reviewed the COL application and checked the referenced U.S. EPR FSAR section to ensure that no issues relating to this section remained for review. The staff's review confirmed that there are no outstanding issues related to this section.

The staff reviewed the information in the U.S. EPR FSAR Tier 2, Section 11.1 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the source terms incorporated by reference in the COL FSAR have been documented in the staff safety evaluation report (SER) on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. **Request for Additional Information (RAI) 222, Question 01-5 is being tracked as an open item as part of this chapter**. The staff will update Section 11.1 of this report to reflect the final disposition of the design certification application.

11.2 Liquid Waste Management System

11.2.1 Introduction

The LWMS is designed to control, collect, process, handle, store, and dispose of liquid radioactive wastes generated as a result of normal operation, including AOOs. Liquid wastes generated by pressurized water reactors (PWRs) include primary coolant, leakage collected from equipment and floor drains, steam generator blowdowns, and process effluent streams generated by treatment systems. The LWMS is also designed to reduce and control radioactive releases into the environment. Releases from the LWMS are conducted as batch releases through a single liquid waste discharge line. The LWMS is equipped with radiation monitoring instrumentation that automatically terminates effluent releases if radioactivity levels in discharges exceed effluent concentration limits set by NRC regulations.

11.2.2 Summary of Application

COL FSAR Section 11.2 incorporates by reference U.S. EPR FSAR Tier 2, Section 11.2, "Liquid Waste Management System."

In addition, in COL FSAR Section 11.2, the COL applicant provided the following:

Combined License Information Items

The COL applicant provided additional information in COL FSAR Section 11.2.4, "Liquid Waste Management System Cost-Benefit Analysis," to address COL Information Item No. 11.2-1 from U.S. EPR FSAR Tier 2, Table 1.8-2, "U.S. EPR Combined License Information Items" as follows:

> A COL applicant that references the U.S. EPR design certification will confirm that the liquid waste management system cost-benefit analysis for the typical site is applicable to their site; if it is not, provide a site-specific cost-benefit analysis.

In response to this COL information item, the COL applicant stated that the liquid waste cost-benefit analysis in U.S. EPR FSAR Tier 2, Section 11.2.4 is intended to represent a generic coastal site. However, the actual site parameters used in the U.S. EPR FSAR are from the CCNPP Unit 3 site. Therefore, the cost–benefit analysis in the U.S. EPR FSAR is applicable to CCNPP Unit 3.

11.2.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the Final Safety Evaluation Report (FSER) related to the U.S. EPR FSAR.

In addition, the relevant requirements of NRC regulations for the LWMS, and the associated acceptance criteria, are specified in NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," (hereafter referred to as NUREG-0800 or the SRP), Section 11.2, "Liquid Waste Management System."

The applicable regulatory requirements for the LWMS are as follows:

1. 10 CFR 20.1301, "Dose limits for individual members of the public," as it relates to limits on doses to members of the public, and liquid effluent concentration limits for unrestricted areas.

2. 10 CFR 20.1302, "Compliance with dose limits for individual members of the public," as it relates to methods used in demonstrating compliance with dose limits to members of the public; and liquid effluent concentration limits of 10 CFR Part 20, Appendix B, "Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage," Table 2, Column 2 for unrestricted areas.

3. 10 CFR Part 50, Appendix I, Section II.A, as it relates to numerical guides for design objectives and limiting conditions for operation to meet the criterion of "as low as is reasonably achievable" and dose criteria for maximally exposed individuals located in unrestricted areas.

4. 10 CFR Part 50, Appendix I, Section II.D, as it relates to the conduct of cost-benefit analysis in reducing population doses from liquid effluents using reasonably demonstrated technology and a favorable cost-benefit ratio.

5. 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations" (the U.S. Environmental Protection Agency (EPA) generally applicable environmental radiation standards), as implemented under 10 CFR 20.1301(e), as it relates to controlling doses within U.S. EPA generally applicable environmental radiation standards.

The related acceptance criteria are as follows:

1. Regulatory Guide (RG) 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," as it relates to demonstrating compliance with the numerical guidelines for dose design objectives and "as low as is reasonably achievable" (ALARA) criteria of 10 CFR Part 50, Appendix I.

2. RG 1.110, "Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors," as it relates to methods and assumptions applied in performing cost-benefit analyses in reducing cumulative doses to populations by using reasonably demonstrated technology.

3. RG 1.113, “Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I,” as it relates to the use of acceptable methods for estimating aquatic dispersion and transport of liquid effluents in surface water bodies in demonstrating compliance with 10 CFR Part 50, Appendix I design objectives.

4. RG 1.143, “Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants,” as it relates to the definition of the discharge path starting at the LWMS interface from plant systems serviced by the LWMS and ending to the point of controlled discharge into the environment using plant and site-specific characteristics.

5. Branch Technical Position (BTP) 11-6, “Postulated Radioactive Releases Due to Liquid-Containing Tank Failures,” as it relates to the assessment of radiological impacts associated with liquid effluent releases.

6. NUREG/CR-4013, “LADTAP II − Technical Reference and User Guide,” as an acceptable method for assessing doses to the maximally exposed offsite individual from liquid effluent releases.

11.2.4 Technical Evaluation

The staff reviewed COL FSAR Section 11.2 and checked the applicable sections of the referenced design certification FSAR to ensure that the combination of the information in the U.S. EPR FSAR and the information in the COL FSAR represents the complete scope of required information relating to this review topic. The review confirmed that the information contained in the COL application and incorporated by reference addresses the required information relating to this section. U.S. EPR FSAR Tier 2, Section 11.2 has been reviewed by the staff under Docket No. 52-020. The staff’s technical evaluation of the information incorporated by reference related to the liquid waste management system has been documented in the staff safety evaluation report on the design certification application for the U.S. EPR.

The staff’s review of the information contained in the COL FSAR is discussed as follows:

The staff reviewed COL FSAR Section 11.2 against SRP Section 11.2 to determine if the information contained in COL FSAR Section 11.2 met the requirements of regulations stated above and NUREG-0800 acceptance criteria and guidance. However, the staff’s review ascertained that there were some outstanding issues, as discussed below.

Combined License Information Items

The staff reviewed COL Information Item No. 11.2-1 from U.S. EPR FSAR Tier 2, Table 1.8-2 included under COL FSAR Section 11.2.4. The COL information item states:

> A COL applicant that references the U.S. EPR design certification will confirm that the liquid waste management system cost-benefit analysis for the typical site is applicable to their site; if it is not, provide a site-specific cost-benefit analysis.

COL FSAR Section 11.2.4 states that COL Information Item No. 11.2-1 is addressed by endorsing the results of the cost-benefit analysis presented in U.S. EPR FSAR Tier 2,

Section 11.2. This approach assumes that the results of the cost-benefit analysis presented in U.S. EPR FSAR Tier 2, Section 11.2 justify, in part, the performance of the LWMS subsystems in demonstrating compliance with the ALARA cost-benefit requirements of 10 CFR Part 50, Appendix I, Section II.D. The cost-benefit analysis is based on the guidance of RG 1.109 and RG 1.110, with the results evaluated against the cost-benefit ratio criteria of 10 CFR Part 50, Appendix I, Section II.D.

A comparison of the information presented in COL FSAR, Revision 6, Sections 11.2.2, "System Description," 11.2.3, "Radioactive Effluent Releases," 10.4.5, "Circulating Water System," and 2.1.1.3, "Boundary for Establishing Effluent Release Limits," and COL FSAR Figure 10.4-6, "Circulating Water System Blowdown Flowpath," indicates that the information presented in the corresponding sections of the U.S. EPR FSAR is different and inconsistent with the characteristics of the CCNPP Unit 3 site used in confirming compliance with 10 CFR Part 50, Appendix I, Section II.D. The staff's review also noted that the COL applicant has not included a comparative analysis to confirm that assumptions and parameters used in dose modeling described in U.S. EPR FSAR Tier 2, Revision 1, Sections 11.2.3.4, "Estimated Doses," and 11.2.3.5, "Maximum Release Concentrations," apply to the specific conditions of the CCNPP Unit 3 site, including confirmation of offsite dose receptors based on the results of the most current land-use census, as conducted by the operator of Calvert Cliffs Units 1 and 2. As a result, the staff concludes that the regulatory compliance analyses presented in U.S. EPR FSAR Tier 2, Revision 1, Section 11.2 cannot be incorporated by reference in COL FSAR Sections 11.2.3, "Radioactive Effluent Releases," and 11.2.4 as a substitute evaluation of radiological impacts associated with liquid effluent releases and compliance with NRC regulations under 10 CFR 20.1301 and 10 CFR 20.1302; 10 CFR Part 20, Appendix B, Table 2, Column 2; and 10 CFR Part 50, Appendix I. Therefore, in RAI 209, Question 11.02-1, the staff requested that the COL applicant evaluate the following and revise COL FSAR Section 11.2 by:

- Presenting in COL FSAR Section 11.2.2, "System Description," descriptions of design features that are applicable to the CCNPP Unit 3 site, including balance-of-plant features, definition of the effluent discharge path from the boundary of the Radioactive Waste Processing Building (RWPB) to the point of release in the Chesapeake Bay, descriptions of plant blowdowns and other plant process effluents with which radioactive liquid effluents are mixed before discharge into the environment, associated plant blowdown, and effluent flow rates used in assessing radiological impacts, change of the in-plant dilution rate whenever the plant operates in the "alternate blowdown path," confirm that radioactive liquid effluents will not be routed to the retention basin before discharge into the Chesapeake Bay under specific operating conditions, and provide information supporting the applied Chesapeake Bay dilution factor.

- Using CCNPP Unit 3 balance-of-plant design features and site-specific information, revise COL FSAR Section 11.2.3 and describe the evaluation and present results demonstrating compliance with the effluent concentration limits of 10 CFR Part 20, Appendix B, Table 2, Column 2; and dose limits to members of the public under 10 CFR 20.1301 and 10 CFR 20.1302; 10 CFR 20.1301(e) in complying with 40 CFR Part 190 for all exposure pathways; design objectives of 10 CFR Part 50, Appendix I, Section II.A for dose receptors based on the current land-use census; and cost-benefit analysis of 10 CFR Part 50, Appendix I, Section II.D and COL Information Item No. 11.2-1 using updated collective population doses. The staff requested that the COL applicant provide sufficient information for the staff to conduct an independent evaluation of the COL applicant's analyses in complying with NRC regulations and

confirm consistency with the corresponding results presented in the CCNPP Unit 3 Environmental Report (ER), Section 5.4. The information should include assumptions used in calculating doses to maximally exposed individuals and collective population doses, and site-specific information on dose receptors and exposure pathways and default parameters used to calculate doses using RG 1.109 and the LADTAP II computer code (NUREG/CR-4013).

- Updating the regulatory description of the plant boundary for radioactive liquid effluents in COL FSAR Section 2.1.1.3, "Boundary for Establishing Effluent Release Limits," by including the requirements of 10 CFR Part 20, Appendix B, Table 2, Column 2, 10 CFR 20.1301 and 10 CFR 20.1302, 10 CFR 20.1301(e), and 10 CFR Part 50, Appendix I. (This last observation also applies to gaseous effluents and it was recommended that, as part of this RAI, the applicant extends the revision of COL FSAR Section 2.1.1.3 to address as well gaseous effluents generated during routine plant operation.)

In an April 14, 2010, response to RAI 209, Question 11.02-1, the COL applicant provided information to address the staff's concerns on the approach used to determine doses to the members of the public due to liquid effluents and confirmed compliance with NRC regulations and conformance to NRC guidance. The response presents a complete revision of COL FSAR Section 11.2 and includes information supporting a site-specific dose assessment for liquid effluent releases to the Chesapeake Bay, a cost-benefit analysis, and a revision to the departures and exemption reports (COL application, Part 7, "Departures and Exemption Requests").

The additional information was determined to be partially acceptable as the staff was unable to independently confirm some of the dose results, approach and results used in the cost-benefit analysis, and noted a number of inconsistencies in the presentation of the new information and proposed revisions to the COL FSAR, given the concerns identified in RAI 209, Questions 11.02-1(1) and 11.02-1(2). Based on the staff's review of responses to RAI 209, Questions 11.02-1(1) and 11.02-1(2), the staff issued follow-up RAI 254, Question 11.02-3, in which the staff requested that the COL applicant address the following items in a proposed revision of COL FSAR Section 11.2 and COL application Part 7:

A. COL FSAR Section 11.2.3.3

Provide the appropriate COL FSAR references (sections or tables) supporting the basis for the:

1. Blowdown discharge rate of 21,008 gallons per minute (gpm) (79,524 liters per minute L/min)) and liquid waste management system discharge flow rate of 11 gpm (41.6 L/min).

2. Dilution factors of 13.3 for fish and invertebrates, 58 for swimming and shoreline exposures, and 296 for desalinization of brackish water to create drinking water.

3. Distance of 168 m (550 ft) as the offshore location of the diffuser discharge point.

B. COL FSAR Section 11.2.3.4.1

In the discussion justifying the exclusion of irrigation as an exposure pathway because of the brackish nature of the Chesapeake Bay, confirm whether this is the case for drinking water within the flow and tidal flux of the Chesapeake Bay that might be drawn and impacted by discharges from the proposed plant.

The information presented in COL FSAR Section 11.2.3.4.1 and supporting text do not discuss, nor reference the results of a land-use census and how its results were justified for the analysis presented in COL FSAR Section 11.2.3.4. The staff requested that the COL applicant provide information supporting the selection of the applied offsite dose receptors and exposure pathways and provide a reference for a land-use census.

C. COL FSAR Section 11.2.3.5

The text states that liquid effluent releases comply with 10 CFR Part 20, Appendix B, Table 2 limits, but does not provide results demonstrating that conclusion. The discussion relies on the results presented in U.S. EPR FSAR, Tier 2, Table 11.2-7 as supporting documentation. It should be noted that the results presented in U.S. EPR FSAR Tier 2, Table 11.2-7 are based on a different set of assumptions applied to a hypothetical site. Consequently, these results and underlying assumptions do not apply to the CCNPP Unit 3 plant and site-specific conditions. The staff requested that the COL applicant provide site-specific information demonstrating compliance with 10 CFR Part 20, Appendix B, Table 2, Column 2 limits for liquid effluents and unity-rule for the sum-of-the-ratios for discharges associated with normal operation and maximum fuel defects.

D. COL FSAR Table 11.2-1

Include a footnote providing the basis of the stated shoreline, swimming, and boating usage times of 200, 100, and 200 hours per year, respectively.

E. COL FSAR Table 11.2-2

Based on an independent analysis of dose results presented in COL FSAR Table 11.2-2, the staff confirmed the results for all but the potable exposure pathway. For potable water, the staff's results for the thyroid are about a factor of 1.8 times higher for all four age groups, while in agreement for all other organs.

F. COL FSAR Table 11.2-3

In COL FSAR Table 11.2-3, a third line entry should be added to include the thyroid dose and identify the corresponding limiting age group.

G. COL FSAR Table 11.2-4

In COL FSAR Table 11.2-4, provide references for the stated historical whole body, thyroid, and maximum organ doses for CCNPP Units 1 and 2 in confirming compliance with 40 CFR Part 190 for the entire site with all three CCNPP units.

H. COL FSAR Table 11.2-5

Confirm and correct accordingly the following observations for the footnotes cited in COL FSAR Table 11.2-5:

1. For footnote 1, confirm that table citations should be COL FSAR Tables 11.2-2 and 11.2-3 and not Tables 11.2-6 and 11.2-7.

2. For footnotes 3 and 4, provide COL FSAR table citations for the stated sector and boundary distances from the site.

3. Staff comments on results characterizing doses from gaseous effluents presented in this table will be addressed as part of the review of the COL applicant's response to RAI 210, Question 11.03-1.

I. COL FSAR Tables 11.2-6, 11.2-7, 11.2-8, and 11.2-9

For the information supporting the results of the cost-benefit analysis (CBA), confirm and correct accordingly the following observations on results and footnotes presented in COL FSAR Tables 11.2-6, 11.2-7, 11.2-8, and 11.2-9 and supporting COL FSAR text:

1. Based on a review of U.S. EPR FSAR Tier 2, Section 11.2-3, the derivation of the liquid effluent source term considers the use of an evaporator, centrifuge, and demineralizer in treating liquid wastes before being released to the environment. A review of COL FSAR Section 11.2.4 and COL FSAR Table 11.2-6 (Footnotes 1 and 2) indicates that the descriptions of the reference and alternate configurations used in the CBA seem to be reversed in their applications. As described, the alternate configuration appears to use the current design features of the liquid waste management system.

2. For population dose results that reflect shoreline, boating, and swimming activities, provide in COL FSAR Table 11.2-7 the values assumed in the LADTAP II code for transient times for each mode of exposure.

3. In COL FSAR Table 11.2-7, confirm that the citation of COL FSAR Table 11.2-4 (column headed "Value") should be corrected to reflect that the corresponding information instead is in U.S. EPR FSAR Tier 2, Section 11.2. As presented, the entry implies that the GALE normal operation source term can be found in COL FSAR Table 11.2-4, which is not correct.

4. A review of the population dose results presented in COL FSAR Table 11.2-8 indicates that the estimated doses assigned to the case where an additional demineralizer is used is the base case and not the alternate case. The staff's evaluation confirmed that the projected population doses of 0.105 total body person–rem and 0.199 thyroid person-rem reflect the base case configuration of the liquid waste management system as described in U.S. EPR FSAR Tier 2, Section 11.2.3 and U.S. EPR Tier 2, Table 11.2-7 using the normal operation source term. In COL FSAR Table 11.2-8, the results for the case without a demineralizer, the population doses are 0.159 total body person–rem and 0.625 thyroid person-rem. If the CBA analysis were to assume a

system augmentation with another demineralizer added to the basic system design features, the resulting population doses would be expected to be lower than the base case of 0.105 total body person–rem and 0.199 thyroid person-rem. The staff requested that the COL applicant address this inconsistency in formulating the conditions and parameters applied to the base and alternate cases.

5. Based on a review of the CBA assumptions listed in COL FSAR Table 11.2-9, the staff was unable to confirm the assumed total cost of $296,000 for the system augmentation using 30 years for operation and maintenance. Based on the information presented in RG 1.110 and applied to the least costly demineralizer option (rated at 50 gpm), the staff used a direct cost of $72,000 (RG 1.110,Table A-1), an operating cost of $5,000 per year (RG 1.110, Table A-2), and a maintenance cost of $5,000 per year (RG 1.110, Table A-3). The total cost is estimated to be $372,000, derived as: $72,000 + [($5,000 + $5,000) x 30].

6. In determining whether the system augmentation complies with 10 CFR Part 50, Appendix I, Section II.D, the methodology applied a process other than described in RG 1.110, Regulatory Position C.5 and Appendix A, while stating in COL FSAR Section 11.2.4.2 that the method applies RG 1.110. The staff requested that the COL applicant describe the equivalency of the method applied in the COL FSAR.

J. Departures and Exemption Report (COL FSAR Part 7)

For the proposed revisions to Section 1.1.X, “Liquid Effluent Discharge Design,” and Section 1.1.Y, “Estimated Doses for Liquid and Gaseous Pathways,” of the departures and exemption report, the staff requested that the COL applicant address and resolve the following observations:

1. Update the proposed revisions to the Departure Report Section 1.1.X (Liquid Effluent Discharge Design) and Section 1.1.Y (Estimated Doses for Liquid and Gaseous Pathways) of the departures and exemption report to reflect the disposition and closure of the above observations.

2. In Departure Report Sections 1.1.X and 1.1.Y, the applicant should refer to the regulatory methodology and process applied in screening out the proposed departures by concluding that the changes do not adversely affect any safety-related system or safety-related portion of a system and does not conflict with applicable regulatory guidance.

In Departure Report Section 1.1.Y, the COL applicant states that doses to maximally exposed individuals from liquid and gaseous effluents are conservative and “bounding for all sites,” based on the information presented in U.S. EPR FSAR, Tier 2, Sections 11.2.3.4 and 11.3.3.4. This conclusion is incorrect since the assumptions and parameters used in U.S. EPR FSAR Tier 2, Sections 11.2 and 11.3 in assessing doses to maximally exposed individuals and populations rely on characteristics assigned to a hypothetical site and the U.S. EPR FSAR does not present a comparative evaluation of its hypothetical site parameters against the characteristics of potential candidate sites.

RAI 254, Question 11.02-3, which is associated with the above request, is being tracked as an open item. This follow-up RAI incorporates the issues identified in RAI 209, Questions 11.02-1(1) and 11.02-1(2), which are therefore subsumed in RAI 254, Question 11.02-3.

In an April 14, 2010, response to RAI 209, Question 11.02-1(3), the COL applicant agreed to update the citations of regulatory requirements applicable for releases of radioactive liquid and gaseous effluents at the plant boundary in COL FSAR Section 2.1.1.3. The update includes listing the requirements of 10 CFR Part 20, Appendix B, Table 2, Column 2, 10 CFR 20.1301 and 10 CFR 20.1302, 10 CFR 20.1301(e), and 10 CFR Part 50, Appendix I. The staff has reviewed the COL applicant's response to this portion of the RAI and finds it acceptable. **RAI 209, Question 11.02-01(3) is being tracked as a confirmatory item** to ensure that the COL FSAR is revised accordingly.

A review of COL FSAR Section 11.2 indicates that the design basis and system descriptions incorporate by reference U.S. EPR FSAR Tier 2, Section 11.2. This endorsement includes those aspects of the quality assurance (QA) program for the design, fabrication, procurement, and installation of the LWMS that would meet the guidance of RG 1.143. COL FSAR Chapter 17, "Quality Assurance and Reliability Assurance," refers to the UniStar Nuclear Topical Report No. UN-TR-06-001-A, "Quality Assurance Program Description," Revision 1, September 11, 2008; and incorporates by reference U.S. EPR FSAR Tier 2, Chapter 17. A review of U.S. EPR FSAR Tier 2, Section 17.2, "Quality Assurance During the Operations Phase," indicates that the construction phase and operations of the U.S. EPR are not applicable in the context of its design certification; U.S. EPR FSAR Tier 2, Section 17.3, "Quality Assurance Program Description," refers to U.S. EPR FSAR Tier 2, Section 17.5, "Quality Assurance Program Description," for details on the description of the QA program; U.S. EPR FSAR Tier 2, Section 17.4, "Reliability Assurance Program," is devoted to the reliability assurance program; and U.S. EPR FSAR Tier 2, Section 17.5 relies on the AREVA NP (AREVA) Topical Report ANP-10266A (Revision 1) in describing its quality assurance program. COL FSAR Section 17.2 directs the COL applicant to provide the applicable quality assurance program; COL FSAR Section 17.3 states that the corresponding section of the U.S. EPR FSAR Tier 2, Section 17.3 is incorporated by reference; COL FSAR Section 17.4 is devoted to the reliability assurance program; and COL FSAR Section 17.5 incorporates by reference UniStar's own topical report (UniStar Nuclear Topical Report No. UN-TR-06-001-A) in describing its QA program responsibility.

A review of UniStar Nuclear Topical Report, Section U, "Quality Assurance Program Commitments," and Section V, "Nonsafety-Related SSC Quality Controls," indicates that RG 1.143 is not listed among the cited documents for the LWMS in complying with NRC regulations. Note, that although Section U refers to RG 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," and RG 1.29, "Seismic Design Classification," these two RGs do not apply to radioactive waste management systems, as stated in both RGs. Similar observations were made during the review of the AREVA Topical Report ANP-10266A (Revision 1).

As a result, COL FSAR Section 11.2 identifies a design feature for the LWMS that is not supported by U.S. EPR FSAR Tier 2, Section 11.2 and U.S. EPR Tier 2, Chapter 17 and UniStar Nuclear Topical Report UN-TR-06-001-A. Therefore, in RAI 213, Question 11.02-2, the staff requested that the COL applicant consider the following and make appropriate revisions to COL FSAR Sections 11.2 and 17.5. Specifically:

- Revise Section U or V of UniStar Nuclear Topical Report UN-TR-06-001-A to include RG 1.143 in its QA program commitments.

- Describe in COL FSAR Tier 2, Section 11.2 the elements of a QA program that address the design, fabrication, procurement, and installation of the LWMS based on the guidance of RG 1.143 in response to U.S. EPR COL Information Item No. 17.2-1.

- Make the corresponding changes to COL FSAR Section 11.3 for the GWMS, COL FSAR Section 11.4 for the SWMS, and COL FSAR Section 11.5 for the PERMSS for consistency in endorsing technical and regulatory guidance and demonstrating compliance with effluent concentration and dose limits of 10 CFR 20.1301 and 20.1302 and design objectives of 10 CFR Part 50, Appendix I.

In the March 24, 2010, and June 10, 2010, responses to RAI 213, Question 11.02-2, the COL applicant proposed to revise Section U of UniStar Nuclear Topical Report UN-TR-06-001-A by adding a reference to RG 1.143. While the addition of RG 1.143 to the UniStar Nuclear Topical Report is acceptable, the staff finds that the addition of a reference does not provide the expected level of details on how the QA elements of RG 1.143 would be implemented at CCNPP Unit 3. Specifically, Revision 6 of COL FSAR Sections 11.2, 17.2, and 17.5 are silent on the elements of a QA program that address the fabrication, procurement, and installation of the LWMS based on the guidance of RG 1.143 for permanently installed and skid-mounted systems. Note that this concern also applies to related QA issues in COL FSAR Section 11.3 for the GWMS and COL FSAR Section 11.4 for the SWMS. Based on the staff's review of this RAI response and the AREVA May 6, 2010, response to a similar RAI 359, Question 11.02-18 for the U.S. EPR design certification; as a follow-up to RAI 259, Question 11.02-4, the staff requested that the COL applicant address and resolve the following items in the respective COL FSAR sections:

- In stating that the implementation of the QA program is described in COL FSAR Section 17, the staff requested that the COL applicant make a clear distinction among those elements of the QA program that are mandated under the requirements of Part 50, Appendix B, as identified in U.S. EPR FSAR Tier 2, Revision 1, Table 3.2.2-1, versus those that would be implemented under RG 1.143 which should be described in COL FSAR Section 11.2 for the LWMS, COLFSAR Section 11.3 for the GWMS, and COL FSAR Section 11.4 for the SWMS.

- In describing the implementation of the QA program that would be implemented under RG 1.143, the staff requested that the COL applicant endorse the following industry guidance: American National Standards Institute (ANSI)/American Nuclear Society (ANS)-55-6-1993 (Reaffirmed May 14, 2007) for the LWMS; ANSI/ANS-55-4-1993 (Reaffirmed May 14, 2007) for the GWMS; and ANSI/ANS-40-37-2009 for the SWMS.

- For the permanently installed LWMS, as described in COL FSAR Section 11.2, the staff requested that the COL applicant clarify those aspects of the RG 1.143 QA program that are the responsibility of the (Combined License Application (COLA) for the development of procurement specifications, and for confirming the proper fabrication and installation of LWMS components.

- For skid mounted-LWMS and SWMS, described as COLA options in U.S. EPR FSAR, Tier 2, Revision 1, Sections 11.2.2 and 11.4.1, the staff requested that the COL

applicant clarify those aspects of the RG 1.143 QA program that are the responsibility of the COLA for the design and development of procurement specifications, proper fabrication, and correct operational interfaces of supplemental skid-mounted processing subsystems with the permanently installed LWMS and SWMS.

- For the permanently installed GWMS, as described in the COL FSAR Section 11.3, the staff requested that the COL applicant clarify those aspects of the RG 1.143 QA program that are the responsibility of the COLA for the development of procurement specifications and proper fabrication and installation of the GWMS against those portions of the GWMS system that fall under the requirements of 10 CFR Part 50, Appendix B, QA program as identified in U.S. EPR FSAR, Revision 1, Tier 2, Table 3.2.2-1.

RAI 259, Question 11.02-4, which is associated with the above request, is being tracked as an open item. This RAI incorporates the issues identified in RAI 213, Question 11.02-2.

Operational Program

There are no specific operational programs required for the operation of the LWMS. All liquid effluent releases associated with the operation of the LWMS are controlled by the offsite dose calculation manual (ODCM). The COL applicant agreed, under COL Information Item No. 11.5-1, to develop a plant and site-specific ODCM by endorsing Nuclear Energy Institute (NEI) Template 07-09A, "Generic FSAR Template Guidance for Offsite Dose Calculation Manual (ODCM) Program Description." The staff has determined the endorsement of NEI ODCM Template 07-09A to be acceptable. The staff finds this agreement acceptable. The staff's evaluation of the ODCM is presented in Section 11.5 of this report.

Technical Specifications

A review of COL FSAR Chapter 16, "Technical Specifications," shows that Technical Specification (TS) 5.5.11, "Gaseous Waste Processing System Radioactivity Monitoring Program," excludes the requirement specifying controls and limits of radioactivity levels in outdoor radioactive waste storage tanks. The generic TS requirement is removed in COL FSAR, because the U.S. EPR design feature does not include the use of outdoor storage tanks. If the use of outdoor storage tanks were to be implemented, the COL applicant or COL holder will be required to reintroduce that aspect of TS 5.5.11 and modify the monitoring program accordingly. The staff determined that this modification to TS 5.5.11 is acceptable given the provision to reinstate the full requirements of TS 5.5.11 should future operational requirements necessitate the use of outdoor tanks under COL Information Item No. 16.0-1, as described in U.S. EPR FSAR Tier 2, Table 1.8-2, and COL FSAR Table 1.8-2, "FSAR Sections that Address COL Items."

Departures and Exemption Requests

The COL applicant describes in COL application, Part 7, departures and exemption requests from the information presented in U.S. EPR FSAR. A review of the information presented in COL application, Part 7, Sections 1.1, "Departures," and 1.2, "Exemption Requests," indicates that there are no departures or exemption requests associated with the design and operation of the LWMS and site-specific characteristics associated with liquid effluent releases.

Postulated Radwaste Tank Failure Analysis

COL FSAR Sections 2.4.13.1.1, "Accident Scenario," to 2.4.13.1.5, "Compliance with 10 CFR Part 20," describe a scenario and assumptions assessing the radiological impact of the release of radioactive materials into ground water and a surface stream following the postulated failure of the reactor coolant storage tank. A review of the assumptions used in the analysis indicates that some information is inconsistently referenced and used from other COL FSAR sections. The staff's RAIs and evaluation are presented in Section 2.4.13 of this report in determining compliance with the acceptance criteria and guidance of SRP Section 11.2 and Branch Technical Position (BTP) 11-6.

11.2.5 Post Combined License Activities

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

11.2.6 Conclusions

The staff reviewed the COL application and checked the referenced U.S. EPR FSAR. The staff's review confirmed that the COL applicant addressed the required information relating to the LWMS, and there is no outstanding information expected to be addressed in the COL FSAR related to this section, other than the open items and confirmatory item noted above.

The staff reviewed the information in the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the LWMS incorporated by reference in the COL FSAR have been documented in the staff's safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 11.2 of this report to reflect the final disposition of the design certification application.

In addition, the staff also compared the additional COL information within the application against relevant NRC regulations, acceptance criteria and guidance defined in NUREG-0800, Section 11.2, and other NRC regulatory guidance. As discussed above, the RAIs given above will need to be resolved, with conclusions revised accordingly.

The staff verified that the COL applicant has provided sufficient information and that the review and calculations support the following conclusions.

The staff concludes that the LWMS includes the equipment necessary to control releases of radioactive materials in liquid effluents in accordance with the requirements in 10 CFR Part 20 and 10 CFR Part 50, Appendix I. Thus, the staff concludes that the LWMS is acceptable and meets the requirements in 10 CFR Part 20, Appendix B, Table 2, Column 2; 10 CFR 20.1301 and 10 CFR 20.1302; 10 CFR 20.1301(e); 10 CFR Part 50, Appendix I, Sections II.A and II.D; and regulatory guidance of RG 1.109, RG 1.110, RG 1.113, and RG 1.143. This conclusion is based on the following:

- Using site-specific conditions and programs to control and monitor annual average concentrations of radioactive materials present in liquid effluents released in unrestricted areas, the COL applicant has demonstrated compliance with the dose limits for members of the public under 10 CFR 20.1301 and 10 CFR 20.1302; and liquid effluent concentration limits for unrestricted areas under 10 CFR Part 20, Appendix B, Table 2, Column 2.

- Using site-specific conditions and programs to control and monitor releases of radioactive materials contained in liquid effluents released in unrestricted areas, the COL applicant has demonstrated compliance with the numerical guides and design objectives and ALARA criteria of 10 CFR Part 50, Appendix I, Section II.A in ensuring that offsite individual doses resulting from liquid effluent releases will not exceed the numerical criteria and design objectives in maintaining effluent releases and doses ALARA.

- The COL applicant is responsible for determining the operational setpoint for its LWMS radiation monitor in a plant-specific offsite dose calculation manual under COL Information Item No. 11.5-1, as described in COL FSAR Sections 11.5, "Process and Effluent Radiological Monitoring and Sampling Systems," and 13.4, "Operational Program Implementation." COL Information Item No. 11.5-1 addresses compliance with liquid effluent releases controlled by 10 CFR Part 20 and Part 50, Appendix I. The staff's related evaluation is presented in Section 11.5 of this report.

- By a comparison of the results presented in support of compliance with 10 CFR Part 50 Appendix I criteria and supplemental information, the COL applicant has demonstrated compliance with the requirements of 10 CFR 20.1301(e) as it relates to 40 CFR Part 190 in controlling doses from facilities within the fuel cycle, which includes nuclear power reactors.

- Using site-specific conditions, the COL applicant has demonstrated compliance with the ALARA criteria of 10 CFR Part 50, Appendix I, Section II.D. The staff considered the potential effectiveness of augmenting the LWMS using items of reasonably demonstrated technology. The staff determined that further effluent treatment is not expected to produce further reductions in collective population doses reasonably expected within an 80 km (50 mi) radius of the reactor at a cost of less than $1,000 per person-rem or person-thyroid-rem.

11.3 Gaseous Waste Management Systems

11.3.1 Introduction

The gaseous waste management systems are designed to receive and process radioactive gases and hydrogen-bearing gases generated during operation and as a byproduct of waste processing. There are two main sources of plant gaseous radioactive effluents. One source is from building ventilation systems servicing radiologically controlled areas and plant system venting, and the other source is from the power cycle gaseous waste processing system. The GWMS is used to control, collect, process, hold for decay, and discharge gaseous radioactive wastes generated during normal operations, including AOOs. The GWMS is designed to reduce and control radioactivity released into the environment. Releases from the GWMS and from building ventilation exhaust systems are conducted and monitored for radioactivity through the plant stack.

11.3.2 Summary of Application

COL FSAR Section 11.3 incorporates by reference U.S. EPR FSAR Tier 2, Section 11.3, "Gaseous Waste Management Systems."

In addition, in COL FSAR Section 11.3, the COL applicant provided the following:

Combined License Information Items

The COL applicant provided additional information in COL FSAR Section 11.3.4, "Gaseous Waste Management System Cost-Benefit Analysis," to address COL Information Item No. 11.3-1 from U.S. EPR FSAR Tier 2, Table 1.8-2 as follows:

> A COL applicant that references the U.S. EPR design certification will confirm that the gaseous waste management system cost-benefit analysis for the typical site is applicable to their site; if it is not, provide a site-specific cost-benefit analysis.

In response to this COL information item, the COL applicant stated that gaseous waste management system cost-benefit analysis in U.S. EPR FSAR Tier 2, Section 11.3 is applicable to and bounds CCNPP Unit 3.

11.3.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the U.S. EPR FSAR.

In addition, the relevant requirements of NRC regulations for the GWMS, and the associated acceptance criteria, are specified in NUREG-0800, Section 11.3, "Gaseous Waste Management System."

The applicable regulatory requirements for the GWMS are as follows:

1. 10 CFR 20.1301 as it relates to limits on doses to members of the public, and gaseous effluent concentration limits for unrestricted areas.

2. 10 CFR 20.1302 as it relates to methods used in demonstrating compliance with dose limits to members of the public; and gaseous effluent concentration limits of 10 CFR Part 20, Appendix B, Table 2, Column 1 for unrestricted areas.

3. 10 CFR Part 50, Appendix I, Sections II.B and II.C, as they relate to numerical guides for design objectives and limiting conditions for operation to meet the criterion of "as low as is reasonably achievable" and dose criteria for maximally exposed individuals located in unrestricted areas.

4. 10 CFR Part 50, Appendix I, Section II.D, as it relates to the conduct of cost-benefit analysis in reducing population doses from gaseous effluents using reasonably demonstrated technology and a favorable cost-benefit ratio.

5. 40 CFR Part 190 as implemented under 10 CFR 20.1301(e), as it relates to controlling doses within U.S. EPA generally applicable environmental radiation standards.

The related acceptance criteria are as follows:

1. RG 1.109 as it relates to demonstrating compliance with the numerical guidelines for dose design objectives and the ALARA criteria of 10 CFR Part 50, Appendix I.

2. RG 1.110 as it relates to methods and assumptions applied in performing cost-benefit analyses in reducing cumulative doses to populations by using reasonably demonstrated technology.

3. RG 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," as it relates to the use of acceptable methods for estimating atmospheric dispersion and deposition for gaseous effluents in demonstrating compliance with 10 CFR Part 50, Appendix I dose objectives.

4. RG 1.143 as it relates to the definition of the discharge path starting at the GWMS interface from plant systems serviced by the GWMS and ending to the point of controlled discharge into the environment using plant and site-specific characteristics.

5. BTP 11-5, "Postulated Radioactive Releases Due to a Waste Gas System Leak or Failure," as it relates to the assessment of radiological impacts associated with gaseous effluent releases.

6. NUREG/CR-4653, "GASPAR II − Technical Reference and User Guide," as an acceptable method for assessing doses to the maximally exposed offsite individual from gaseous effluent releases.

11.3.4 Technical Evaluation

The staff reviewed COL FSAR Section 11.3 and checked the referenced design certification FSAR to ensure that the combination of the information in the U.S. EPR FSAR and the information in the COL FSAR represents the complete scope of required information relating to this review topic. The review confirmed that the information contained in the COL application and incorporated by reference addresses the required information relating to this section. U.S. EPR FSAR Tier 2, Section 11.3 has been reviewed by the staff under Docket No. 52-020. The staff's technical evaluation of the information incorporated by reference related to GWMS has been documented in the staff safety evaluation report on the design certification application for the U.S. EPR.

The staff's review of the information contained in the COL FSAR is discussed as follows:

The staff reviewed COL FSAR Section 11.3 against SRP Section 11.3 to determine if the information contained in COL FSAR Section 11.3 met the requirements of the regulations stated above and NUREG-0800 acceptance criteria and guidance. However, the staff's review ascertained that there were some outstanding issues, as discussed below.

Combined License Information Items

The staff reviewed COL Information Item No. 11.3-1 from U.S. EPR FSAR Tier 2, Table 1.8-2 included under COL FSAR Section 11.3.4. The COL information item states:

> A COL applicant that references the U.S. EPR design certification will confirm that the gaseous waste management system cost-benefit analysis for the typical site is applicable to their site; if it is not, provide a site-specific cost-benefit analysis.

COL FSAR Section 11.3.4 states that COL Information Item No. 11.3-1 is addressed by endorsing the results of the cost-benefit analysis presented in U.S. EPR FSAR Tier 2, Section 11.3. This approach assumes that the results of the cost-benefit analysis presented in U.S. EPR FSAR Tier 2, Section 11.3 justify, in part, the performance of the GWMS and building ventilation exhaust systems in demonstrating compliance with the ALARA cost-benefit requirements in 10 CFR Part 50, Appendix I, Section II.D. The cost-benefit analysis is based on the guidance of RG 1.109 and RG 1.110, with the results evaluated against the cost-benefit ratio criteria of 10 CFR Part 50, Appendix I, Section II.D.

A comparison of the information presented in Revision 6 of COL FSAR Sections 11.3.2, "System Description," 11.3.3, "Radioactive Effluent Release," 11.3.4, 2.1.1.3, and 2.3.5, "Long-Term Atmospheric Dispersion Estimates for Routine Releases," and COL FSAR Figure 2.1-1, "Site Area Map," indicates that the information presented in the corresponding sections of the U.S. EPR FSAR is different and inconsistent with the characteristics of the CCNPP Unit 3 site used in confirming compliance with 10 CFR Part 50, Appendix I, Section II.D. The staff's review also noted that the COL applicant has not included a comparative analysis to confirm that assumptions and parameters used in dose modeling described in U.S. EPR FSAR Tier 2, Revision 1, Sections 11.3.3.4, "Estimated Doses," and 11.3.3.5, "Maximum Release Concentrations," apply to the specific conditions of the CCNPP Unit 3 site, including confirmation of offsite dose receptors based on the results of the most current land-use census, as conducted by the operator of Calvert Cliffs Units 1 and 2. As a result, the staff concludes that the regulatory compliance analyses presented in U.S. EPR FSAR Tier 2, Section 11.3 cannot be incorporated by reference in COL FSAR Sections 11.3.3 and 11.3.4 as a substitute evaluation of radiological impacts associated with gaseous effluent releases and compliance with NRC regulations under 10 CFR 20.1301 and 10 CFR 20.1302; 10 CFR Part 20 Appendix B, Table 2, Column 1; and 10 CFR Part 50, Appendix I. Therefore, in RAI 210, Question 11.03-1, the staff requested that the COL applicant evaluate the following and revise COL FSAR Section 11.3 by:

- Presenting in COL FSAR Section 11.3.3 descriptions of CCNPP Unit 3 site-specific features used to estimate doses to members of the public and populations, including descriptions of offsite dose receptors and exposure pathways based on the current land-use census; locations and distances of dose receptors and exposure pathways from CCNPP Unit 3; sources and estimates of direct radiation exposures from CCNPP Unit 3 building and facilities and materials to members of the public; annual average atmospheric dispersion and deposition parameters for all identified offsite dose receptors and population within a 50 mile radius of CCNPP Unit 3; assumptions used in calculating doses to maximally exposed individuals and collective population doses; and site-specific and default parameters used to calculate doses using RGs 1.109 and 1.111 and the GASPAR II computer code (NUREG/CR-4653).

- Using CCNPP Unit 3 site-specific information, revise COL FSAR Section 11.3.3 and describe the evaluation and present results demonstrating compliance with the effluent concentration limits of 10 CFR Part 20, Appendix B, Table 2, Column 1; and dose limits to members of the public under 10 CFR 20.1301 and 10 CFR 20.1302; 10 CFR 20.1301(e) in complying with 40 CFR Part 190 for all exposure pathways; design objectives of 10 CFR Part 50, Appendix I, Sections II.B and II.C for dose receptors based on the current land-use census; and cost-benefit analysis of 10 CFR Part 50, Appendix I, Section II.D and COL Information Item No. 11.3-1 using updated collective population doses. The staff requested that the COL applicant provide

sufficient information for the staff to conduct an independent evaluation of the COL applicant's analyses in complying with NRC regulations and confirm consistency with the corresponding results presented in CCNPP Unit 3 ER, Section 5.4. The information should include assumptions used in calculating doses to maximally exposed individuals and collective population doses, and site-specific information on dose receptors and exposure pathways and default parameters used to calculate doses using RGs 1.109 and 1.111 and the GASPAR II computer code (NUREG/CR-4653).

In an April 14, 2010, response to RAI 210, Question 11.03-1, the COL applicant provided information to address the staff's concerns on the approach used to determine doses to the members of the public due to gaseous effluents and confirming compliance with NRC regulations and guidance. The response presents a complete revision of COL FSAR Section 11.3 and includes information supporting a site-specific dose assessment for gaseous effluent releases, a cost-benefit analysis, and a revision to the departures and exemption reports (COL application Part 7).

The additional information is acceptable. The staff confirmed the dose results for the maximally exposed individual, but was unable to independently confirm population dose results lacking specific information on parameters and approach used in the cost-benefit analysis. The staff also noted a number of inconsistencies in the presentation of the new information and proposed revisions to the COL FSAR given the concerns identified in RAI 210, Questions 11.03-1(1) and 11.03-1(2). Based on the staff's review of responses to RAI questions; in follow-up RAI 255, Question 11.03-2, the staff requested that the COL applicant address the items listed below and provide sufficient information for the staff to conduct an independent evaluation of the approach and results presented in the proposed revision of COL FSAR Section 11.3:

A. COL FSAR Section 11.3.3.4

1. In COL FSAR Section 11.3.3.4, the discussion presenting the dose result of 1.47 mrem/yr should be qualified as this result includes an exposure pathway and locations that are different than those forming the basis of the maximally exposed individual (MEI) dose results presented in COL FSAR Tables 11.3-5, 11.3-6 and 11.3-7. The staff requested that the COL applicant qualify the differences in exposure pathway locations in that discussion.

2. A new paragraph should be added to this section addressing the requirements of 10 CFR Part 50, Appendix I, Section II.B.1 in complying with the beta and gamma air dose design objectives. The discussion should refer the results listed in COL FSAR Table 11.3-7.

3. The staff requested that the COL applicant add a reference for RG 1.109 since it forms the basis of the dose calculation methodology. The inclusion of RG 1.109 here ensures consistency with references listed in COL FSAR Section 11.2 on dose calculations for liquid effluent discharges.

B. COL FSAR Section 11.3.3.5

In COL FSAR Section 11.3.3.5, the text states that gaseous effluent releases comply with 10 CFR Part 20, Appendix B, Table 2 limits, but does not provide results demonstrating that conclusion. The discussion relies on the results presented in U.S. EPR FSAR Tier 2, Table 11.3-6 as supporting documentation. It should be

noted that the results presented in U.S. EPR Tier 2, FSAR Table 11.3-6 are based on a different set of assumptions applied to a hypothetical site. Consequently, these results and underlying assumptions do not apply to the CCNPP Unit 3 plant and site-specific conditions. The staff requested that the COL applicant provide site-specific information demonstrating compliance with 10 CFR Part 20, Appendix B, Table 2, Column 1 limits for gaseous effluents and unity-rule for the sum-of-the-ratios for plant stack releases associated with normal operation and maximum fuel defects.

C. COL FSAR Table 11.3-1

The April 14, 2010, response to RAI 210, Question 11.3-1 states that the selection of dose receptors and exposure pathways is based on the results of the 2007 land-use census. However, the information presented in COL FSAR Table 11.3-1 and supporting text do not discuss, nor reference the results of a land-use census and how its results were justified for the analysis presented in COL FSAR Section 11.3.3.4. The staff requested that the COL applicant provide information supporting the selection of the applied offsite dose receptors and exposure pathways and provide a reference for the 2007 land-use census.

D. COL FSAR Tables 11.3-1, 11.3-5, and 11.3-6

1. A review of COL FSAR Section 2.3.5 and COL FSAR Table 2.3-130 indicates that a nearest resident is listed among other dose receptor locations. COL FSAR Tables 11.3-1, 11.3-5, and 11.3-6 do not identify the nearest resident under the location and dose receptor table headings, while COL FSAR Table 11.3-4 identifies locations only. The staff requested that the COL applicant identify the nearest resident location and doses in COL FSAR Tables 11.3-1, 11.3-5, and 11.3-6.

2. Footnote b to COL FSAR Table 11.3-1 states that specific locations for the beef cattle exposure pathway are not available. Similarly, Footnote c to COL FSAR Table 11.3-1 states that there are no milk animals within 8 km (5 mi) of the proposed CCNPP Unit 3 plant site. The staff requested that the COL applicant provide specific references for these statements in table footnotes. These observations also apply to the information and footnotes presented in COL FSAR Tables 11.3-4, 11.3-6, and 11.3-7.

E. COL FSAR Table 11.3-2

1. Footnote 1 to COL FSAR Table 11.3-1 states that the crop growing and animal grazing seasons occur from April to October. The staff requested that the COL applicant provide a reference for this statement.

2. Under the “Value” column heading indicates whether all table citations are from the COL FSAR.

F. COL FSAR Table 11.3-3

For the information presented in COL FSAR Table 11.3-3, the staff requested that the COL applicant cite a reference for the listed regional food and crop production rates.

G. COL FSAR Table 11.3-6

In COL FSAR Table 11.3-6, the staff requested that the COL applicant include thyroid doses for the inhalation, vegetable, and meat exposure pathways given that the thyroid, along with bone, are the organs with the highest projected dose estimates.

H. COL FSAR Tables 11.3-8 to 11.3-19 and Supporting COL FSAR Section 11.3.4

For the information supporting the results of the cost-benefit analysis (CBA), confirm and correct the following observations on results and footnotes presented in COL FSAR Tables 11.3-8 to 11.3-19 and supporting discussions in COL FSAR Section 11.3.4:

1. COL FSAR Section 11.3.4.1 states that the CBA relies on an additional charcoal delay bed for the system augmentation; however, COL FSAR Section 11.3.4.1 and COL FSAR Table 11.3-8 do not specify its size. The staff requested that the COL applicant qualify the results presented in COL FSAR Table 11.3-8 for the alternate case by noting that the increased noble gases holdup time reflects the use of a 3-ton charcoal delay tank.

2. In COL FSAR Section 11.3.4.2, confirm that the reference to COL FSAR Table “11.2-19” should be changed to COL FSAR Table 11.3-19 in the last line of the second paragraph.

3. In COL FSAR Section 11.3.4.2, the last paragraph acknowledges that sources of airborne radioactivity from building ventilation systems do not benefit from the holdup afforded by the additional charcoal delay tank as a system augmentation. The sources of radioactivity from plant buildings is characterized as being significantly higher than the source term processed and treated via the gaseous waste processing system. For the gaseous effluent source term shown in U.S. EPR FSAR Tier 2, Table 11.3-3, the radioiodine source term is two to three orders of magnitude higher than any of the particulate radionuclides, and the particulate source term, in the aggregate, is comparable to that of I-131 or I-132. Given the above, the CBA should consider another case that includes a system augmentation applying a High Efficiency Particulate Air (HEPA)/charcoal filtration system for particulates and radioiodines. The staff requested that the COL applicant evaluate the source term presented in U.S. EPR FSAR Tier 2, Table 11.3-3 and update the assumptions for the base and alternate cases and CBA results presented in COL FSAR Tables 11.3-8, 11.3-18, and 11.3-19.

4. COL FSAR Table 11.3-10 lists atmospheric dispersion parameters used in calculating population doses within a 80 km (50 mi) radius. While not stated in Table 11.3-10, a review of the data and Table 11.3-2 indicates that they represent undecayed and undepleted X/Q values. COL FSAR Table 11.3-10 and the balance of the information supporting the CBA do not present the other set of atmospheric parameters, namely: Decayed Decayed and undepleted, and decayed and depleted out to 80 km (50 mi). Given that the CBA analysis and dose calculations are stated to rely on RG 1.109 and

1.110, the staff requested that the COL applicant include in COL FSAR Section 11.3.4 the missing meteorological dispersion parameters.

5. For the food production data presented in COL FSAR Tables 11.3-9 to 11.3-17, provide references supporting the listed population distributions and production rates for milk, beef, poultry, grain, and vegetable within the 80 km (50 mi) radius.

6. In determining whether the system augmentation complies with 10 CFR Part 50, Appendix I, Section II.D the methodology summarized in COL FSAR Table 11.3-19 describes a process other than noted in RG 1.110, Regulatory Position C.5 and Appendix A, while stating in COL FSAR Section 11.3.4 that the method applies RG 1.110. The staff requested that the COL applicant describe the equivalency of the method applied in COL FSAR.

7. In COL FSAR Table 11.3-19, the staff requested that the COL applicant confirm that RG 1.110, Table A-3 should be added to the entry listing the annual operating and maintenance costs of $67,000 for the system augmentation.

RAI 255, Question 11.03-2, which is associated with the above request, is being tracked as an open item. This RAI incorporates the issues identified in RAI 210, Questions 11.03-1(1) and 11.03-1(2).

Operational Program

There are no specific operational programs required for the operation of the GWMS. All gaseous effluent releases associated with the operation of the GWMS are controlled by the ODCM. The COL applicant agreed under COL Information Item No. 11.5-1 to develop a plant and site-specific ODCM by endorsing NEI ODCM Template 07-09A, "Generic FSAR Template Guidance for Offsite Dose Calculation Manual (ODCM) Program Description." The staff has determined the endorsement of NEI ODCM Template 07-09A to be acceptable. The staff finds this agreement acceptable. The staff's evaluation of the ODCM is presented in Section 11.5 of this report.

Technical Specifications

COL FSAR Chapter 16 incorporates the U.S. EPR generic technical specifications and bases by reference, as described in U.S. EPR FSAR Tier 2, Chapter 16.

Departures and Exemption Requests

The COL applicant describes in COL application, Part 7, departures and exemption requests from the information presented in U.S. EPR FSAR. A review of the information presented in COL application, Part 7, Sections 1.1 and 1.2 indicates that there are no departures or exemption requests associated with the design and operation of the GWMS.

However, COL application, Part 7, Sections 1.1.3 and 1.2.3 identify a departure and an exemption, both entitled: "Maximum Annual Average Atmospheric Dispersion Factor (0.5 mile − limiting sector)." In both cases, the departure and request reflect a change in the

maximum annual average atmospheric dispersion factor from the default value of the U.S. EPR FSAR to a site-specific location for CCNPP Unit 3, located in the NE Sector at 0.8 km (0.5 mi). This change addresses the recognition that this location is about 0.35 km (0.22 mi) offshore in the Chesapeake Bay, and no one is expected to reside (e.g., while boating) at this location for reasonably extended time periods. U.S. EPR FSAR Tier 2, Table 2.1-1, "U.S. EPR Site Design Envelope," assigns a value of "≤4.973E-06 s/m^3", while the site-specific value for CCNPP Unit 3 as specified in COL FSAR Section 2.3.5.2, "Calculations," and Tables 2.0-1, "U.S. EPR Site Design Envelope Comparison," and 2.3-119, "Normal Effluent Annual Average, Undecayed, Undepleted χ/Q Values for Mixed Mode Release Using 242,458 cfm Flow Rate for Grid Receptors," is "5.039E-06 s/m^3". The COL applicant states that the resulting change in the atmospheric dispersion factor will not result in doses exceeding the design objectives of 10 CFR Part 50, Appendix I for the assumed MEI.

The staff's evaluation of resulting doses to the MEI is evaluated under the COL applicant's response to staff RAI 210, Question 11.03-1, and RAI 255, Question 11.03-2, as described above. The staff's evaluation of the resulting change in the maximum annual average atmospheric dispersion factor from the default value of the U.S. EPR FSAR to a CCNPP Unit 3 site-specific value is presented in Section 2.3.5 of this report.

11.3.5 Post Combined License Activities

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

11.3.6 Conclusions

The staff reviewed the COL application and checked the referenced U.S. EPR FSAR. The staff's review confirmed that the COL applicant addressed the required information relating to the GWMS, and there is no outstanding information expected to be addressed in the COL FSAR related to this section, other than the open item noted above.

The staff reviewed the information in the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the GWMS incorporated by reference in the COL FSAR have been documented in the staff's safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 11.3 of this report to reflect the final disposition of the design certification application.

In addition, the staff also compared the additional COL information within the application against relevant NRC regulations, acceptance criteria and guidance defined in NUREG-0800, Section 11.3, and other NRC regulatory guidance. As discussed above, the RAIs given above will need to be resolved, with conclusions revised accordingly.

The staff verified that the COL applicant has provided sufficient information and that the review and calculations support the following conclusions.

The staff concludes that the GWMS includes the equipment necessary to control and monitor releases of radioactive materials in gaseous effluents in accordance with the requirements in 10 CFR Part 20 and 10 CFR Part 50, Appendix I. Thus the staff concludes that the GWMS is acceptable and meets the requirements in 10 CFR Part 20, Appendix B, Table 2, Column 1; 10 CFR 20.1301 and 10 CFR 20.1302; 10 CFR 20.1301(e); 10 CFR Part 50, Appendix I,

Sections II.B, II.C, and II.D; and regulatory guidance of RG 1.109, RG 1.110, RG 1.111, and RG 1.143. This conclusion is based on the following:

- Using site-specific conditions and programs to control and monitor annual average concentrations of radioactive materials present in gaseous effluents released in unrestricted areas, the COL applicant has demonstrated compliance with the dose limits for members of the public under 10 CFR 20.1301 and 10 CFR 20.1302; and gaseous effluent concentration limits for unrestricted areas under 10 CFR Part 20, Appendix B, Table 2, Column 1.

- Using site-specific conditions and programs to control and monitor releases of radioactive materials contained in gaseous effluents released in unrestricted areas, the COL applicant has demonstrated compliance with the numerical guides and design objectives and ALARA criteria of 10 CFR Part 50, Appendix I, Sections II.B and II.C in ensuring that offsite individual doses resulting from gaseous effluent releases will not exceed the numerical criteria and design objectives in maintaining doses and effluent releases ALARA.

- The COL applicant is responsible for determining the operational setpoint for its GWMS and plant stack radiation monitors in a plant-specific offsite dose calculation manual under COL Information Item No. 11.5-1, as described in COL FSAR Sections 11.5 and 13.4. COL Information Item No. 11.5-1 addresses compliance with gaseous effluent releases controlled by 10 CFR Part 20 and 10 CFR Part 50, Appendix I. The staff's related evaluation is presented in Section 11.5 of this report.

- By a comparison of the results presented in support of compliance with 10 CFR Part 50 Appendix I criteria and supplemental information, the COL applicant has demonstrated compliance with the requirements of 10 CFR 20.1301(e), as it relates to 40 CFR Part 190 in controlling doses from facilities within the fuel cycle, which includes nuclear power reactors.

- Using site-specific conditions, the COL applicant has demonstrated compliance with the ALARA criterion of 10 CFR Part 50, Appendix I, Section II.D. The staff considered the potential effectiveness of augmenting the GWMS using items of reasonably demonstrated technology. The staff determined that further effluent treatment is not expected to produce further reductions in collective population doses reasonably expected within an 80 km (50 mi) radius of the reactor at a cost of less than $1,000 per person-rem or person-thyroid-rem.

11.4 Solid Waste Management Systems

11.4.1 Introduction

The solid waste management system is designed to process wet and dry solid radioactive wastes during normal operations and AOOs. As part of the treatment process of the LWMS and GWMS, various types of wet wastes, such as concentrates, sludge, spent adsorption media, and spent filters, are generated as byproduct waste streams. Other plant operations, such as refueling and routine maintenance, generate wet and solid wastes, including paper, plastic, glass, metal scraps, wood, spent filters, and tools, among others. The SWMS reduces the total volume of waste material by compaction, shredding, and evaporation processes and provides

temporary storage of wastes prior to offsite shipment to licensed radioactive waste disposal facilities or waste processors. There are two SWMS subsystems, the solid waste processing and storage system which treats dry wastes; and the radioactive concentrates and spent ion exchange resins processing system, which treats wet wastes. The SMWS includes provisions for connecting skid-mounted processing equipment to permanently installed processing subsystems; this design feature is an option for consideration by COL applicants or COL holders and is not part of the U.S. EPR design certification. The radioactive waste processing building provides space for the near-term (about 8 years) storage of low-level radioactive wastes, with an agreement to identify and secure additional storage capacity, such as by building a separate onsite storage facility in accordance with NRC regulations and guidance, or by procuring the necessary storage space through licensed commercial waste processors or disposal sites.

11.4.2 Summary of Application

COL FSAR Section 11.4 incorporates by reference U.S. EPR FSAR Tier 2, Section 11.4, "Solid Waste Management Systems."

In addition, in COL FSAR Section 11.4, the COL applicant provided the following:

Combined License Information Items

The COL applicant provided additional information in COL FSAR Section 11.4.3, "Radioactive Effluent Releases," to address COL Information Item No. 11.4-1 from U.S. EPR FSAR Tier 2, Table 1.8-2 as follows:

> A COL applicant that references the U.S. EPR will fully describe, at the functional level, elements of the Process Control Program (PCP). This program description will identify the administrative and operational controls for waste processing process parameters and surveillance requirements which demonstrate that the final waste products meet the requirements of applicable federal, state, and disposal site waste form requirements for burial at a 10 CFR Part 61 licensed low level waste (LLW) disposal site and will be in accordance with the guidance provided in RG 1.21, NUREG-0800, BTP 11-3, ANSI/ANS-55.1-1992, and Generic Letters 80-09, 81-38, and 81-39.

The COL applicant indicated that the CCNPP Unit 3 PCP included, as COL application Part 11E, describes elements of the PCP at the functional level. The COL applicant includes, by reference, NEI Template 07-10A, "Generic FSAR Template Guidance for Process Control Program (PCP)," Revision 0, March 2009, as the basis of the PCP for CCNPP Unit 3. The milestone for the implementation of the PCP is identified in COL FSAR, Section 13.4 and Table 13.4-1, "Operational Programs Required by NRC Regulations and Program Implementation."

11.4.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the U.S. EPR FSAR.

In addition, the relevant requirements of NRC regulations for the SWMS, and the associated acceptance criteria, are specified in NUREG-0800, Section 11.4, "Solid Waste Management System."

The applicable regulatory requirements for the SWMS are as follows:

1. 10 CFR 61.55, “Waste Classification,” and 10 CFR 61.56, “Waste Characteristics,” as they relate to the classification, characterization, processing, and disposal of dry solid and wet wastes at approved low-level radioactive waste disposal sites.

2. 10 CFR 20.2006, “Transfer for Disposal and Manifests,” and 10 CFR Part 20, Appendix G, “Requirements for Transfers of Low-Level Radioactive Waste Intended for Disposal at Licensed Land Disposal Facilities and Manifests,” as they relate to the requirements for transferring and manifesting radioactive material shipments to authorized facilities (e.g., disposal sites, waste processors, and offsite storage facilities).

3. 10 CFR 20.2007, “Compliance with Environmental and Health Protection Regulations,” as it relates to compliance with other applicable Federal, State, and local regulations governing the presence of any other toxic or hazardous properties in radioactive wastes, such as mixed wastes characterized by the presence of hazardous chemicals and radioactive materials that may be shipped and disposed of under 10 CFR Part 20 and 10 CFR Part 61, “Licensing Requirements for Land Disposal of Radioactive Waste.”

4. 10 CFR 20.2108, “Records of Waste Disposal,” as it relates to the maintenance of waste disposal records until the NRC terminates the pertinent license requirements.

5. 10 CFR Part 71, “Packaging and Transportation of Radioactive Material,” and 49 CFR Parts 171-180, “Subchapter C - Hazardous Materials Regulations,” (U.S. Department of Transportation, (DOT)), as they relate to the use of approved containers and packaging methods for the shipment of radioactive materials and low-level radioactive wastes.

6. 49 CFR 173.443, “Contamination Control,” as it relates to methods and procedures used to monitor for the presence of removable contamination on shipping containers; and 49 CFR 173.441, “Radiation Level Limitations and Exclusive Use Provisions,” as it relates to methods and procedures used to monitor external radiation levels for shipping containers and vehicles.

The related acceptance criteria are as follows:

1. BTP 11-3, “Design Guidance for Solid Waste Management Systems Installed in Light-Water Cooled Nuclear Power Plants,” Revision 3, March 2007.

2. NUREG-0800, SRP Section 11.4, Appendix 11.4-A, including updated guidance from SECY-93-323, “Withdrawal of Proposed Rulemaking to Establish Procedures and Criteria for On-Site Storage of low-Level Radioactive Waste After January 1, 1996,” and SECY-94-198, “Review of Existing Guidance Concerning the Extended Storage of Low Level Radioactive Waste,” with respect to long-term onsite storage (e.g., for several years, but within the operational life of the plant).

3. NUREG-1301, “Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors,” as it relates to the development of a plant-specific process control program. Alternatively, a COL applicant may use NEI PCP Template 07-10A, Revision 0, March 2009, for the purpose of meeting this regulatory milestone until a plant-specific PCP is prepared under the requirements of a license

condition described in COL FSAR Section 13.4 of a COL application. The NEI PCP Template 07-10A has been determined to be acceptable by the staff.

4. Generic Letter (GL) 89-01, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors," as it relates to the restructuring of the process control program and radiological effluent technical specification (RETS). (GL 89-01 is included in NUREG-1301).

5. GL 80-009, "Low Level Radioactive Waste Disposal," as it relates to ensuring that the physical and chemical properties of wastes shipped for disposal comply with waste disposal criteria of the receiving disposal facility.

6. GL 81-038, "Storage of Low Level Radioactive Wastes at Power Reactor Sites," as it relates to the conduct of safety evaluations under 10 CFR 50.59, "Changes, Tests, and Experiments," at reactor sites planning to build onsite waste storage facilities.

7. GL 81-039, "NRC Volume Reduction Policy," as it relates to the policy statement addressing the need for generator to minimize the quantities of waste produced and apply waste volume reduction practices.

8. NRC Regulatory Issue Summary (RIS) 2008-32, "Interim Low Level Radioactive Waste Storage at Reactor Sites," as it relates to the use of NRC and industry guidance in addressing limited access to radioactive waste disposal facilities.

9. RG 1.21, "Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste," as it relates to the processing of solid and wet wastes and disposal reports.

11.4.4 Technical Evaluation

The staff reviewed COL FSAR Section 11.4 and checked the referenced design certification FSAR to ensure that the combination of the information in the U.S. EPR FSAR and the information in the COL FSAR represents the complete scope of required information relating to this review topic. The review confirmed that the information contained in the COL application and incorporated by reference addresses the required information relating to this section. U.S. EPR FSAR Tier 2, Section 11.4 has been reviewed by the staff under Docket No. 52-020. The staff's technical evaluation of the information incorporated by reference related to SWMS has been documented in the staff safety evaluation report on the design certification application for the U.S. EPR.

The staff's review of the information contained in the COL FSAR is discussed as follows:

The staff reviewed COL FSAR Section 11.4 against SRP Section 11.4 to determine if the information contained in COL FSAR Section 11.4 met the requirements of the regulations stated above and NUREG-0800 acceptance criteria and guidance. However, the staff's review ascertained that there were some outstanding issues, as discussed below.

Combined License Information Items

The staff reviewed COL Information Item No. 11.4-1 from U.S. EPR FSAR Tier 2, Table 1.8-2 included under COL FSAR Section 11.4.3. The COL information item states:

A COL applicant that references the U.S. EPR will fully describe, at the functional level, elements of the Process Control Program. This program description will identify the administrative and operational controls for waste processing process parameters and surveillance requirements which demonstrate that the final waste products meet the requirements of applicable federal, state, and disposal site waste form requirements for burial at a 10 CFR Part 61 licensed low level waste disposal site and will be in accordance with the guidance provided in RG 1.21, NUREG-0800, BTP 11-3, ANSI/ANS-55.1-1992, and Generic Letters 80-09, 81-38, and 81-39.

The COL information item addresses the implementation of a plant-specific PCP using operating procedures and technical specifications, as they relate to the classification, treatment, and disposal of radioactive wastes processed by the SWMS in accordance with NRC, U.S. Department of Transportation, and State and local regulatory requirements. The COL applicant includes, by reference, NEI PCP Template 07-10A as the basis for the PCP. NEI PCP Template 07-10A, Revision 0, March 2009, has been reviewed and found acceptable by the staff. The milestone for the implementation of the PCP is identified in COL FSAR, Section 13.4 and Table 13.4-1.

When implemented, the NEI PCP Template will demonstrate compliance with the requirements of 10 CFR Part 20, SubPart K, "Waste Disposal," 10 CFR 50.34a, "Design Objectives for Equipment to Control Releases of Radioactive Material in Effluents – Nuclear Power Reactors," 10 CFR 50.36a, "Technical Specifications on Effluents from Nuclear Power Reactors," 10 CFR 61.55, 10 CFR 61.56, 10 CFR 20.2006, and 10 CFR Part 20, Appendix G. The template describes technical and regulatory considerations used to process solid, wet, and liquid wastes with selected waste processing technologies and methods. The PCP identifies surveillance requirements that are consistent with the plant's technical specifications, administrative procedures, operational procedures, quality assurance and quality control program, radiological controls and monitoring program, information to be contained in annual radiological effluent release reports, reporting requirements to the NRC, instructions on using the NRC uniform radioactive shipping waste manifest, and the process for initiating and documenting changes to the CCNPP Unit 3 PCP and its supporting procedures. The basis for acceptance in the staff's review is conformance of the COL applicant's endorsement of the U.S. EPR SWMS design and agreement to develop a specific PCP for CCNPP Unit 3. The staff finds that this item is satisfactorily addressed in COL FSAR Section 13.4, Table 13.4-1 Item 9, which lists the milestone for the development and implementation of the PCP. The staff finds the agreement acceptable in conforming to COL Information Item No. 11.4-1.

Although the use of NEI PCP Template 07-10A was found to be acceptable, a review of COL FSAR Sections 11.4.2, "System Description," and 11.4.3 indicates the COL applicant did not address the long-term storage of low-level radioactive waste in the event that access to a low-level radioactive waste disposal site is not available. U.S. EPR FSAR Tier 2, Section 11.4.1, "Design Basis," describes provisions within the Radioactive Waste Processing Building (RWPB) to store low-level radioactive wastes for about 8 years of waste generation. The COL applicant has not described in COL FSAR Section 11.4.2 provisions for storage beyond 8 years using the provisions of RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," and RG 1.143 and acceptance criteria of SRP Section 11.4 and NUREG-0800, Appendix 11.4-A. Therefore, in RAI 206, Question 11.04-1, the staff requested that the COL applicant identify options and address associated regulatory compliance for long-term storage, such as**:**

- Constructing a separate onsite storage facility that would complement the existing storage capacity of the Radioactive Waste Processing Building

- Making arrangements for the transfer of low-level radioactive wastes to licensed third-party facilities

- Making arrangements for the transfer of low-level radioactive wastes to an operating nuclear power plant managed by a parent or holding company with a license to store radioactive waste generated by CCNPP Unit 3

The staff requested that the COL applicant provide enough details about storage options for the staff to evaluate compliance with NRC regulations, including 10 CFR Part 20, 10 CFR 50.34a, 10 CFR 50.59 like process described in 10 CFR Part 52 for the U.S. EPR design certification, 10 CFR 61.55 and 61.56 as they relate to waste classification and characteristics; and NRC guidance and acceptance criteria of SRP Section 11.4, NUREG-0800, RG 1.143, RIS 2008-32, and industry guidance as applicable.

In a February 3, 2010, response to RAI 206, Question 11.04-1, the COL applicant agreed to revise COL FSAR Section 11.4.3 and identify processes and options for the storage of Class B and C low-level radioactive wastes in the event that access to a low-level radioactive waste disposal site is not available. Currently, there is one U.S. facility, located in Clive, Utah, that will accept Class A low-level radioactive wastes generated by licensees outside of the State of Utah or Northwest Low level Radioactive Waste Compact. In its response, the COL applicant recognizes that, while the design of the Radioactive Waste Processing Building offers some storage capacity for several years, the storage space is not sufficiently large enough to store Class B and C low level radioactive wastes over the term of the license. The COL applicant identifies options, including access to other disposal or storage sites, if available; construction of an onsite interim storage facility; and establishment of commercial agreements with third party contractors to process, store, and take ownership and subsequent disposal of wastes generated by CCNPP Unit 3.

The option to ship Class B and C low level radioactive wastes to the facility located in Andrews County, Texas depends on whether that facility will receive approval by the State of Texas to accept wastes from waste generators located in Maryland. As part of this option, the COL applicant proposes to implement waste generation practices that would minimize the amounts of Class B and C wastes being generated in the interim time period. These measures include techniques and operating practices recognized by the nuclear industry. These measures are sufficient to extend the storage capacity of the existing CCNPP Unit 3 facilities for Class B and C wastes, provide additional time for the development of offsite storage capacity by commercial third parties, or allow the COL applicant to plan and construct an onsite storage facility that would supplement the existing storage capacity of the CCNPP Unit 3 plant.

The option of relying on commercial agreements with third party contractors to process and store, and take ownership and dispose of wastes depends on whether third party contractors have their own access to State or regional waste disposal facilities that would permit the long-term storage of low level radioactive waste, or take ownership of wastes generated by CCNPP Unit 3 followed by disposal under the contractor's own license. Setting aside the matter of contractual obligations in securing such commercial services, CCNPP Unit 3 is expected to comply with all waste acceptance criteria imposed under the contractor's license conditions and those of 10 CFR 61.55 and 10 CFR 61.56, 10 CFR 20.2006, and 10 CFR Part 20, Appendix G,

before the contractor would accept wastes generated by CCNPP Unit 3. However, licenses issued to third party waste processors typically impose restrictions on how long wastes generated by third parties can be held in storage. In taking ownership of radioactive wastes generated by others, license conditions might impose limits on yearly volumes and total radioactivity inventories of Class B and C wastes. While it is presumed that such services will become available in the future, it is not clear whether CCNPP Unit 3 could obtain such services in a timely a manner, and, if so, what share of the yearly total volume and radioactivity allocations it might be able to secure contractually for itself. Given these uncertainties, it is deemed necessary for the COL applicant to have the option of constructing an onsite interim or long-term low level radioactive storage facility to meet regulatory requirements in managing the generation of Class B and C wastes for the term of the CCNPP Unit 3 license.

In all instances, the COL applicant agrees to comply with all applicable NRC, Federal, State, and local regulations addressing the generation, onsite storage, characterization, packaging and labeling, shipment and transportation, and waste acceptance criteria for the disposal of Class B and C low-level radioactive wastes. The design and construction of an onsite low-level radioactive storage facility or modifications to existing storage capacity are expected to comply with the requirements of the change process that is outlined in the U.S. EPR design certification rule (similar to the process included in 10 CFR 50.59), as it relates to facility modifications, changes in structures, systems, and components that could affect performance, and compliance with the requirements in 10 CFR Part 20 and 10 CFR Part 50, and changes in methods described in the COL FSAR and operating procedures. Additional technical and regulatory guidance is given in RG 1.143, RG 4.21, “Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning,” RG 8.8, “Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be As Low As Is Reasonably Achievable,” and RG 8.10, “Operating Philosophy for Maintaining Occupational Radiation Exposures as Low as Is Reasonably Achievable.” These requirements apply whether onsite storage is planned as an interim or as a long-term storage facility. Similarly, CCNPP Unit 3 would comply with parallel sets of requirements for wastes shipped to third-party contractors and disposed or managed under their respective licenses issued by Federal and State regulatory agencies.

In this context, the NRC has issued technical and regulatory guidance on the storage of low level radioactive waste. In GL 81-038, November 10, 1981, the NRC provides guidance to licensees on the addition of onsite low level radioactive waste storage facilities.
SRP Section 11.4, Appendix 11.4-A, “Design Guidance for Temporary Storage of Low-Level Radioactive Waste,” and RIS 2008-32 provide guidance on waste storage at reactor sites.
SRP Appendix 11.4-A addresses the guidance of GL 80-009 on low level radioactive waste disposal; GL 81-038 discusses the storage of low level radioactive waste at reactor sites; and GL 81-039 presents the NRC low level radioactive waste volume reduction policy.
10 CFR 20.1406 addresses requirements for the design and operation of facilities with the objective of minimizing releases of radioactivity and contamination to the environment.
Inspection and Enforcement (IE) Circular 80-18, “10 CFR 50.59 Safety Evaluations for Changes to Radioactive Waste Treatment Systems,” presents criteria in considering changes made to radioactive waste treatment systems under the requirements of 10 CFR 50.59 for license holders. The industry has also issued guidelines for the safe operation of interim onsite low-level radioactive waste disposal facilities (i.e., “Guidelines for Operating an Interim On Site Low Level Radioactive Waste Storage Facility,” Electric Power Research Institute (EPRI) Report 1017005, February 2009).

The operation of an onsite low-level radioactive storage facility is expected to comply with 10 CFR Part 20 and the CCNPP Unit 3 radiation protection program and process control program (as described above) in protecting members of the public and plant workers. The COL applicant is required to meet the ALARA requirements of 10 CFR 20.1101 and 10 CFR Part 50, Appendix I. 10 CFR 20.1101 requires licensees to use procedures and engineering controls to maintain occupational radiation exposures and doses to members of the public ALARA. Among other guidance documents, RG 8.8 and RG 8.10 address such requirements implemented under the control of an operational radiation protection program. The operational program covers work activities associated with the movement, storage, surveys, and inspection of containers containing radioactive wastes. The radiation protection program also addresses technical issues in considering the duration of the intended storage, types and forms of wastes, selection and expected long-term integrity of waste storage containers, and maximum amounts of radioactive materials contained in wastes in ensuring public health and safety, minimizing doses to operating personnel, and protection of the environment. Radiation surveys are conducted to confirm that external radiation and airborne radioactivity levels within the storage facility and in areas surrounding the storage facility are in compliance with the dose limits of 10 CFR 20.1201, "Occupational dose limits for adults," and 10 CFR 20.1301. Chapter 12 of this report presents the staff's evaluation of the COL applicant's occupational radiation protection program.

With respect to keeping doses ALARA for members of the public, the COL applicant is required to meet the dose limits of 10 CFR 20.1301 and to comply with liquid and gaseous effluent concentration limits of 10 CFR Part 20, Appendix B, Table 2. The requirements of 10 CFR Part 20, Appendix B, Table 2 effluent concentration limits would apply if the storage facility were equipped with its own liquid waste processing and ventilation systems. As is described in U.S. EPR FSAR Tier 2, Section 11.4, the LWMS and GWMS, located in the RWPB, are used to treat and control liquid and gaseous effluent releases generated during the operation of the SWMS. Compliance with the requirements of 10 CFR Part 20, Appendix B and 10 CFR Part 50, Appendix I for the SWMS is addressed in COL FSAR Section 11.2 for the LWMS, and COL FSAR Section 11.3 for the GWMS. Sections 11.2 and 11.3 of this report present the results of the staff's evaluation in confirming compliance with ALARA requirements and dose and effluent concentration limits of 10 CFR Part 20 for members of the public and design objectives of 10 CFR Part 50, Appendix I.

The staff finds the clarifications and proposed revisions for COL FSAR Section 11.4.3 acceptable. The proposed revisions present a current assessment of the limitations and constraints in managing the storage and disposal of Class B and C wastes, and identify realistic options for the storage and/or disposal of low level radioactive wastes. Given the uncertainties in the access for either disposal or long term storage with commercial third parties, the COL applicant has provided sufficient information that the combination of the planned onsite storage and the option of constructing an onsite long-term low level radioactive storage facility are sufficient to manage low level radioactive waste during the term of its license. The COL applicant agrees to comply with all applicable NRC, Federal, State, and local regulations that address the generation, onsite storage, characterization, packaging and labeling, shipment and transportation, and waste acceptance criteria for the disposal of Class B and C low-level radioactive wastes. If third party commercial contractors were used, CCNPP Unit 3 is expected to comply with similar requirements under their respective licenses issued by Federal and State regulatory agencies. The staff has reviewed the COL applicant's response to this RAI and finds it acceptable for the reasons stated above. **RAI 206, Question 11.04-01 is being tracked as a confirmatory item** to ensure that the COL FSAR is revised accordingly.

Operational Program

The COL applicant agreed to develop and implement a plant-specific PCP in COL FSAR Table 13.4-1, Item 9. The program and its elements are included in NEI PCP Template 07-10A, which the staff has determined to be acceptable and are included under COL Information Item No. 11.4-1. The staff finds the scope of the PCP and its implementation acceptable.

Other than the PCP, there are no specific operational programs required for the operation of the SWMS. All liquid and gaseous effluent releases associated with the operation of the SWMS are managed through the operation of the LWMS and GWMS, respectively. All liquid and gaseous effluent releases are controlled by the ODCM. The COL applicant included COL Information Item No. 11.5-1 to develop a plant and site-specific ODCM by endorsing NEI ODCM Template 07-09A. The staff has determined the endorsement of NEI ODCM Template 07-09A to be acceptable. The staff finds this acceptable. The staff's evaluation of the ODCM is presented in Section 11.5 of this report.

Technical Specifications

A review of COL FSAR Chapter 16 shows that U.S. EPR FSAR Tier 2, Chapter 16, TS 5.6.2, "Radioactive Effluent Release Report," is adopted by reference, with one revision. TS 5.6.2 requires that the annual report include a summary of the amounts of radioactive wastes shipped offsite for disposal. The TS requires that the information, included in the yearly summary, be consistent with the objectives outlined in the PCP and in conformance with 10 CFR Part 50.36a and 10 CFR Part 50, Appendix I.

The revision noted in COL FSAR Chapter 16 removes the generic provision addressing the submission of a single annual report for COL holders that operate multiple power plants, since the CCNPP Unit 3 COL application is for a single power plant. The staff has determined that this modification to TS 5.6.2 is acceptable, since the implementation of the PCP and compliance with NRC reporting requirements will be addressed in a plant-specific PCP under COL Information Item No. 11.4-1, as described in U.S. EPR FSAR Tier 2, Section 1.8.1, "COL Information Items," and U.S. EPR FSAR Tier 2, Table 1.8-2, and COL FSAR Section 1.8.1, "COL Information Items," and COL FSAR Table 1.8-2.

Departures and Exemption Requests

In COL application Part 7, the COL applicant describes departures and exemption requests from the information presented in the U.S. EPR FSAR. A review of the information presented in COL application, Part 7, Sections 1.1 and 1.2 indicates that there are no departures or exemption requests associated with the design and operation of the SWMS.

Compliance with Effluent Concentration Limits and Doses to Members of the Public

Under 10 CFR Part 20, Appendix B and 10 CFR Part 50, Appendix I, COL applicants are responsible for addressing requirements in controlling radioactive effluent releases in unrestricted areas and doses to a hypothetical maximally exposed member of the public and populations living near the proposed nuclear power plant. Specifically, 10 CFR Part 50, Appendix I, Sections II.A, II.B, II.C, and II.D contain these requirements. The requirements for liquid and gaseous effluent releases are described in 10 CFR Part 20, Appendix B, Table 2, Columns 1 and 2. The LWMS and GWMS control liquid and gaseous effluent releases, respectively, generated during the operation of the SWMS. Accordingly, compliance with the

requirements of 10 CFR Part 20, Appendix B and 10 CFR Part 50, Appendix I for the SWMS is subsumed in COL FSAR Section 11.2 for the LWMS, and COL FSAR Section 11.3 for the GWMS. Sections 11.2 and 11.3 of this report present the results of the staff's evaluation in confirming compliance with dose and effluent concentration limits of 10 CFR Part 20 for members of the public and design objectives of 10 CFR Part 50, Appendix I.

11.4.5 Post Combined License Activities

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

11.4.6 Conclusions

The staff reviewed the COL application and checked the referenced U.S. EPR FSAR. The staff's review confirmed that the COL applicant addressed the required information relating to the SWMS, and there is no outstanding information expected to be addressed in the COL FSAR related to this section other than the confirmatory item noted above.

The staff reviewed the information in the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the SWMS incorporated by reference in the COL FSAR have been documented in the staff's safety evaluation report on the design certification application for the U.S. EPR The SER on the U.S. EPR FSAR is not yet complete The staff will update Section 11.4 of this report to reflect the final disposition of the design certification application.

In addition, the staff also compared the additional COL information within the application against relevant NRC regulations, acceptance criteria and guidance defined in NUREG-0800, Section 11.4, and other NRC regulatory guidance. As discussed above, the RAI given above, as a confirmatory item, will need to be reviewed and resolved, with conclusions revised accordingly.

The staff verified that the COL applicant has provided sufficient information and that the review supports the following conclusions.

The staff concludes that the SWMS includes the equipment and operational program necessary to process wet and dry solid wastes associated with the operation of the SWMS, is acceptable and meets the requirements of 10 CFR 20.2006, 10 CFR 20.2007, 10 CFR 20.2108, 10 CFR 61.55, 10 CFR 61.56, 10 CFR Part 71, and applicable U.S. DOT regulations under 49 CFR Parts 171-180. This conclusion is based on the following:

- The COL applicant's endorsement of NEI PCP Template 07-10A for the CCNPP Unit 3 PCP meets the requirements of 10 CFR 20.2006, 10 CFR 20.2007, and 10 CFR 20.2108; 10 CFR Part 61 and 10 CFR Part 71; and applicable U.S. DOT regulations under 49 CFR Parts 171-180. The PCP addresses operating procedures and acceptance criteria, as they relate to the treatment, characterization, classification, and disposal of low level radioactive wastes processed by the SWMS, as stated in COL FSAR Sections 11.4.3 and 13.4.

- With respect to the operation of the SWMS, all associated releases of liquid and gaseous effluents will be monitored and controlled through the operation of the LWMS and GWMS. The COL applicant is responsible for determining the operational setpoint for its LWMS and GWMS radiation monitors in a plant-specific offsite dose calculation

manual under COL Information Item No. 11.5-1, as described in COL FSAR Sections 11.5 and 13.4. COL information Item No. 11.5-1 addresses compliance with liquid and gaseous effluent releases controlled by 10 CFR Part 20 and 10 CFR Part 50, Appendix I. The staff's related evaluations are presented in Sections 11.2, 11.3, and 11.5 of this report.

- In COL FSAR Chapter 16, the COL applicant has adopted by reference U.S. EPR FSAR Generic TS 5.6.2, with one revision. The revision of COL FSAR Chapter 16, TS 5.6.2 removes the generic provision addressing the submission of a single annual report for COL holders that operate multiple power plants, since the CCNPP Unit 3 COL application is for a single power plant. TS 5.6.2 requires that the annual report include a summary of the amounts of radioactive wastes shipped offsite for disposal. In the context of COL FSAR Section 11.4, the staff has determined that this modification to TS 5.6.2 is acceptable. The staff's full evaluation of TS for CCNPP Unit 3 is presented in Chapter 16 of this report.

  The staff concludes that the endorsement of NEI PCP Template 07-10A, Revision 0, March 2009, and supplemental information contained in COL FSAR Section 11.4.3 are consistent with the requirements of GL 89-01 and guidance of NUREG-1301 in demonstrating compliance with NRC regulations and guidance, and applicable Federal, State, and local regulations for licensed facilities to which the COL applicant may ship radioactive wastes for disposal, or ship radioactive materials and contaminated plant equipment for storage and refurbishing.

11.5 Process and Effluent Radiological Monitoring and Sampling Systems

11.5.1 Introduction

The process and effluent radiological monitoring and sampling systems are used to monitor liquid and gaseous process streams and effluent releases from waste management systems during normal operation, AOOs, and post-accident conditions. The systems include radiation monitors to detect and measure radioactivity and radiation levels and provide indications of radioactive release rates or concentration levels in process and effluent streams. The PERMSS include sampling systems to extract samples from process or effluent streams and provide the means to collect samples on filtration and in adsorbent media. The PERMSS provide the means to establish alarm setpoints to indicate when excessive radioactivity levels are present, track and record rates of radioactivity releases, and initiate protective isolation actions, such as diverting process streams or terminating effluent releases.

PERMSS components consist of skid-mounted radiation monitoring equipment and permanently installed sampling lines. The equipment is located at points to measure radioactivity or collect samples that are representative of process flows and effluent releases. Samples collected on filtration and in adsorbent media are evaluated by laboratory analyses to confirm measurement results recorded by radiation monitors and determine radioactivity levels for radionuclides that are not readily detected by radiation monitoring devices. The system includes local instrumentation readout panels and alarm functions in addition to those located in the main control room.

The PERMSS does not generate additional sources of radioactive materials associated with its operation, given that it is used only to control and monitor liquid and gaseous process streams and effluents discharged into the environment. Fluid samples collected from process and effluent streams are returned to their origins and are not discharged locally.

11.5.2 Summary of Application

COL FSAR Section 11.5 incorporates by reference U.S. EPR FSAR Tier 2, Section 11.5, "Process and Effluent Radiological Monitoring and Sampling Systems."

In addition, in COL FSAR Section 11.5, the COL applicant provided the following:

Combined License Information Items

The COL applicant provided additional information in COL FSAR Section 11.5.2, "System Description," to address COL Information Item No. 11.5-1 from U.S. EPR FSAR Tier 2, Table 1.8-2 as follows:

> A COL applicant that references the U.S. EPR will fully describe, at the functional level, elements of the process and effluent monitoring and sampling programs required by 10 CFR Part 50, Appendix I and 10 CFR 52.79(a)(16). This program description, "Offsite Dose Calculation Manual," will specify how a licensee controls, monitors, and performs radiological evaluations of releases. The program will also document and report radiological effluents discharged to the environment.

The COL applicant indicated that the CCNPP Unit 3 ODCM, included as COL application, Part 11F, describes elements of the ODCM at the functional level. The COL information item addresses the implementation of a plant and site-specific ODCM using operating procedures and technical specifications in controlling and monitoring effluent releases and calculating offsite doses due to liquid and gaseous effluent releases. The COL applicant endorses by reference NEI ODCM Template 07-09A as the basis of its ODCM as an operational program document. The milestone for the implementation of the ODCM is identified in COL FSAR Section 13.4 and COL FSAR Table 13.4-1.

11.5.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the U.S. EPR FSAR.

In addition, the relevant requirements of NRC regulations for the PERMSS, and the associated acceptance criteria, are specified in NUREG-0800, Section 11.5, "Process and Effluent Radiological Monitoring Instrumentation and Sampling Systems."

The applicable regulatory requirements for PERMSS are as follows:

1. 10 CFR 20.1302 and 10 CFR 20.1301, as they relate to monitoring radioactivity in plant radiological effluents to unrestricted areas and compliance with U.S. EPA 40 CFR Part 190, as implemented under 10 CFR 20.1301(e). These criteria apply to all effluent releases generated during normal plant operations and AOOs.

2. 10 CFR 50.34a, as it relates to program and procedures used to control releases of radioactive materials to the environment within the design objectives of Appendix I to 10 CFR Part 50.

3. 10 CFR 50.36a, as it relates to program and operating procedures and equipment installed in radioactive waste management systems pursuant to 10 CFR 50.34a in ensuring that releases of radioactive materials to unrestricted areas are kept ALARA.

4. 10 CFR Part 50, Appendix I, as it relates to numerical guides and design objectives to meet the requirements of 10 CFR 50.34a and 10 CFR 50.36a, which specify that radioactive effluents released to unrestricted areas and doses to members of the public be kept ALARA.

The related acceptance criteria are as follows:

1. NUREG-1301 as it relates to the development of a plant and site-specific ODCM program. Alternatively, a COL applicant may use NEI ODCM Template 07-09A, Revision 0, March 2009, for the purpose of meeting this regulatory milestone until a plant-specific ODCM is prepared, before fuel load, under the requirements of a license condition described in COL FSAR Section 13.4 of a COL application. The staff has reviewed NEI ODCM Template 07-09A and determined it to be acceptable.

2. GL 89-01 as it relates to the restructuring of the ODCM, PCP, RETS or standard radiological effluent controls (SREC), and implementation of a radiological environmental monitoring program (REMP). (GL 89-01 is included in NUREG-1301).

11.5.4 Technical Evaluation

The staff reviewed COL FSAR Section 11.5 and checked the referenced design certification FSAR to ensure that the combination of the information in the U.S. EPR FSAR and the information in the COL FSAR represents the complete scope of required information relating to this review topic. The review confirmed that the information contained in the COL application and incorporated by reference addresses the required information relating to this section. U.S. EPR FSAR Tier 2, Section 11.5 has been reviewed by the staff under Docket No. 52-020. The staff's technical evaluation of the information incorporated by reference related to the PERMSS has been documented in the staff safety evaluation report on the design certification application for the U.S. EPR.

The staff's review of the information contained in the COL FSAR is discussed as follows:

The staff reviewed COL FSAR Section 11.5 against SRP Section 11.5 to determine if the information contained in COL FSAR Section 11.5 met the requirements of the regulations stated above and NUREG-0800 acceptance criteria and guidance. However, the staff's review ascertained that there were some outstanding issues, as discussed below.

Combined License Information Items

The staff reviewed COL Information Item No. 11.5-1 from U.S. EPR FSAR Tier 2, Table 1.8-2 included under COL FSAR Section 11.5.2. The COL information item states:

A COL applicant that references the U.S. EPR will fully describe, at the functional level, elements of the process and effluent monitoring and sampling programs required by 10 CFR Part 50, Appendix I and 10 CFR 52.79(a)(16). This program description, Offsite Dose Calculation Manual, will specify how a licensee controls, monitors, and performs radiological evaluations of releases. The program will also document and report radiological effluents discharged to the environment.

COL FSAR Revision 6, Section 11.5.2 endorses the use of NEI ODCM Template 07-09A, Revision 0, March 2009, to meet COL Information Item No. 11.5-1 until a plant and site-specific ODCM is prepared, before fuel load, under the requirements of a license condition described in COL FSAR Section 13.4, Table 13.4-1, Item 9. The NEI ODCM Template identifies monitoring criteria, liquid and gaseous radiological effluent controls, monitoring instrumentation, methods for deriving lower limits of detection and detection sensitivities, methods for establishing instrumentation alarm setpoints, dose limits for members of the public, and requirements for process and effluent sampling in various plant systems. The NEI ODCM Template also identifies requirements limiting effluent releases, surveillance requirements, methods for calculating effluent release rates and doses, elements of a radiological environmental monitoring program, elements of a quality assurance and quality control program, information to be contained in annual radiological effluent release reports, reporting requirements to the NRC, process for initiating and documenting changes to the CCNPP Unit 3 ODCM and supporting procedures, and record keeping.

Once implemented, the NEI ODCM Template will present the functional elements of an ODCM that would demonstrate compliance with liquid and gaseous effluent releases under 10 CFR Part 20, Appendix B, Table 2, Columns 1 and 2; dose limits for members of the public in 10 CFR 20.1301 and 10 CFR 20.1302; 10 CFR Part 20.1301(e) in meeting U.S. EPA environmental radiation protection standards of 40 CFR 190 for facilities within the fuel-cycle, including nuclear power reactors; and the requirements of 10 CFR 50, Appendix I, Sections II.A, II.B, II.C, and II.D for liquid and gaseous effluents generated during the operation of the LWMS, GWMS, and SWMS.

The staff has reviewed NEI ODCM Template 07-09A and found it acceptable. The development of the site-specific ODCM and implementing procedures should meet the provisions of GL 89-01, Supplement No. 1, "Radiological Assessment Branch Technical Position," Revision 1, November 1979, included as NUREG-1301, Appendix A, as ODCM guidance for PWRs, and the guidance of NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants." The staff finds this approach acceptable, given the inclusion of COL Information Item No. 11.5-1 in U.S. EPR FSAR Tier 2, Revision 1, Sections 1.8.1 and 11.5.2, "System Description," and its implementation in COL FSAR Revision 6, Section 13.4.

While the proposed use of NEI ODCM Template is acceptable, the COL FSAR Section 11.5 does not address unique site-specific conditions that are not covered in NEI ODCM Template 07-09A. The COL FSAR does not consider how the ODCM will control liquid and gaseous effluent releases and doses to members of the public given that two licensees (Constellation for CCNPP Units 1 and 2, and UniStar for CCNPP Unit 3) will be contributing to and competing for a single dose allocation to members of the public under 10 CFR 20.1301 and 10 CFR 20.1302; 10 CFR 20.1301(e) in complying with 40 CFR Part 190; and the unity-rule in meeting liquid and gaseous effluent concentration limits of 10 CFR Part 20, Appendix B, Table 2, Columns 1 and 2. Therefore, in RAI 207, Question 11.05-1, the staff requested that the COL applicant:

1. Describe in COL FSAR Section 11.5.2, the administrative program and procedures that will be used to coordinate all liquid and gaseous effluent releases and dose allocations to members of the public between Constellation for CCNPP Units 1 and 2 and UniStar for CCNPP Unit 3 in complying with NRC regulations.

2. If UniStar has already made specific arrangements with Constellation on this matter, the COL applicant is requested to describe in COL FSAR Section 11.5.2 the type and duration of such arrangements, the scope of the arrangements made in coordinating the responsibility to control liquid and gaseous effluent releases and doses to members of the public, and how the arrangements will be implemented in CCNPP Unit 3 administrative programs and procedures in COL FSAR Section 13.1.

3. Include this additional responsibility in the job functional description of the Radiation Protection/Chemistry Manager in COL FSAR Section 13.1.2.2.1.1.3.

In a March 4, 2010, response to RAI 207, Question 11.05-1, the COL applicant proposed revisions to COL FSAR Section 11.5.2 to address Items 1 and 2 of this RAI. The proposed revision would implement, via the offsite dose calculation manual and procedures, a notification process between UniStar for CCNPP Unit 3 and Constellation for CCNPP Units 1 and 2 to ensure that effluent concentrations and offsite doses and dose rate limits are not exceeded. The notification process includes the means to coordinate and control releases of liquid and gaseous effluents, such that both licensed plants are jointly aware of routine and planned releases, and anticipated operational occurrences. While the COL applicant acknowledges that such arrangements have not yet been formalized, the responsibility to implement such arrangements is assigned with the development of the ODCM for CCNPP Unit 3. The development of the ODCM is described in COL FSAR Section 13.4 (Table 13.4-1, Item 9) and is to be completed before fuel load. Among other operational programs, the implementation of the ODCM is included as part of License Condition 3, described in COL application, Part 10.

The staff has determined that the proposed approach is acceptable given that the COL applicant recognizes that both licensees, Constellation for CCNPP Units 1 and 2 and UniStar for CCNPP Unit 3 will be contributing to and competing for a single dose allocation to members of the public under 10 CFR 20.1301 and 10 CFR 20.1302; 10 CFR 20.1301(e) in complying with 40 CFR Part 190; and the unity-rule in meeting liquid and gaseous effluent concentration limits of 10 CFR Part 20, Appendix B, Table 2, Columns 1 and 2. The staff has determined that there is reasonable assurance that the inclusion of this provision and arrangements between both licensees into the CCNPP Unit 3 ODCM will ensure compliance with NRC regulations, as summarized above. The staff has reviewed the COL applicant's response to this RAI and finds it acceptable for the reasons stated above. **RAI 207, Question 11.05-01, Items 1 and 2, are being tracked as confirmatory items** to ensure that the COL FSAR is revised accordingly.

As a follow-up to RAI 207, Question 11.05-1, Item 3, and RAI 208, Question 13.01.02 - 13.01.03-11, the staff requested that the COL applicant propose additional revisions to COL FSAR Section 13.1.2.2.1.1.3, to address the staff concern about describing the functions of the Radiation Protection/Chemistry Manager. The COL applicant's proposed COL FSAR revisions to the manager's functions, as described in the March 4 and March 9, 2010, responses to RAI 207, Question 11.05-1 and RAI 208, Question 13.01.02 - 13.01.03-11, were determined to be inconsistent, as they relate to duties associated with the control and monitoring of liquid and gaseous effluents. Therefore, in follow-up RAI 235, Question 11.05-2,

the staff requested that the COL applicant reconcile the description of functions listed in the two RAI responses, and propose appropriate revisions to the COL FSAR.

In March 4, 2010, and May 27, 2010, responses to RAI 207, Question 11.05-01 and RAI 235, Question 11.05-02, the COL applicant proposed to revise the functions assigned to the Radiation Protection/Chemistry Manager and Radiation Protection/Chemistry Shift Supervisors. The revised functions include those associated with the management of radioactive liquid and gaseous effluent releases, control of associated offsite doses, and implementation of the radiological environmental monitoring program. Regarding waste management, the revised functions address responsibilities for processing solid radioactive wastes under the process control program. The staff finds the clarifications and proposed revisions to functions described in COL FSAR Sections 13.1.2.2.1.1.3, "Radiation Protection/Chemistry Manager," and 13.1.2.2.1.1.3.2, "Radiation Protection/Chemistry Shift Supervisors," acceptable. The revised functions are found to be consistent with those applied to demonstrate compliance with 10 CFR 20.1301 and 10 CFR Part 50, Appendix I to be implemented under a plant and site-specific offsite dose calculation manual; and with 10 CFR 20.2006, and 10 CFR Part 20, Appendix G, and 10 CFR 61.55 and 61.56 implemented under a plant-specific process control program. The staff has reviewed the COL applicant's responses to these RAIs and finds them acceptable for the reasons stated above. **RAI 207, Question 11.05-01, Item 3, and RAI 235, Question 11.05-02 are being tracked as confirmatory items** to ensure that the COL FSAR is revised accordingly.

Operational Program

The COL applicant provided an implementation schedule to address the development and implementation of a plant and site-specific process and effluent monitoring and sampling program in COL FSAR Section 13.4 and COL FSAR Table 13.4-1, Item 9. The elements of the program consist of the radiological effluent technical specifications/standard radiological effluent controls, the ODCM, and the radiological environmental monitoring program. The program and its elements are included in NEI ODCM Template 07-09A, which the staff has determined to be acceptable, and are included as COL Information Item No. 11.5-1. The staff finds the scope of the program and its implementation to be acceptable.

Technical Specifications

A review of COL FSAR Chapter 16 shows that U.S. EPR FSAR Generic Technical Specifications 5.5.1, "Offsite Dose Calculation Manual," TS 5.5.3, "Radioactive Effluent Controls Program," and TS 5.6.1, "Annual Radiological Environmental Operating Report," are adopted by reference. The use of an ODCM is mandated as one of the operational programs described in COL FSAR Section 13.4 and COL FSAR Table 13.4-1 (Item 9). The staff determined these requirements are acceptable, since the implementation of the ODCM will be addressed in a plant and site-specific ODCM under COL Information Item No. 11.5-1, as described in U.S. EPR FSAR Tier 2, Section 1.8.1 and U.S. EPR Tier 2, Table 1.8-2, and COL FSAR Section 1.8.1 and COL FSAR Table 1.8-2.

Departures and Exemption Requests

In COL application, Part 7, the COL applicant describes departures and exemption requests from the information presented in U.S. EPR FSAR. A review of the information presented in COL application Part 7, Sections 1.1 and 1.2 indicates that there are no departures or

exemption requests associated with the design and operation of the PERMSS and site-specific characteristics in monitoring liquid and gaseous effluent releases.

11.5.5 Post Combined License Activities

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

11.5.6 Conclusions

The staff reviewed the COL application and checked the referenced U.S. EPR FSAR. The staff's review confirmed that the COL applicant addressed the required information relating to the PERMSS, and there is no outstanding information expected to be addressed in the COL FSAR related to this section other than the confirmatory items noted above.

The staff reviewed the information in the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the PERMSS incorporated by reference in the COL FSAR have been documented in the staff's safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 11.5 of this report to reflect the final disposition of the design certification application.

In addition, the staff also compared the additional COL information within the application against relevant NRC regulations, acceptance criteria defined in NUREG-0800, Section 11.5, and other NRC regulatory guidance. As discussed above, the confirmatory items given above will need to be resolved, with conclusions revised accordingly.

The staff verified that the COL applicant has provided sufficient information and that the review supports the following conclusions.

The staff concludes that the PERMSS includes the equipment and operational program necessary to monitor process and effluent streams, describes an operational program to control and assess offsite doses due to radioactive effluent releases associated with the operation of the LWMS, GWMS, and SWMS, provides the means to collect and analyze samples from process and effluent streams, and incorporates provisions to implement an environmental sampling and monitoring program. The PERMSS and ODCM are found acceptable and meet the applicable requirements 10 CFR 20.1301 and 10 CFR 20.1302; 10 CFR 20.1301(e) in complying with the U.S. EPA environmental standards of 40 Part 190; 10 CFR 50.34a and 10 CFR 50.36a; 10 CFR Part 50, Appendix I; and guidance of NUREG-1301 and GL 89-01. This conclusion is based on the following:

- The PERMSS includes the instrumentation for monitoring and sampling radioactivity in liquid and gaseous process and effluent streams, and in solid wastes during routine operations, AOOs, and accident conditions. The staff evaluated the provisions proposed for sampling and monitoring appropriate process streams and effluent release points, including non-radioactive systems that could become contaminated through interfaces with radioactive systems.

- By endorsing NEI ODCM Template 70-09A, the COL applicant has agreed to develop a plant and site-specific ODCM for the purpose of controlling and monitoring liquid and gaseous effluent releases due to the operation of the LWMS, GWMS, and SWMS. The ODCM will be used to comply with the requirements of 10 CFR Part 20, Appendix B,

Table 2, Columns 1 and 2; dose limits for members of the public in 10 CFR 20.1301 and 10 CFR 20.1302; 10 CFR 20.1301(e) in meeting the U.S. EPA environmental radiation protection standards of 40 CFR Part 190 for facilities within the fuel-cycle, including nuclear power reactors; and design objectives and ALARA requirements of 10 CFR 50, Appendix I, Sections II.A, II.B, II.C, and II.D for liquid and gaseous effluents, as stated in COL FSAR Sections 11.5.2 and 13.4.

- By endorsing NEI ODCM Template 70-09A, the COL applicant will develop a plant-specific process through which radiation monitoring instrumentation sensitivity and detection levels, and PERMSS instrumentation alarm setpoints will be established in monitoring and controlling releases of liquid and gaseous radioactive materials into the environment.

- The staff concludes that the endorsement of NEI ODCM Template 07-09A, Revision 0, March 2009, and supplemental information contained in COL FSAR Section 11.5.2 are consistent with the guidance in GL 89-01 and NUREG-1301 for demonstrating compliance with NRC regulations and guidance for the control and monitoring of releases of liquid and gaseous effluents in unrestricted areas and coordinating liquid and gaseous effluent releases with those of Calvert Cliffs Units 1 and 2 in demonstrating compliance with dose limits for members of the public due to all releases from Calvert Cliffs Units 1, 2, and 3