

11 RADIOACTIVE WASTE MANAGEMENT

11.1 Source Terms

11.1.1 Introduction

This chapter describes the results of the U.S. Nuclear Regulatory Commission (NRC) staff's, hereinafter referred to as the staff, review of the Comanche Peak Nuclear Power Plant (CPNPP) Units 3 and 4 Combined License (COL) Final Safety Analysis Report (FSAR). This chapter provides information regarding 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* (10CFR) Part 20, "Standards for Protection Against Radiation," for members of the public, and 10 CFR Part 50, Appendix I, "Numerical guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion, As Low as is Reasonably Achievable, for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents," in meeting numerical guides for design objectives and limiting conditions for operation to meet the criterion of "as low as is reasonably achievable" (ALARA). This chapter addresses the design basis and average radioactive source terms, and radioactive waste management systems (RWMS).

The design basis source term, addressed in 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 also used to assess doses to members of the public due to liquid and gaseous effluent releases.

The RWMS includes the liquid waste management system (LWMS, Section 11.2), gaseous waste management system (GWMS, Section 11.3), solid waste management system (SWMS, Section 11.4), and process effluent radiation monitoring and sampling systems (PERMS, 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) (activities such as loss of power to all recirculation pumps, tripping of the turbine generator set, isolation of the main condenser, and loss of offsite power).

11.1.2 Summary of Application

Section 11.1, "Source Terms," of the CPNPP, Units 3 and 4 COL FSAR, Revision 1, incorporates by reference Section 11.1, "Source Terms," of the United States - Advanced Pressurized Water Reactor (US-APWR) Design Control Document (DCD), Revision 2, without any departures.

US-APWR COL Information Items

FSAR Section 11.1 does not contain any COL information items or supplementary information related to the DCD Section 11.1.

Interface Requirements

The US-APWR DCD Tier 2, Section 1.8, Table 1.8-1, "Significant Site-Specific Interfaces with the Standard US-APWR Design," identifies significant interfaces between the US-APWR standard design and the COL Application (COLA). This table does not specify any interfaces related to Section 11.1 of the DCD.

11.1.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the Final Safety Evaluation Report (FSER) related to the US-APWR DCD.

Acceptance criteria which meet the regulatory requirements for this review are also contained in:

1. Regulatory Guide (RG) 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," issued June 2007.
2. NUREG-0800, "Standard Review Plan," Section 11.1, "Source Terms."

11.1.4 Technical Evaluation

The staff reviewed Section 11.1 of the CPNPP, Units 3 and 4 COL FSAR and checked the referenced US-APWR DCD to ensure that the combination of the design certification (DC) and information in the FSAR represent the complete scope of information relating to the review of the radiation source terms.

The staff reviewed Section 11.1 of the CPNPP, Units 3 and 4 COL FSAR against Section 11.1 of the Standard Review Plan (SRP, NUREG-0800) to determine if the information contained in FSAR Section 11.1 met the requirements of the NRC regulations and NUREG-0800 acceptance criteria and guidance. The staff also reviewed the conformance of Section 11.1 of the CPNPP, Units 3 and 4 COL FSAR to the guidance in RG 1.206, Section C.III.1, Chapter C.1.11.1.

Because the radioactive source terms are determined by the design and are not affected by the characteristics of the site where the plant is to be located, the staff finds that Luminant Generation Company, LLC, hereinafter referred to as the applicant, appropriately incorporates by reference Section 11.1 of the US-APWR DCD. Section 11.1 of the US-APWR DCD is being reviewed by the staff under Docket No. 52-021. The staff's technical evaluation of the information incorporated by reference related to radioactive source terms will be documented in the staff safety evaluation report regarding the DC for the US-APWR design.

11.1.5 Post Combined License Activities

There are no post COL activities related to this section.

11.1.6 Conclusion

The staff concludes that the information pertaining to Section 11.1 of the CPNPP, Units 3 and 4 COL FSAR is within the scope of the DC and adequately incorporates by reference Section 11.1 of the US-APWR DCD, and is thus acceptable.

11.2 Liquid Waste Management System

11.2.1 Introduction

The LWMS is designed to monitor, control, collect, process, handle, store, and dispose of liquid radioactive waste generated as the result of normal operation including AOOs. The LWMS is also designed to reduce and control radioactivity releases into the environment. The LWMS is comprised of four types of major subsystems as permanently installed equipment and connected to other plant equipment such that liquid wastes from various plant systems can be segregated and processed separately. The four LWMS subsystems in the US-APWR design are the equipment and floor drainage processing subsystem, detergent drainage subsystem, chemical drainage subsystem, and reactor coolant drainage subsystem. The LWMS process subsystems rely on filtration systems, ion exchange columns (demineralizers), and carbon and cartridge filters. The LWMS is designed to process the maximum design basis input in one week, assuming 40 hours work week, or processing one tank of liquid waste in one operating shift. 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 (ECLs) under NRC regulations. The system provides for sampling at several process points, administrative controls, and detection and alarm of abnormal conditions against accidental discharges in the environment. Radioactive liquid wastes are collected in various collection tanks located within the auxiliary building (A/B) and reactor building (R/B). Airborne releases from LWMS components (e.g., tanks) and ventilation exhaust systems servicing radiologically controlled areas are conducted through the vent stack evaluated in Section 11.3.4, "Technical Evaluation," of the Safety Evaluation (SE). The applicant proposes to use an evaporation pond designed to manage the tritium (H-3) concentration in the Squaw Creek Reservoir (SCR) at the CPNPP site. The evaporation pond does not have an H-3 concentration limit, but the SCR has a Technical Specification (TS) limit of 30,000 pCi/L (H-3) by providing temporary holdup of treated liquid effluent for discharge. The applicant opened the SCR for restricted public recreational use at the CPNPP site.

11.2.2 Summary of Application

Section 11.2, "Liquid Waste Management System," of the CPNPP, Units 3 and 4 COL FSAR, Revision 1 incorporates by reference, with supplemental information, Section 11.2, "Liquid Waste Management System," of the US-APWR DCD, Revision 2. The applicant provided additional information in response to the COL information items identified in US-APWR DCD

Section 1.8, "Interfaces for Standard Design," and Table 1.8-2, "Compilation of All Combined License Applicant Items for Chapters 1-19".

The staff reviewed the COLA and evaluated the referenced DC application for any outstanding issues related to the review of the LWMS. The staff's review determined that there were some outstanding issues, as discussed in this section of this SE.

US-APWR COL Information Items

- CP COL 11.2(1) Mobile and Temporary Liquid Radwaste Processing Equipment.

The applicant provided additional information in CP COL 11.2(1) to satisfy COL Information Item 11.2(1) in the DCD, Revision 2, regarding the process piping connections.

- CP COL 11.2(2) Site-Specific Information of the LWMS.

The applicant provided additional information in CP COL 11.2(2) to satisfy COL Information Item 11.2(2) in the DCD, Revision 2, regarding the process flow diagrams of process equipment, operational method, control instrumentation, and release monitoring.

- CP COL 11.2(3) Liquid Containing Tank Failure.

The applicant provided additional information in CP COL 11.2(3) to satisfy COL Information Item 11.2(3) in the DCD, Revision 2, regarding the liquid tank failure described in the DCD, Revision 3, Section 11.2.3.2.

- CP COL 11.2(4) Site-Specific Dose Calculation.

The applicant provided additional information in CP COL 11.2(4) to satisfy COL Information Item 11.2(4) in the DCD, Revision 2, regarding the calculation of public doses from operation of the LWMS.

- CP COL 11.2(5) Site-Specific Cost Benefit Analysis.

The applicant provided additional information in CP COL 11.2(5) to satisfy COL Information Item 11.2(5) in the DCD, Revision 2, regarding the site-specific cost-benefit analysis (CBA).

- CP COL 11.2(6) Piping and Instrumentation Diagrams.

The applicant provided additional information in CP COL 11.2(6) to satisfy COL Information Item 11.2(6) in the DCD, Revision 2, regarding the site-specific piping and instrumentation diagrams (P&IDs) for the LWMS and the evaporation pond.

- CP COL 11.2(7) Epoxy Coatings Program.

The applicant provided additional information in CP COL 11.2(7) to satisfy COL Information Item 11.2(7) in the DCD, Revision 3, regarding the Epoxy Coatings Program for developing

implementation and maintenance guidelines, and addressing the milestones for decontaminable paints. This COL information item is related to CP COL 11.4(9) to satisfy COL Information Item 11.4(9) in the DCD, Revision 3, evaluated in Section 11.4.5 of this SE.

Interface Requirements

The US-APWR DCD Tier 2, Section 1.8, Table 1.8-1, "Significant Site-Specific Interfaces with the Standard US-APWR Design," identifies significant interfaces between the US-APWR standard design and the COLA. This table does not specify any interfaces related to Section 11.2 of the DCD.

11.2.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the US-APWR DCD. In addition, the relevant requirements of NRC regulations for site-specific information regarding the LWMS, and the associated acceptance criteria, are provided in SRP Section 11.2. The following lists the regulatory basis for which site-specific information was evaluated, either because the applicant provided site-specific information, or the staff's review determined that supplemental information was necessary in the CPNPP, Units 3 and 4 COL FSAR. The applicable regulatory requirements and guidance for the COL specific items described above are as follows:

1. Title 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 60, "Control of releases of radioactive materials to the environment," which requires that the nuclear power plant unit design include means to control suitably the release of radioactive materials in gaseous and liquid effluents and to handle radioactive solid wastes produced during normal reactor operation, including AOOs.
2. 10 CFR Part 50, Appendix A, GDC 64, "Monitoring radioactive releases," which requires that means be provided for monitoring effluent discharge paths and plant environs for radioactivity that may be released from normal operations, including AOOs.
3. 10 CFR 20.1301, "Dose limits for individual members of the public," as it relates to limits regarding doses to members of the public and liquid ECLs for unrestricted areas.
4. 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 ECLs of 10 CFR Part 20, Appendix B, Table 2, Column 2 for unrestricted areas.
5. 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.
6. 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.

7. 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 the EPA's generally applicable environmental radiation standards.

The following RGs and NRC documents contain regulatory positions and guidance in demonstrating compliance with the relevant requirements of the regulations identified above:

1. 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," Revision 1, issued October 1977, as it relates to demonstrating compliance with the numerical guidelines for dose design objectives and ALARA criteria of Appendix I to 10 CFR Part 50.
2. RG 1.110, "Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors," issued March 1976 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," Revision 1, issued April 1977 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," Revision 2, issued November 2001, 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. RG 4.21, "Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning," issued June 2008, as it relates to minimizing the contamination of equipment, plant facilities, and environment, and minimizing the generation of radioactive waste during plant operation.
6. SRP Section 11.2, "Liquid Waste Management System," and Branch Technical Position (BTP) 11-6, "Postulated Radioactive Releases Due to Liquid-Containing Tank Failures," as they relate to the assessment of radiological impacts associated with liquid effluent releases.
7. 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.

8. RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," issued June 2007.

11.2.4 Technical Evaluation

The staff reviewed Section 11.2 of the CPNPP, Units 3 and 4 COL FSAR and checked the referenced US-APWR DCD to ensure that the combination of the DCD and information in the FSAR represent the complete scope of information relating to the review of the LWMS. The staff is reviewing Section 11.2 of the US-APWR DCD on Docket Number 52-021. The staff's technical evaluation of the information incorporated by reference relating to LWMS will be documented in the staff's SE regarding the DC for the US-APWR design.

The staff reviewed Section 11.2 of the CPNPP, Units 3 and 4 COL FSAR against Section 11.2 of the SRP to determine if the information contained in FSAR Section 11.2 met the requirements of NRC regulations and was consistent with SRP acceptance criteria and guidance. The staff also reviewed conformance of Section 11.2 of the CPNPP, Units 3 and 4 COL FSAR to the guidance in RG 1.206, Section C.III.1, Chapter C.1.11.2. The staff's technical evaluation of the information incorporated by reference related to the LWMS will be documented in the staff's SE regarding the DC for the US-APWR design. The staff's review confirmed that the information contained in the COLA and incorporated by reference in the FSAR addresses the required information related to the LWMS. However, the staff's review determined that there were some site-specific issues as discussed below.

The staff reviewed the following information in the CPNPP, Units 3 and 4 COL FSAR:

US-APWR COL Information Items

- CP COL 11.2(1) Mobile and Temporary Liquid Radwaste Processing Equipment

The applicant provided additional information in CP COL 11.2(1) to satisfy COL Information Item 11.2(1). COL Information Item 11.2(1) states:

The COL applicant is responsible for ensuring that mobile and temporary liquid radwaste processing equipment and its interconnection to plant systems conforms to regulatory requirements and guidance such as 10 CFR 50.34a, 10 CFR 20.1406 and RG 1.143, respectively.

The applicant first addressed this COL information item in FSAR, Revision 0, Section 11.2.1.6. FSAR Section 11.2.1.6 states the process piping connections have connectors different from the utility connectors to prevent cross-connection and contamination. Based on its review of FSAR Section 11.2.1.6, the staff found that the applicant did not address compliance with 10 CFR 20.1406 on the mobile liquid radioactive waste processing equipment and interconnection to plant systems, conformance with the design guidance described in RG 1.143, "Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants," and the applicant did not provide a description regarding the capability to permit inspection, testing of components, shielding, and operational procedures. Additionally, DCD Figure 12.3-1 (Sheet 17 of 34) depicts the mobile or temporary equipment at an elevation of 3'-7" adjacent to the truck bay access to outside areas.

However, the applicant did not describe in FSAR Section 11.2.1.6 how it complied with 10 CFR 20.1406. Specifically, the FSAR did not include site specific design features and related inspection and maintenance requirements necessary to prevent or mitigate contamination of the facility and environment from use of mobile or temporary equipment that contain radioactive material, through the truck bay entrance door, or contamination of below grade elevations via nearby stairways. As a result, the staff requested in Request for Additional Information (**RAI 2747, Question 11.02-2** and **RAI 3398, Question 11.02-6**) that the applicant provide this information.

In response to **RAI 2747, Question 11.02-2**, dated September 24, 2009, and **RAI 3398, Question 11.02-6**, dated October 19, 2009, the applicant revised FSAR Section 11.2.1.6 to address the regulatory requirements of 10 CFR 50.34a and 10 CFR 20.1406, and the guidance in RG 4.21, "Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning," and RG 1.143 in the purchase or lease contracts of mobile or temporary equipment. The applicant stated the inspection, testing of components, and shielding for mobile or temporary equipment will be specified in the purchase or lease contracts, evaluated, and approved prior to use. The applicant also stated operating procedures will be implemented and training will be completed prior to use. The staff reviewed the applicant's response and found it acceptable because Revision 1 to FSAR Section 11.2.1.6 included this information. Therefore, part of **RAI 2747, Question 11.02-2** and **RAI 3398, Question 11.02-6** are resolved and closed.

- CP COL 11.2(2) Site-Specific Information of the LWMS.

The applicant provided additional information in CP COL 11.2(2) to satisfy COL Information Item 11.2(2). COL Information Item 11.2(2) states:

Site-specific information of the LWMS, e.g., radioactive release points, effluent temperature, shape of flow orifices, etc., is provided in the COLA.

The applicant addressed this COL information item in FSAR, Revision 0, Sections 11.2.2 and 11.2.3.1, and provided process flow diagrams in Figure 11.2-201 depicting LWMS process equipment, operational method, control instrumentation, and release monitoring. FSAR Section 11.2.2 states that the shape of the flow orifices and other technical details will be developed in the "detail design" phase. From review of FSAR, Section 11.2.2, the staff determined that the site-specific design information, including radioactive LWMS release points, effluent temperature, and flow orifice information, to address CP COL 11.2(2) was not described for compliance with 10 CFR 50.34a. As a result, the staff requested in **RAI 3398, Question 11.02-7** that the applicant provide this information. In response to **RAI 3398, Question 11.02-7**, dated October 19, 2009, the applicant stated the flow orifice is addressed in its response to **RAI 2747, Question 11.02-2**, which describes in the mark-up to FSAR Section 11.2.2, why the initial described liquid release flow mixing orifice was not needed. This question is addressed in the applicant's response to **RAI 2747, Question 11.02-2** evaluated below. **RAI 3398, Question 11.02-7** is closed.

FSAR Sections 11.2.2 and 11.2.3.1 describe the temperature and liquid effluent discharge via the CPNPP, Unit 1 circulating water return line with the ability to send effluents to an evaporation pond. However, the shape of the flow orifices and other technical details to

address CP COL 11.2(2) was not described. In **RAI 2747, Question 11.02-2**, the staff requested that the applicant provide the design information needed to address CP COL 11.2(2).

In response to **RAI 2747, Question 11.02-2**, dated September 24, 2009, the applicant provided details relating to the LWMS discharge configuration and justification for excluding some site-specific design information relating to liquid effluent release points such as orifice shapes. The applicant also provided a mark-up to FSAR Section 11.2.2 and 11.2.3.1 with revised design information, flow path description, and added Figure 11.2-201 (Sheet 10 of 10) depicting the P&IDs for treated liquid effluents flow path from the CPNPP, Units 3 and 4, and the evaporation pond for release via the CPNPP, Unit 1 condenser water box discharge into the SCR. The staff reviewed the applicant's response and found that the information provided in the FSAR mark-up adequately addresses, in part, CP COL 11.2(2). The staff confirmed that Revision 1 to the FSAR included this information. Therefore, all parts of **RAI 2747, Question 11.02-2** are closed.

To support the review of FSAR Chapter 11, the staff conducted a site safety audit in Somervell County, Texas, from June 23 - 24, 2009 (ADAMS Accession Number ML092730519). The staff looked at information on the calculations of effluent releases and radiological doses, and the designs for the evaporation pond and onsite radwaste storage facility which was necessary for the staff's confirmatory calculations and design reviews. During the audit, the staff discussed with the applicant, items which included its proposed process for discharging treated liquid from the LWMS to the SCR via the evaporation pond to maintain the H-3 concentration level in the SCR below its TS limit of 30,000 pCi/L (H-3); design features and specifications, maintenance and inspection criteria, and radiation monitoring and sampling for the evaporation pond; mobile liquid waste processing system; and calculations of effluent releases and doses.

The applicant provided additional information on the evaporation pond in FSAR Section 11.2.3.1. The applicant is required to maintain the H-3 concentration level in the SCR below the 30,000 pCi/L offsite dose calculation manual (ODCM) limit. The operation of the CPNPP, Units 1 and 2, along with the proposed CPNPP, Units 3 and 4 could result in the SCR exceeding this limit. As such, a portion of the treated liquid effluent from CPNPP, Units 3 and 4 would be diverted to the evaporation pond. The applicant described that up to 50 percent of the treated liquid effluent from each unit could be diverted to the evaporation pond to maintain a 20 percent margin below the offsite dose calculation manual (ODCM); whereas, 100 percent of the treated liquid effluent could be diverted to the evaporation pond on a temporary basis. Once the applicant confirms the treated liquid effluent meets discharge requirements, the liquid effluent is released into SCR via the CPNPP, Units 1 and 2 circulating water return line. The applicant described that in the event that both the CPNPP, Units 1 and 2 are temporarily not in operation, or when there is no dilution flow, the waste holdup and waste monitor tanks have enough capacity to store more than a month of the daily waste input. The CPNPP, Units 3 and 4 discharge header and the evaporation pond discharge lines are connected to the circulating water return line for the CPNPP, Units 1 and 2 in two locations before the circulating water is discharged into the SCR. The evaporation pond is designed to provide sufficient surface area for natural evaporation based on the local area rainfall and evaporation rate and half of liquid effluent, and is sized to prevent overflow due to local maximum rainfall condition. The design includes a discharge line and transfer pump that connects into the CPNPP, Units 1 and 2 circulating water return line to keep the evaporation pond from overflowing during periods of extreme weather conditions. The applicant calculated liquid effluent concentrations assuming 247,500 gpm per unit of circulating water from the CPNPP, Units 1 and 2 ODCM, and reported

that ratio values of the expected liquid effluent releases comply with Appendix B of 10 CFR Part 20.

Based on its review of FSAR, Revision 0, Section 11.2, the staff found that the applicant did not fully describe the detailed design information on the evaporation pond and the analysis for a postulated liquid effluent release. As a result, the staff in **RAI 3398, Question 11.02-8** requested that the applicant provide this information.

In response to **RAI 3398, Question 11.02-8**, dated October 19, 2009, the applicant revised FSAR, Sections 11.2.3.2 to include design information for compliance with the NRC and State of Texas regulations. The applicant also referred to its responses to other staff's questions related to the evaporation pond on **RAI 2747, Question 11.02-2** and **RAI 2747, Question 11.02-3**.

The applicant submitted Calculation #28831-LWM-25-05-500-001, Revision D, "Determination of the Tritium Concentration in the Squaw Creek Reservoir," to evaluate the H-3 concentration in the SCR and Calculation #28831-LWM-25-05-500-002, Revision C, "Preliminary Sizing of Evaporation Pond," as the analysis referred to in FSAR Section 11.2.3.1 that considers site environmental data (e.g., local rainfall, evaporation, etc.) performed to evaluate how the evaporation pond maintains the H-3 concentration limit of 30,000 pCi/L in the ODCM for the SCR since this H-3 concentration limit could be exceeded with four units (CPNPP, Units 1 through 4) operating at full power. The analysis demonstrates that the H-3 concentration limit in the ODCM for the SCR is not exceeded. The staff confirmed that Revision 1 to the FSAR was updated to include this information. **RAI 3398, Question 11.02-8** is closed.

Based on its review of FSAR, Revision 0, Section 11.2.3.1, the staff found that the applicant did not fully describe the details on how the evaporation pond complied with 10 CFR 20.1406 and conformed to RG 1.143 and SRP Section 11.2 to address CP COL 11.2(2). As a result, the staff in **RAI 2747, Question 11.02-3** requested that the applicant describe how the evaporation pond complies with the requirements of 10 CFR 20.1406; conforms (or justify its exclusion) to the guidance in RG 1.143 and SRP Section 11.2, such as, seismic and quality group classifications. In addition, the applicant was requested to justify the absence of a downstream radiation monitor and describe how liquid releases from the evaporation pond are controlled; and describe (or justify exclusion of) sampling provisions for the evaporation pond.

In response to **RAI 2747, Question 11.02-3**, dated September 24, 2009 the applicant stated that the boundary of the LWMS ends at the isolation valve of the discharge lines to a tank or the discharge header, and that the evaporation pond is designed to be non-seismic and non-safety-related. The evaporation pond is designed to manage the H-3 concentration in the SCR which has a TS limit of 30,000 pCi/L (H-3) by providing temporary holdup of treated liquid effluent for discharge. An evaporation pond discharge radiation monitor (RMS-RE-111), evaluated in Section 11.5.4 of this SE, is added in the evaporation pond design which alarms in the radwaste control room and main control room (MCR) for operator action in the event that the liquid effluent discharge exceeds the radiation setpoint, and simultaneously turns off the evaporation pond discharge pump and closes the discharge valve in the revised Figure 11.2-201 (Sheet 9 of 10). The applicant also added information on the evaporation pond to include other design features such as construction materials, leak detection, and procedures to meet compliance with 10 CFR 20.1406. The staff reviewed the applicant's response and found that the

information provided in the FSAR mark-up adequately addresses, in part, CP COL 11.2(2). The staff confirmed that Revision 1 to the FSAR included this information. Therefore, **RAI 2747, Question 11.02-3** related to the evaporation pond compliance to 10CFR 20.1406 and conformance to RG 1.143 and SRP Section 11.2 is closed.

FSAR Figure 11.2-201 depicts some structures, systems, and components (SSCs) such as the evaporation pond, the CPNPP Units 3 and 4 discharge headers, piping, instrumentation, discharge line connections to the CPNPP Units 1 and 2 circulating water lines, and discharge line into the SCR, etc. Based on its review of Figure 11.2-201, the staff found that the figure was incomplete in regards to the description of design equipment associated with the evaporation pond for compliance with 10 CFR 50.34a, and monitoring of effluent discharge paths and plant environs for compliance with GDC 64. As a result, the staff in **RAI 3398, Question 11.02-10** requested that the applicant clarify the dotted lines representing both proposed (evaporation pond) and existing SSCs (piping on the CPNPP, Units 1 and 2 circulating water lines) in Figure 11.2-201; identify the transfer pump described in FSAR Section 11.2.3.1, but not shown in Figure 11.2-201; and identify the radiation monitoring and sampling locations from the evaporation pond origin to the ultimate discharge point into the SCR in Figure 11.2-201.

In response to **RAI 3398, Question 11.02-10**, dated October 19, 2009, the applicant addressed the details on the existing and proposed piping in its response to **RAI 2747, Question 11.02-2**. The transfer pump is shown in the revised Figure 11.2-201 (Sheets 9 and 10) and evaporation pond discharge radiation monitor (RMS-RE-111) is shown close to the pump discharge in the revised Figure 11.2-201 (Sheets 9 and 10). The applicant states that specific sample points will be located during the “detailed design” and will ensure that representative samples of the evaporation pond are taken before its contents are transferred to the SCR via the CPNPP, Units 1 and 2 circulating water return line. The staff previously evaluated the applicant’s response to **RAI 2747, Question 11.02-2** and found it acceptable. Therefore, **RAI 3398, Question 11.02-10** is closed. However, the staff found that the “detailed design” information regarding the site-specific sampling locations for the evaporation pond was not provided to address CP COL 11.2(2) for compliance with 10 CFR 50.34a. Therefore, the staff in follow-up **RAI 5854, Question 11.02-18** requested that the applicant provide this detailed design information. **RAI 5854, Question 11.02-18** is being tracked as **Open Item 11.02-1**.

GDC 60 requires the nuclear power unit design include means to control suitably the release of radioactive materials in gaseous and liquid effluents and to handle radioactive solid wastes produced during normal reactor operation including AOOs. In **RAI 2747, Question 11.02-4** the staff requested that the applicant provide information in the FSAR relating to the bypass around the in-line process liquid effluent radiation monitor (RMS-RE-035), which includes bypass valve VLV-531, in Figure 11.2-201 (Sheet 6 of 9); explain in the FSAR when this pathway will be used and the precautions in place to prevent an unmonitored release; provide a discussion that includes, but is not limited to, valve leakage, valve failure, and operator error; and describe in the FSAR how a single failure will not result in an unmonitored release.

In response to **RAI 2747, Question 11.02-4**, dated September 24, 2009, the applicant stated that the manually operated valve (VLV-531) is administratively controlled and normally maintained in the locked-closed position and tagged. Use of VLV-531 is limited to unlikely situations such as the failure of the remotely operated discharge valves (RCV-035A/B), which

are inside the A/B and downstream of the discharge isolation valves (AOV-522A/B), or failure of the process liquid effluent radiation monitor (RE-035). Prior to opening VLV-531, waste monitor tanks (ATK-006A and ATK-006B) will be sampled and the contents confirmed to meet the ECLs. In the event VLV-531 is inadvertently left open or partially open, the liquid flow element will detect liquid flow and initiate alarm for operator action. A portion of liquid flow will go through the process liquid effluent radiation monitor (RMS-RE-035). Signals will be sent to initiate pump shutdown, valve closure, and operator actions if the setpoint is exceeded. The applicant stated that VLV-531 can only be opened with a key controlled by CPNPP Operations and verified by two technically qualified members of CPNPP Operations for valve position. Any leakage from the VLV-531 is collected in the floor drain sump and is forwarded to the waste holdup tank (WHT) for re-processing and compliance with 10 CFR 20.1406. During normal operation, liquid effluent discharge is anticipated to occur once a week for approximately three hours for treated liquid effluent, and one discharge (approximately an hour at 20 gpm) of detergent waste (filtered personnel showers and hand washes) daily. The line is flushed with demineralized water following each liquid effluent discharge for decontamination.

The applicant revised the last paragraph of FSAR Subsection 11.2.2 to address the precautions in place to prevent an unmonitored release, valve leakage, valve failure, and operator error; and how a single failure will not result in an unmonitored release. However, because some of the information provided in the FSAR mark-up was not incorporated into Revision 1 of the FSAR, and because an additional issue was raised regarding process liquid effluent radiation monitor (RMS-RE-035) sensitivity, the staff closed **RAI 2747, Question 11.02-4**, and issued follow-up **RAI 5474, Question 11.02-17** and **RAI 5377, Question 11.05-4**, respectively. In follow-up **RAI 5474, Question 11.02-17**, the staff requested that the applicant include in the FSAR the statement to ensure tank concentrations sampled from ATK-006A/B are less than the ECLs prior to opening VLV-531 to comply with GDC 60, "Control of Releases of Radioactive Materials to the Environment," and GDC 64, "Monitoring Radioactivity Releases;" provide additional information in the FSAR to confirm that an unmonitored release will not occur during the scenario where the unmonitored discharge bypass is being used for an offsite discharge and the monitor tank sample is not indicative of the actual tank concentration (e.g., due to human or analysis equipment error) will comply with the ECLs; and address (or justify exemption to) SRP Section 11.2 and (American National Standards Institute (ANSI)/American Nuclear Society (ANS)-55.6-1993 (R2007) as it relates to the design ensuring the pathway of liquid radioactive release to the environment will always be monitored. The applicant's response to **RAI 5377, Question 11.05-4**, dated April 13, 2011, is evaluated in Section 11.5.4 of this SE.

In response to **RAI 5474, Question 11.02-17**, dated April 13, 2011, the applicant referred to its response to **RAI 5377, Question 11.05-4**, and described the administrative controls associated with the bypass valve (VLV-531) around the process liquid effluent radiation monitor (RMS-RE-035) and procedures to prevent unmonitored liquid effluent discharge into the environment, and monitoring even if the process liquid effluent radiation monitor (RMS-RE-035) is inoperable and the bypass line is used. In the mark-up to FSAR Section 11.2.2, the applicant included the procedural requirement to sample tank radionuclide concentrations by sampling and verifying tank water volume by level indicator prior to liquid effluent release via the bypass valve, and that the ODCM and supporting procedures will ensure appropriate actions to prevent an unmonitored release. The staff reviewed the proposed revision to FSAR Section 11.2.2 which includes this information and finds it acceptable because the SRP acceptance criteria, as it relates to the monitoring of batch releases, is satisfied. **RAI 5474, Question 11.02-17** is being

tracked as **Confirmatory Item 11.02-12** pending verification that the change is incorporated in a future revision of the CPNPP, Units 3 and 4 FSAR.

Based on its review of FSAR, Revision 1, Section 11.2.3.4, Section 14.2, and Section 14.3; Tier 1 information; Updated Tracking Report (UTR), Revision 4; and response to **RAI 3401, Question 11.04-3**, dated October 19, 2009, that requested the values, bases and assumptions for the site specific CBA for the LWMS and GWMS, the staff found that information regarding testing and inspection requirements for the evaporation pond was not fully described. FSAR Section 11.2.3.4 provides design criteria and specifications for the evaporation pond and states it is designed and constructed in accordance with Texas Commission of Environment Quality (TCEQ) and other applicable standards (e.g., American Society for Testing and Materials (ASTM)). The evaporation pond is equipped with several design features such as a liner, leak collection and detection instrumentation, radiation monitor with alarm, and back flow preventer, etc. for compliance with 10 CFR Part 20, Appendix B, Table 2; 10 CFR Part 50, Appendix A, GDC 64; 10 CFR 50.36a; and 10 CFR 20.1406. However, the staff found that the testing and inspection requirements (i.e., TCEQ permit process, NRC Initial Test Program (ITP) and Inspections, Tests, Analysis, and Acceptance Criteria (ITAAC)) that will be conducted to ensure that the evaporation pond and its features will be designed and constructed in accordance with TCEQ requirements and NRC regulations was not described. As a result, in **RAI 5374, Question 11.02-15**, the staff requested that the applicant to provide this information.

In response to **RAI 5374, Question 11.02-15**, dated April 19, 2011, the applicant provided the mark-up to FSAR Section 11.2.3.4, and included the TCEQ permit process and requirements for the evaporation pond. The staff reviewed the proposed revision to FSAR Section 11.2.3.4 which includes this information and finds it acceptable because the applicant will use the TCEQ permit process to address the State of Texas requirements and Technical Guidelines in the Texas Administrative Code (TAC), and to ensure that the evaporation pond is properly constructed and periodically tested and inspected during normal operation. This periodic testing and inspection comprises water sample and analysis before draining and decontamination to monitor concentration buildup, liner and welt seams integrity, drainage capability, liquid level instrument calibration, and soil and groundwater contamination analysis per Nuclear Energy Institute (NEI) 07-07, "Ground-Water Protection Initiative." Because the evaporation pond is not part of the LWMS considering the guidance in SRP Section 14.3.7 and RG 1.143, ITAAC is not required on the evaporation pond design and construction. **RAI 5374, Question 11.02-15** is being tracked as **Confirmatory Item 11.2-10** pending verification that the change is incorporated in a future revision of the CPNPP, Units 3 and 4 FSAR.

- CP COL 11.2(3) Liquid Containing Tank Failure

The applicant provided additional information in CP COL 11.2(3) to satisfy COL information item 11.2(3). COL information item 11.2(3) states:

The COL applicant is responsible for providing site-specific hydrogeological data (such as contaminant migration time), and analysis to demonstrate that the potential groundwater contamination resulting from radioactive release due to liquid containing tank failure is bounded by the analysis discussed in Subsection 11.2.3.2.

The applicant addressed this COL information item in FSAR, Revision 0, Section 2.4.13 and Section 11.2.3.2, and evaluated the liquid tank failure analysis described in DCD, Revision 2, Section 11.2.3.2 to determine if the site-specific analysis was bounding. The applicant considered a travel time of one year compared to the site-specific hydrogeological data in FSAR Section 2.4.12 which indicates the contaminant migration time is about two years. Design features include leakage detection and overflow alarm in tank cubicles to reduce potential for groundwater contamination. However, the staff in **RAI 4315, Question 2.4.13-5**, requested that the applicant justify the applicability of the liquid tank failure evaluation in the DCD as the bounding analysis for the site-specific evaluation to satisfy COL Information Item 11.2(3), the applicant changed the approach and method on the liquid tank failure analysis in the DCD. In response to **RAI 4315, Question 2.4.13-5**, dated June 16, 2010, the applicant revised DCD Tier 2, Section 11.2.3.2 and deleted the liquid tank failure analysis which used site-specific information; revised COL Information Item 11.2(3); and performed new calculations of failed liquid tank concentrations using an alternative approach described below.

The staff reviewed the applicant's response to **RAI 4315, Question 2.4.13-5**, dated June 16, 2010, and found it unacceptable because the approach uses the methodology in ANSI/ANS-18.1-1999 to develop realistic source terms in lieu of design basis source terms to evaluate a postulated liquid tank failure which is considered as an accident-like event. The staff also determined that the approach to use realistic source terms in the liquid tank failure analysis is not conservative or consistent with the NRC guidance as these concentrations are less than design basis source term concentrations. The staff discussed its evaluation with the applicant during a Category 1 public meeting at the NRC, located in Rockville, Maryland and held on June 28, 2010 (ADAMS Accession Number ML101650152). The staff's resolution of this issue is described in Section 11.2 and Section 11.3 of the US-APWR DCD Chapter 11 SE (ADAMS Accession Number ML110660127). **RAI 4315, Question 2.4.13-5** will be evaluated by the staff in FSAR Section 2.4.13.

Based on the staff's audit, the DC applicant submitted a proposed revision to DCD Section 11.2.3.2. Because FSAR Section 11.2.3.2, under concurrent staff review, needed to be updated to reflect these DCD changes, the staff in **RAI 5374, Question 11.02-13** requested that the applicant update FSAR Section 11.2.3.2 and Section 2.4.13 with an assessment based on the methodology and information proposed in DCD, Revision 3, Section 11.2.3.2 and COL Information Item 11.2(3). The assessment uses the RATAF code to calculate source terms for the failed liquid tank (ADAMS Accession Number ML102570067) as described in Mitsubishi Heavy Industries, Ltd. (MHI) Technical Report, "Calculation Methodology for Radiological Consequences in Normal Operation and Tank Failure Analysis," MUAP-10019 [Proprietary]P (R0), MHI's Technical Report MUAP-10019[Non-Proprietary]NP (R0) (ADAMS Accession Number ML102850683); makes reference to MHI's Technical Report MUAP-10019P/NP (R0), (ADAMS Accession Number ML102850683). MHI's Technical Report MUAP-10019P/NP (R0) which describes the methodology, basis, and assumptions on the failed liquid tank analysis for plants referencing the US-APWR design; in FSAR Section 11.2.3.2 and Section 2.4.13, fully describe the approach and results to select the failed liquid tank and provide the basis and assumptions on all site-specific parameter values in the respective updated FSAR sections for assessing the radioactive effluent release to surface or groundwater from liquid tank failure using site-specific groundwater transport and soil properties to meet compliance with 10 CFR Part 20, Appendix B, Table 2, Column 2, under the unity rule, at the nearest potable water and surface water supplies in an unrestricted area. FSAR Section 11.2.3.2 is updated to address

the impact of the plant capacity factor of 80 percent applied in the calculation of doses from a liquid containing tank failure when typical operating plant capacity factors exceed 90 percent based on the liquid tank evaluation, update FSAR Section 11.2.3.4 to identify the failed liquid tank that bounds the contamination level due to failure of the evaporation pond; and provide a copy of any input/output code files or calculation packages which show demonstration of compliance for the staff's review.

In response to **RAI 5374, Question 11.02-13**, dated April 19, 2011, the applicant revised FSAR Section 11.2.3.2 to state that the source term for each liquid tank is provided in the DCD and the assessment of this model using the site-specific parameters to evaluate the conservatism of liquid tank failure to address CP COL 11.2(3) is described in FSAR Section 2.4.13 and conform to the guidance in BTP 11.6 and SRP Section 11.2. The staff finds the applicant's response acceptable for the following reasons: the proposed revision of FSAR Section 2.4.13 references the proposed revision of DCD, Revision 3, and COL Information Item 11.2(3), which updates the liquid tank failure assessment based on the methodology and information proposed in DCD; incorporates by reference the relevant DC technical basis documents, MHI's Technical Report MUAP-10019P/NP (R1), failed liquid tank (the boric acid tank (BAT) is identified by applicant as bounding); addresses the impact of the plant capacity factor of 80 percent in the PWR-GALE and RATAF codes to calculate liquid effluent releases and failed liquid tank concentrations; and describes the tank failure analysis in FSAR Section 2.4.13. **RAI 5374, Question 11.02-13** is being tracked as **Confirmatory Item 11.02-8** pending verification that the change is incorporated in a future revision of the CPNPP, Units 3 and 4 FSAR.

- CP COL 11.2(4) Site-Specific Dose Calculation.

The applicant provided additional information in CP COL 11.2(4) to satisfy COL information item 11.2(4). COL information item 11.2(4) states:

The COL applicant is to calculate doses to members of the public following the guidance of RG 1.109 and RG 1.113 using site-specific parameters, and compares the doses due to the liquid effluents with the numerical design objectives of Appendix I to 10 CFR 50 and compliance with requirements of 10 CFR 20.1302, 40 CFR 190.

The applicant addressed COL Information Item 11.2(4) in FSAR, Revision 0, Section 11.2.3.1 and Tables 11.2-10R, 11.2-11R, 11.2-12R, 11.2-13R, 11.2-14R, and 11.2-15R. To comply with 10 CFR Part 20, Appendix I to 10 CFR Part 50, and 40 CFR Part 190, as referenced in 10 CFR 20.1301(e), the applicant performed plant and site-specific dose calculations from liquid effluent releases with the LADTAP II code using the site-specific input parameter values in FSAR Table 11.2-14R which considers parameters such as the source term, hydrological model (impoundment volume with complete mixing), discharge rate to receiving water body, water type (freshwater), shore-width factors, transit times from discharge to exposure locations, exposure pathway models (fishing, shoreline, swimming, and boating for usage locations), midpoint of plant life, dilution factors, irrigation rate, food production, and population values; and default age-specific usage and consumption input parameters on applicable food pathways based on the guidance in 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." The applicant's basis and assumptions for these input parameters used in the LADTAP II code

calculation of doses to the maximally exposed individual (MEI) and population are described in TXUT-001-ER-5.4-CALC-010, Revision 0, "Estimated Annual Dose Due to Normal Liquid Effluents," (ADAMS Accession Number ML093380026) provided in response to **RAI 3398, Question 11.02-9**, dated September 14, 2009, discussed later in this section of this SE.

FSAR Section 11.2.1.5 reports population doses of 2.14 person-rem (Total Body) and 2.04 person-rem (Thyroid), and maximum individual doses of 0.90 mrem/yr (Adult-Total Body) and 1.28 mrem/yr (Teenager's Liver). The applicant stated the calculated doses are well below the dose criteria in Appendix I of 10 CFR Part 50, and that releases from sites with up to four operating reactors (CPNPP, Units 1 through 4) also conform with 40 CFR Part 190 according to NUREG-0543, "Methods for Demonstrating LWR Compliance With the EPA Uranium Fuel Cycle Standard." These site-specific doses were subsequently revised to include the small dose contribution from public access to the SCR discussed later in this section of this SE.

The staff reviewed the site-specific information included in FSAR Section 11.2.3.1 and found the input parameter values and its basis was not fully described. Additionally, the staff was not able to independently confirm the applicant's calculated effluent concentrations and resulting doses because the DC applicant used its own proprietary version of the NRC PWR-GALE code referred to as the MHI PWR-GALE code. The MHI PWR-GALE code is evaluated in the staff's SE for the US-APWR DCD Chapter 11 (ADAMS Accession Number ML110660127). As a result, the staff in **RAI 3398, Question 11.02-5**, requested that the applicant provide a full description and supporting rationale for all modifications made to the code subroutines and submit the PWR-GALE input/output files for the site-specific application.

In response to **RAI 3398, Question 11.02-5**, dated October 19, 2009, the applicant described the basis for the site-specific annual liquid effluent release from the LWMS, gaseous effluent release from the GWMS, and gaseous effluent release from the evaporation pond. The CPNPP, Units 3 and 4 liquid effluent releases in FSAR Table 11.2-10R, are based on US-APWR DCD calculations determined as the total liquid effluent calculated minus the detergent waste release. The site-specific gaseous effluent release from the plant vent stack in FSAR Table 11.3-8R is the same as the DCD calculation. The site-specific annual gaseous effluent release from the evaporation pond is conservatively assumed as half of the site-specific annual liquid effluent release from the LWMS diverted to the evaporation pond. The staff reviewed the applicant's response above and found it acceptable because it described the basis and assumptions for the site-specific annual effluent releases from the LWMS, GWMS, and evaporation pond. **RAI 3398, Question 11.02-5** is closed.

Because the individual and population doses are determined from the liquid and gaseous effluent releases, the staff in **RAI 3398, Question 11.02-9**, requested that the applicant provide the LADTAP II input/output code files for the site-specific application, calculation and supporting technical basis and references for selecting the site-specific parameter values used in the LADTAP II code calculations, and address an inconsistency between FSAR Tables 11.2-14R and 11.3-8R identifies different animals (cow and/or goat) considered in the irrigated foods - milk pathway dose for liquid effluent releases.

In response to **RAI 3398, Question 11.02-9** dated October 19, 2009, the applicant provided the supporting technical basis calculation TXUT-001-ER-5.4-CALC-010, Revision 0, by letter dated September 14, 2009, and revised FSAR Table 11.2-14R to show both goats and cows as

animals considered in the irrigated foods - milk pathway dose for liquid effluent releases. TXUT-001-ER-5.4-CALC-010, Revision 0, provides the technical basis and assumptions for the site-specific input parameter values used in the LADTAP II code to calculate offsite doses to the population and MEI from liquid effluents expected to be released from the CPNPP, Units 3 and 4 to demonstrate compliance with 10 CFR Part 20 and Appendix I to 10 CFR Part 50, and all four operating units (CPNPP, Units 1 through 4) at the CPNPP site to demonstrate compliance with 40 CFR Part 190. The applicant considered two cases in the site-specific dose calculation: Case 1 considers the CPNPP, Units 3 and 4 discharges from the SCR to Squaw Creek which determines the MEI doses; and Case 2 considers the increased discharges from the CPNPP, Units 1 through 4 from the SCR to Squaw Creek which determines the population doses due to increased effluent releases and lower dilution.

TXUT-001-ER-5.4-CALC-010, Revision 0, applies for its source term, the annual liquid effluent releases without the detergent waste stream due to contracted offsite laundry services in DCD Tables 11.2-9 and 11.2-10 calculated with the MHI PWR-GALE code. The staff found that the technical basis calculation on the supported the site-specific input parameters for the LADTAP II code calculation of doses to the population and MEI in FSAR Tables 11.2-14R and 11.2-15R. However, because the dose contribution from public access to the SCR was not adequately described in FSAR Chapter 11 and since the staff had other questions related to the PWR-GALE assumptions and site-specific input parameter in the calculation of effluent releases, the staff closed **RAI 3398, Question 11.02-9**, and in follow-up **RAI 5374, Question 11.02-12**, requested that the applicant provide this information.

RAI 5374, Question 11.02-12, Item 1 requested the following information: FSAR Section 11.2.3.1 describes annual average radionuclide releases determined by the PWR-GALE code with reactor coolant activities in US-APWR DCD Tier 2 Section 11.1 and input design parameter values in DCD Table 11.2-9 (Sheets 1 and 2). The staff's calculations show different liquid effluent total releases (for "Isotope" and "All others") using the MHI PWR-GALE code, a proprietary version of the NRC PWR-GALE code, with no onsite laundry (no detergent waste effluent input). Given the observed differences, confirm that DCD Table 11.2-9 is incorporated by reference (IBR) (other than no detergent waste effluent input). If not IBR, tabulate the input parameter values in FSAR Section 11.2 and provide the basis for all departures.

In response to **RAI 5374, Question 11.02-12, Item 1** dated April 19, 2011, FSAR Section 11.2.3.1 describes that contaminated laundry will be a contracted offsite. The applicant stated that hand calculations based on the PWR-GALE code analyses results for the DCD were performed to reflect the site-specific application. The applicant further stated that list of input parameters for the PWR-GALE code calculation is incorporated by reference. The staff calculations resulted in some differences in the liquid effluent total releases (for "Isotope" and "All others") using the MHI PWR-GALE code, a proprietary version of the NRC PWR-GALE code, with no onsite laundry (no detergent waste effluent input). This item is evaluated by the staff in the applicant's response to **RAI 5374, Question 11.02-12, Item 5**. **RAI 5374, Question 11.02-12, Item 1** is closed.

RAI 5374, Question 11.02-12, Item 2 requested the following information: FSAR Tables 11.2-10R (Sheets 1 and 2) and 11.2-11R (Sheets 1 and 2) present expected and maximum annual liquid effluent total releases (Ci/yr), respectively. Confirm whether these liquid effluent releases

are calculated using plant-specific input values. Suggest adding a footnote to these tables to indicate the calculated liquid effluent releases are for a single new unit.

In response to **RAI 5374, Question 11.02-12, Item 2**, dated April 19, 2011, the applicant added Note 4 to Tables 11.2-10R and 11.2-11 indicating that liquid effluent releases are for a single new unit. The applicant stated these liquid effluent releases are calculated using plant-specific input values. The staff reviewed the proposed mark-ups to Tables 11.2-10R and 11.2-11 which includes this note and found them acceptable. **RAI 5374, Question 11.02-12, Item 2** is being tracked as **Confirmatory Item 11.02-2** pending verification that the change is incorporated in a future revision of the CPNPP, Units 3 and 4 FSAR.

RAI 5374, Question 11.02-12, Item 3 requested the following information: FSAR Tables 11.2-12R (Sheets 1 and 2) and 11.2-13R (Sheets 1 and 2) present expected and maximum annual liquid effluent fractions of concentration limits, respectively. Confirm whether these liquid effluent releases are calculated using plant-specific input values. Provide the methodology, basis, and assumptions on the dilution flow of 247,500 gpm in Note 2 of these tables. Suggest adding a footnote to these tables to indicate the unity rule calculations (sum-of-fractions) are for a single new unit.

In response to **RAI 5374, Question 11.02-12, Item 3** dated April 19, 2011, the applicant revised Note 2 to Tables 11.2-10R and 11.2-11 indicating that a Safety Factor of 0.9 to compensate for flow fluctuations is included in the site-specific 247,500 gpm dilution flow parameter value which is based on release of average daily discharge for 292 days per year. The applicant states that this dilution flow rate is obtained from pump curves in the CPNPP, Units 1 and 2 ODCM. The applicant added Note 4 to Tables 11.2-10R and 11.2-11 indicating the fractions of 10 CFR Part 20 ECLs (unity rule or sum-of-fractions) are for a single new unit. The staff reviewed the proposed mark-ups to Tables 11.2-10R and 11.2-11 which includes this note and found them acceptable. **RAI 5374, Question 11.02-12, Item 3** is being tracked as **Confirmatory Item 11.02-3** pending verification that the change is incorporated in a future revision of the CPNPP, Units 3 and 4 FSAR.

RAI 5374, Question 11.02-12, Item 4 requested the following information: FSAR Tables 11.2-15R presents population doses from liquid effluent releases during normal operation including AOOs. Suggest adding a footnote to this table to indicate the calculated liquid effluent doses are for a single new unit.

In response to **RAI 5374, Question 11.02-12, Item 4**, the applicant added a Note to Table 11.2-15R indicating doses to the population from liquid effluent releases during normal operation including AOOs are for a single new unit. The staff reviewed the proposed mark-up to Table 11.2-15R which includes this note and found it acceptable. **RAI 5374, Question 11.02-12, Item 4** is being tracked as **Confirmatory Item 11.02-4** pending verification that the change is incorporated in a future revision of the CPNPP, Units 3 and 4 FSAR.

RAI 5374, Question 11.02-12, Item 5 requested the following information: In FSAR Section 11.2 (and all other applicable FSAR sections), make reference to the MHI PWR-GALE code and the MHI Technical Report MUAP-10019[Proprietary]P (R0), MHI Technical Report MUAP-10019[Non-Proprietary]NP (R0) (ML102850683), which describes the methodology,

basis, and assumptions for the calculation of expected and maximum annual liquid effluent releases during normal operation including AOOs for plants referencing the US-APWR design.

In response to **RAI 5374, Question 11.02-12, Item 5**, dated April 19, 2011, the applicant added references to the MHI PWR-GALE code and MHI Technical Reports MUAP-10019P (R1) and MUAP-10019NP (R1), which describe the methodology, basis, and assumptions for the calculation of expected and maximum annual liquid effluent releases during normal operation including AOOs for plants referencing the US-APWR design, in FSAR Section 11.2.5 and a discussion on the MHI PWR-GALE code in FSAR Section 11.2.3.1. MHI Technical Reports MUAP-10019P (R1) and MUAP-10019NP (R1) were revised by the DC applicant as part of the response to **RAI 711, Question 11.03-4, Item 4**, in the DCD, dated March 30, 2011, and as described in the COL applicant's response to **RAI 5375, Question 11.03-4** dated April 11, 2011. The staff reviewed the proposed mark-ups which include references to the MHI PWR-GALE code and MHI Technical Reports MUAP-10019P (R1) and MUAP-10019NP (R1) in FSAR Sections 11.2.3.2 and 11.2.5 and found them acceptable. **RAI 5374, Question 11.02-12, Item 5** is being tracked as **Confirmatory Item 11.02-5** pending verification that the change is incorporated in a future revision of the CPNPP, Units 3 and 4 FSAR.

RAI 5374, Question 11.02-12, Item 6 requested the following information: FSAR Section 11.2.3.1 describes annual average liquid effluent releases are taken from DCD Table 11.2-10 (Sheets 1 and 2) to calculate population doses from liquid effluent releases. Given that FSAR Table 11.2-10R (Sheets 1 and 2) presents plant-specific liquid effluent releases, justify why population doses were not calculated using plant-specific liquid effluent releases.

In response to **RAI 5374, Question 11.02-12, Item 6**, dated April 19, 2011, the applicant indicated that DCD Table 11.2-10 is not referenced in FSAR Section 11.2.3.1 which provides site-specific annual average liquid effluent releases in FSAR Table 11.2-10R. However, FSAR Section 11.2.3.1 references DCD Table 11.2-9 for the MHI PWR-GALE code input parameter values. The applicant states that DCD Table 11.2-9 is incorporated by reference and the site-specific liquid effluent releases in the FSAR are calculated by subtracting the calculated DCD detergent release from the DCD total release to give the site-specific releases in FSAR Table 11.2-10R. The staff calculated the site-specific liquid effluent releases by subtracting the detergent waste releases from the total releases in DCD Table 11.2-10. The staff observed for Rh-106, a total release of $3.90\text{E-}02$ Ci/yr compared to $3.90\text{E-}05$ Ci/yr in FSAR Table 11.2-10R. The staff also confirmed the calculated release of $3.90\text{E-}2$ Ci/yr for Rh-106 using the MHI PWR-GALE code excluding detergent waste effluent input. Because Rh-106 is not included in Table 2 of 10 CFR Part 20, Appendix B, this radionuclide is excluded from the calculation of the effluent discharge concentration. **RAI 5374, Question 11.02-12, Item 6** is closed. FSAR Tables 11.12-R and 11.2-13R present comparisons of expected annual average and maximum liquid effluent release concentrations with 10 CFR Part 20, Appendix B, Table 2. The staff found that these site-specific liquid effluent releases excluding detergent waste comply with the ECLs in Table 2 of Appendix B to 10 CFR Part 20 using the sum-of-fractions given as $4.12\text{E-}03$ and $1.60\text{E-}02$, in FSAR Tables 11.2-R and 11.3-R, respectively.

RAI 5374, Question 11.02-12, Item 7 requested the following information: In FSAR Section 11.2.3.1, describe why the various potential exposure pathways for liquid effluent releases are not considered in the LADTAP II code calculation of population doses from restricted public access of Squaw Creek Reservoir. In response to **RAI 5374, Question 11.02-**

12, Item 7, dated April 19, 2011, the applicant identified the exposure pathways considered in the LADTAP II code calculation as fishing and shoreline recreation due to public access to the SCR. The applicant assumes the number of daily users is 250 (100 boats × 2 people per boat + 50 additional people on the shoreline). Swimming is not a significant contributor based on population doses. Due to a TS limit of 30,000 pCi/L (H-3), the SCR is considered to be a non-potable water supply (no drinking water or irrigated food pathways). The applicant indicates that public access to the SCR is a minor contributor to the overall population dose and does not change the 50-mile population dose. Therefore, the swimming, drinking water, irrigated foods, and fish ingestion pathways are not considered in the site-specific dose calculations consistent with the guidance in RG 1.109. The staff reviewed the proposed mark-ups to FSAR Section 11.2.3.1 which describes these exposure pathways and small increase to population doses from the shoreline recreation pathway in FSAR Table 11.2-15R and found it acceptable. The site-specific dose calculation from public access to the SCR to address, in part, CP COL Information Item 11.2(4) is bounded by site-specific dose calculation of liquid effluent releases assuming no diversion to the evaporation pond which results in higher doses to the MEI compared to the combination of liquid effluent going to the SCR and into the air through evaporation, in Table 11.2-1 of this SE. **RAI 5374, Question 11.02-12, Item 7** is being tracked as **Confirmatory Item 11.02-6** pending verification that the change is incorporated in a future revision of the CPNPP, Units 3 and 4 FSAR. The doses from public use of the SCR are also described in the Part 3 - Environmental Report (ER) Sections 5.4.2 and 5.4.3, and in the staff's evaluation presented in NUREG-1943, "Environmental Impact Statement for Combined Licenses (COLs) for Comanche Peak Nuclear Power Plant Units 3 and 4," Final Report, Section 5.9 and Appendix G, May 2011.

RAI 5374, Question 11.02-12, Item 8 requested the following information: Update FSAR Section 11.2 to address the impact of the plant capacity factor of 80 percent applied in population dose calculations from liquid effluents when typical operating plant capacity factors exceed 90 percent for compliance with the NRC regulations and 40 CFR Part 190 (see response to RAI 523-4246, Question 11.02-30, ML100770379).

In response to **RAI 5374, Question 11.02-12, Item 8**, dated April 19, 2011, the applicant added Note 5 to FSAR Tables 11.2-12R and 11.2-13R indicating that the built-in capacity factor of 80 percent in the PWR-GALE code, which is less than the expected capacity factor for the US-APWR design (between 80 percent to 100 percent capacity factor), has no impact on liquid effluent releases and doses as addressed in the DC's response to **RAI 523-4246, Question 11.02-30**, dated March 15, 2010. But, there is a minor impact on the gaseous effluent releases and doses. The staff reviewed the proposed mark-ups to FSAR Tables 11.2-12R and 11.2-13R which includes this note and found it acceptable. **RAI 5374, Question 11.02-12, Item 8** is being tracked as **Confirmatory Item 11.02-7** pending verification that the change is incorporated in a future revision of the CPNPP, Units 3 and 4 FSAR.

The estimated site-specific dose calculations from liquid effluent releases for a single unit (and all four units) to address CP COL Information Item 11.2(4) and demonstrate compliance with the dose limits to individual members of the public in 10 CFR 20.1302 and 40 CFR Part 190 as referenced in 10 CFR 20.1301(e), and the dose objectives in Appendix I to 10 CFR Part 50 are summarized in Table 11.2-1 of this SE.

- CP COL 11.2(5) Site-Specific Cost Benefit Analysis.

The applicant provided additional information in CP COL 11.2(5) to satisfy COL Information Item 11.2(5). COL Information Item 11.2(5) states:

The COL applicant is to perform a site-specific cost benefit analysis to demonstrate compliance with the regulatory requirements.

The applicant addressed COL Information Item 11.2(5) in FSAR, Revision 1, Section 11.2.1.5, which indicates the site-specific calculated doses due to the release of radioactive liquid effluents to the environment during normal operations, including AOOs, results in a public dose of less than 1 person-rem per year (/yr) and dose cost of less than \$1,000/yr in 1975 dollars. Based on a population doses of 2.14 person-rem/yr (Total Body), 2.04 person-rem/yr (Thyroid) and the equipment and operating costs using guidance of RG 1.110, the applicant concluded that the addition of processing equipment of reasonable treatment technology is not favorable or cost beneficial, and that the site-specific LWMS design complies with Appendix I of 10 CFR Part 50. The related site-specific CBA for the GWMS to address CP COL 11.3(8) is described in FSAR Section 11.3.1.5. The site-specific CBA for the SWMS to address CP COL 11.4(6) is considered in the site-specific CBA for the LWMS and GWMS because there is no direct release pathway from the solid waste handling operation into the environment which warrants a separate CBA. Although there is a COL information item identified in FSAR Section 11.5 on the site-specific CBA to address CP COL 11.5(6), the applicant refers to the site-specific CBA for the LWMS and GWMS described in FSAR Sections 11.2.1.5 and 11.3.1.5, respectively. As with the SWMS, the PERMS do not have a direct release pathway into the environment that would result in population doses and require a site-specific CBA.

The staff reviewed the additional information included in FSAR Sections 11.2.1.5, 11.3.1.5, 11.4.1.5, and 11.5.2.11 and found that the values, bases and assumptions for the site-specific CBA for the LWMS and GWMS was not provided. As a result, the staff in **RAI 3401, Question 11.04-3** requested that the applicant provide this information.

In response to **RAI 3401, Question 11.04-3** dated October 19, 2009, the applicant described that the site-specific CBA for the LWMS and GWMS assumes liquid effluent population doses of five person-rem/yr (Total Body) and five person-rem/yr (Thyroid) and gaseous effluent population doses of four person-rem/yr (Total Body) and four person-rem/yr (Thyroid), respectively. Although some site-specific inputs to determine the Capitol Recovery Factor (CRF) and Labor Cost Correction Factor (LCCF) were provided, the augment(s) listed in Table A-1 to RG 1.110, "Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors," and other associated costs described in Appendix A to RG 1.110 applied in the site-specific CBA calculations were not identified. Further, because the liquid effluent population doses of 2.14 person-rem/yr (Total Body) and 2.04 person-rem/yr (Thyroid) in FSAR Section 11.2.1.5 and gaseous effluent population doses of 2.59 person-rem/yr (Total Body) and 2.97 person-rem/yr (Thyroid) in FSAR Section 11.3.1.5 appeared to be evaluated prior to public use of the SCR at the CPNPP site which resulted in a small increase to the calculated population doses from effluent releases, the staff closed **RAI 3401, Question 11.04-3**, and in follow-up **RAI 5374, Question 11.02-11** requested that the applicant confirm the site-specific population doses to the Thyroid and Total Body from liquid effluents in FSAR Section 11.2.1.5 which appear to be evaluated prior to public use of the SCR and specifically identify the LWMS augment(s) and all costs considered in the site-specific CBA for the LWMS and provide

sufficient information for the staff to evaluate the bases and assumptions of these costs. The site-specific CBA for the GWMS is evaluated in Section 11.3.4 of this SE.

In response to **RAI 5374, Question 11.02-11** dated April 19, 2011; the applicant revised the site-specific population doses in FSAR Section 11.2.3.1 from liquid effluents which include public access to the SCR as 2.36 person-rem/yr (Total Body) and 2.07 person-rem/yr (Thyroid). FSAR Section 11.2.1.5 was revised to reflect these site-specific population doses with inputs used to calculate the total annual cost (TAC) for each radwaste treatment system augment in accordance with the guidance in RG 1.110 and NUREG/BR-0058, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission." The applicant described the generic parameters to calculate the TAC are from RG 1.110 and fixed generic parameters Annual Operating Cost (Table A-2), Annual Maintenance Cost (Table A-3 to RG 1.110), Direct Cost of Equipment and Materials (Table A-1 to RG 1.110), and Direct Labor Cost (Table A-1 to RG 1.110). Inputs on the CRF of 0.07123 determined from an interest rate of 7 percent per year and 60-year service life (Table A-6 to RG 1.110), Indirect Cost Factor of 1.75 for an unitized radwaste system at a multi-unit site (Table A-5 to RG 1.110), and LCCF of 1.1 for relative labor costs between geographical regions (Table A-4 to RG 1.110) are assumed in the site-specific CBA for the LWMS. The applicant's first augment considered a near replica train of the current US-APWR LWMS system design consisting of a single cartridge filter and four clean waste demineralizers. Additionally, the applicant considered augmenting the LWMS with a liquid waste evaporator, reverse osmosis unit, and 90 gpm cartridge filter. The applicant stated the direct costs for the considered augments were scaled to represent the flow rates of the site-specific design and 10 percent contingency factor. The applicant determined that the lowest TAC of \$14,910 (1,975 dollars) was the 90 gpm cartridge filter augment which results in a dose reduction of 14.91 person-rem (Total Body or Thyroid) to be cost beneficial based on the \$1,000 per person-rem criterion in 10 CFR Part 50, Appendix I. Because the site-specific population doses from liquid effluents of 2.36 person-rem/yr (Total Body) and 2.07 person-rem/yr (Thyroid) are much less than the dose reduction of 14.91 person-rem (Total Body or Thyroid), the applicant concludes that there are no cost-beneficial liquid radwaste augments and no further CBA is needed to demonstrate compliance with 10 CFR Part 50 Appendix I, Section II.D.

The staff reviewed the mark-up to the proposed revision to FSAR Section 11.2.1.5 on the site-specific CBA for the LWMS for compliance with 10 CFR Part 50 Appendix I, Section II.D and found it acceptable. The staff also performed an independent CBA and concluded that the information provided to address CP COL 11.2(5) complies 10 CFR Part 50 Appendix I, Section II.D. **RAI 5374, Question 11.02-11** is being tracked as **Confirmatory Item 11.02-1** pending verification that the change is incorporated in a future revision of the CPNPP, Units 3 and 4 FSAR.

Based on its review of FSAR Section 11.2.1.6 of UTR, Revision 4, the staff found that information on sampling procedures to measure H-3 concentration in the evaporation pond and the SCR was not fully described. FSAR Section 11.2.1.6 states that sampling procedures will need to be developed to confirm release H-3 concentrations from these surface water bodies. As a result, the staff in **RAI 5374, Question 11.02-16** requested that the applicant identify the implementation milestones on the development of H-3 sampling procedures.

In response to **RAI 5374, Question 11.02-16** dated April 19, 2011, the applicant revised FSAR Section 11.2.3.4 to describe that operating procedures will limit the use of the evaporation pond

to receive treated effluent on an as-needed basis and that the evaporation pond will be washed each time it is emptied. The proposed revision to FSAR Section 11.2.3.1 (applicant's response to **RAI 5474, Question 11.02-17** dated April 13, 2011) states that the evaporation pond is sampled and analyzed before discharging into the SCR via the CPNPP, Units 1 and 2 circulating water return line. Sampling procedures will be used to confirm the H-3 concentration in the SCR is below the pre-determined setpoint, and that the liquid effluent is acceptable for release. The applicant states these sampling procedures, which currently exist for the CPNPP, Units 1 and 2 ODCM, will be included in the site-wide ODCM, which is part of the Radiological Effluent Controls Program.

The Radiological Effluent Controls Program has an implementation milestone identified in FSAR Table 13.4-201, Item 9. The ODCM and the Radiological Effluent Controls Program is evaluated by the staff in Section 11.5.4 of this SE. The staff reviewed the proposed revision to FSAR Section 11.2.3.4 described above and found it acceptable. **RAI 5374, Question 11.02-16** is being tracked as **Confirmatory Item 11.02-11** pending verification that the change is incorporated in a future revision of the CPNPP, Units 3 and 4 FSAR.

- CP COL 11.2(6) Piping and Instrumentation Diagrams.

The applicant provided additional information in CP COL 11.2(6) to satisfy COL Information Item 11.2(6). COL Information Item 11.2(6) states:

The COL applicant is to provide piping and instrumentation diagrams (P&IDs).

The applicant addressed this COL information item in FSAR Section 11.2.2 and provided P&IDs depicting piping and process equipment, and instrumentation and controls for the site-specific LWMS in Figure 11.2-201 (Sheets 1-10) to address CP COL 11.2(6). From review of FSAR Section 11.2.2 and Figure 11.2-201, the staff identified areas where additional information was needed to complete its evaluation. The staff noted in Figure 11.2-201 (Sheet 6 of 10) that there was a potential bypass around the process liquid effluent radiation monitor (RMS-RE-035) in the discharge line (evaluated in Section 11.5.4 of this SE). As a result, the staff in **RAI 2747, Question 11.02-4** requested that the applicant confirm the requirements of GDC 60, as it relates to suitably controlling the release of radioactive materials in liquid effluents, have been satisfied. The staff previously evaluated the applicant's response to **RAI 2747, Question 11.02-4** related to suitably of controlling the release of radioactive materials in liquid effluents, in this section of this SE and found it acceptable.

- CP COL 11.2(7) Epoxy Coatings Program.

The applicant provided additional information in CP COL 11.2(7) to satisfy COL Information Item 11.2(7) in DCD, Revision 3. COL Information Item 11.2(7) states:

The COL applicant is responsible for identifying the implementation milestones for the coatings program used in the SWMS. The coatings program addresses RG 1.54 Revision 1, recognizing that more recent standards may be used if referenced in DCD Section 11.2.

The applicant addressed this COL information item by stating that the applicant is responsible for identifying the implementation milestones for the coatings program used in the LWMS. The coatings program addresses RG 1.54, "Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants," Revision 1, recognizing that more recent standards may be used if referenced in the DCD Section 11.2 in its response to **RAI 5374, Question 11.02-14**. This new COL information item was generated as a result of the staff's concurrent review of DCD, Revision 2. From the review of the DCD and the FSAR, the staff found that Sections 11.2 and 11.4 of the FSAR needed to be updated due to the DCD design change which replaced stainless-steel liners in the cells/cubicles of the LWMS and steel liners in the spent resin storage tank (SRST) rooms of the SWMS with epoxy coatings. Therefore, the staff in **RAI 5374, Question 11.02-14** requested that the applicant update the relevant FSAR sections such as 1.9, 11.4, and 13.5, etc. to address CP COL 11.2(7).

In response to **RAI 5374, Question 11.02-14** dated April 19, 2011, the applicant provided a mark-up to FSAR Sections 11.2.4 and 11.4.6, and Tables 1.9-201 and 13.4-201 with additional information to address CP COL 11.2(7) and 11.4(9) to satisfy COL Information Items 11.2(7) and 11.4(9), respectively, in DCD, Revision 3. The applicant added FSAR Sections 11.2.4 and 11.4.6 to identify the Epoxy Coatings Program used to facilitate the ALARA objective of promoting decontamination in radiologically controlled areas outside containment. The Epoxy Coatings Program serves to control the refurbishment, repair, and replacement of coatings in accordance with the manufacturers' product data sheets and good painting practices, and will be implemented as described in Table 13.4-201. In Table 1.9-201, the applicant added conformance to RG 1.54, Revision 1, with the applicable exceptions as described in the corresponding FSAR Sections 11.2 and 11.4.

The staff reviewed the mark-ups to the proposed revision of FSAR Sections 11.2.4 and 11.4.6, and Tables 1.9-201 and 13.4-201 which include the commitment to follow recommendations from liner manufacturers for developing epoxy coating implementation and maintenance guidelines, and address the implementation milestones for decontaminable paints, and found them acceptable. **RAI 5374, Question 11.02-14** is being tracked as **Confirmatory Item 11.02-9** pending verification that the change is incorporated in a future revision of the CPNPP, Units 3 and 4 FSAR.

Table 11.2.1: Estimated site-specific liquid effluent dose calculations.

Description	Design Objective ¹ or Dose Limit ²	Site-Specific Calculated Dose ³
Doses to the MEI from liquid effluent release ^{1,4} (CPNPP, Unit 3 or 4)	3 mrem/yr (Total Body) 10 mrem/yr (Organ) 10 mrem/yr (Organ)	0.9 mrem/yr (Adult-Total Body) 1.3 mrem/yr (Teenager-Liver) 0.2 mrem/yr (Adult-Thyroid)
Doses to the population from liquid effluent release ⁴ (CPNPP, Unit 3 or 4)	- - -	2.4 person-rem/yr (Total Body) 2.2 person-rem/yr (GI-LLI) 2.1 person-rem/yr (Thyroid)
Doses from liquid effluent	25 mrem/yr (Whole Body)	7.8 mrem/yr (Whole Body)

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releases ^{2,4} (CPNPP, Units 1 through 4)	25 mrem/yr (Organ) 75 mrem/yr (Thyroid)	11.4 mrem/yr (GI-LLI) 9.2 mrem/yr (Thyroid)
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Notes:

1. Numerical design objectives in 10 CFR Part 50, Appendix I for estimating annual doses above background from liquid effluents for any individual in an unrestricted area, for one unit, from all exposure pathways are 3 mrem/yr (Total Body) or 10 mrem/yr (Organ).
2. Dose limits specified in 40 CFR Part 190 as implemented under 10 CFR Part 20.1301(e), for an individual member of the public are 25 mrem/yr (Whole Body), 25 mrem/yr (Organ), and 75 mrem/yr (Thyroid).
3. Liquid effluent doses from FSAR Section 11.2.3.1 and/or Table 11.2-15R.
4. Includes doses from public use of the SCR with shoreline recreation and fishing pathways, but no drinking water pathway, which are bounded by the doses from the liquid effluent release to the SCR. Doses from public use of the SCR are determined by multiplying the estimated maximum number of daily users (250 persons = 100 boats × 2 people per boat + 50 additional people on the shoreline) times the doses to the MEI.

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 ODCM. The applicant included a commitment, under CP COL 11.5(2), to develop a plant and site-specific ODCM by endorsing the NRC staff approved NEI ODCM Template 07-09A. The staff has determined the endorsement of NEI ODCM Template 07-09A to be acceptable (ADAMS Accession Number ML091050234). The staff finds the commitment to use NEI 07-09A acceptable. The staff's evaluation of the ODCM is presented in Section 11.5 of this SE.

Technical Specifications:

Chapter 16 of the FSAR states that the US-APWR TS and Bases in the DCD are incorporated by reference into Section B of Part 4 of the COL application.

Departures and Exemption Requests:

Part 7, "Generic DCD Departures Report," of the COL that would indicate departures or exemption requests from the information presented in US-APWR DCD associated with the design and operation of the LWMS and site-specific characteristics in monitoring liquid effluent releases are not used and; therefore, are not evaluated by the staff.

11.2.5 Post Combined License Activities

There are no post COL activities related to this section.

11.2.6 Conclusion

Except for the open and confirmatory items identified below, the staff concludes that the applicant has demonstrated that the LWMS includes the equipment necessary to control releases of radioactive materials in liquid effluents in accordance with GDC 60 and GDC 61 of Appendix A to 10 CFR Part 50 and the requirements of 10 CFR 50.34a. The staff concludes that the applicant has demonstrated that the design of the LWMS is acceptable and meets the requirements of 10 CFR 20.1301; 10 CFR 20.1302; 10 CFR 20.1301(e); 10 CFR 20.1406; and 10 CFR 50.34a. This conclusion is based on the following:

1. The applicant has met the requirements of GDC 60 and GDC 61 with respect to controlling releases of radioactive materials to the environment by assuring that the design of the LWMS includes the equipment to monitor and control releases of radioactive materials in liquid effluents. As demonstrated in FSAR Section 12.2 using site specific conditions, the applicant has met the requirements of Section II.A of Appendix I to 10 CFR Part 50 with respect to design objectives by including a LWMS that is capable of maintaining releases of radioactive materials in liquid effluents such that the calculated individual doses in an unrestricted area from all exposure pathways are less than 0.03 mSv (3 mrem) to the total body and 0.1 mSv (10 mrem) to any organ.
2. The applicant has met the requirements of Section II.D of Appendix I to 10 CFR Part 50 with respect to meeting the ALARA criterion using site-specific conditions. The staff has

considered the potential effectiveness of augmenting the LWMS using items of reasonably demonstrated technology and has determined that further effluent treatment will not affect reductions in cumulative population doses reasonably expected within an 80-km (50-mile) radius of the reactor at a cost of less than \$1,000 per man-rem or man-thyroid-rem.

3. The applicant has met the requirements of 10 CFR 20.1301 and 10 CFR 20.1302, as demonstrated in FSAR Section 12.4 using site-specific conditions. The staff has determined that the concentrations of radioactive materials in liquid effluents in unrestricted areas will be within the limits specified in 10 CFR Part 20, Appendix, Table 2, Column 2.
4. The staff has reviewed the sources of radiation and radioactivity and associated doses to members of the public and concludes that annual doses from all sources of radioactivity and radiation from the site (using site specific conditions), including liquid and gaseous effluents and external radiation exposures from buildings and storage tanks will not exceed the EPA generally applicable environmental radiation standards of 40 CFR Part 190 as implemented under 10 CFR Part 20.1301(e), as demonstrated in FSAR Section 12.4 using site-specific conditions.
5. The applicant has met the requirements of 10 CFR 20.1406 and guidance of RG 4.21 with respect to providing a description of how facility design features and procedures for operation, described in FSAR Sections 11.2 and 12.3, will minimize, to the extent practicable, contamination of the facility and the environment; facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of radioactive waste.
6. The staff has reviewed the provisions incorporated in the applicant's design to control the release of radioactive materials in liquids resulting from inadvertent tank overflows, avoid the contamination of non-radioactive systems, prevent uncontrolled and unmonitored releases of radioactive materials in the environment, and avoid interconnections with potable and sanitary water systems and concludes that the measures proposed by the applicant are consistent with the requirements of GDC 60 and GDC 61, Inspection and Enforcement (IE) Bulletin 80-10, and guidance of RG 1.143 and RG 4.21 for liquids and liquid wastes produced during normal operation and AOOs.
7. The staff has reviewed the commitment to comply with the requirements of 10 CFR Part 52.80(a) and ITAAC for the LWMS. The ITAAC address descriptions and functional arrangements of the LWMS. The proposed ITAAC once performed by the COL applicant and meeting their respective acceptance criteria, provide reasonable assurance that a plant that incorporates the US-APWR DC and establishes operational programs in accordance with the DC and site-specific conditions will meet the provisions of the NRC regulations.

For **Open Item 11.02-1, RAI 5854, Question 11.02-18**, which is related to the site-specific sampling locations for the evaporation pond to address CP COL 11.2(2), the staff concludes using the information presented in the application, that the applicant has not fully demonstrated compliance with the NRC regulations and guidance in providing adequate design information for

the staff to evaluate compliance with the NRC regulations, including 10 CFR 50.34a, 10 CFR 50.36a, and the guidance and acceptance criteria of SRP Section 11.2.

The following confirmatory items, are being tracked under the following RAIs: **Confirmatory Item 11.02-12, RAI 5474, Question 11.02-17** related to administrative controls associated with the bypass valve (VLV-531) around the process liquid effluent radiation monitor (RMS-RE-035) and procedures to prevent unmonitored liquid effluent discharge into the environment; **Confirmatory Item 11.02-10, RAI 5374, Question 11.02-15** related to the TCEQ permit process to address the State of Texas requirements and Technical Guidelines in the TAC, and to ensure that the evaporation pond is properly constructed and periodically tested and inspected during normal operation; **Confirmatory Item 11.02-8, RAI 5374, Question 11.02-13** related to the failed liquid tank evaluation; **Confirmatory Item 11.02-2, RAI 5374, Question 11.02-12, Item 2** related to a note in FSAR Tables 11.2-10R and 11.2-11 qualifying liquid effluent releases are for a single new unit; **Confirmatory Item 11.02-3, RAI 5374, Question 11.02-12, Item 3** related to a note in FSAR Tables 11.2-10R and 11.2-11 qualifying the unity rule or sum-of-fractions of ECLs in Appendix B to 10 CFR Part 20 are for a single new unit; **Confirmatory Item 11.02-4, RAI 5374, Question 11.02-12, Item 4** related to a note in FSAR Table 11.2-15R qualifying population doses from liquid effluent releases during normal operation including AOs are for a single new unit; **Confirmatory Item 11.02-5, RAI 5374, Question 11.02-12, Item 5** relating to references to the MHI PWR-GALE code and MHI Technical Reports MUAP-10019P (R1) and MUAP-10019NP (R1) in FSAR Sections 11.2.3.2 and 11.2.5; **Confirmatory Item 11.02-6, RAI 5374, Question 11.02-12, Item 7** related to the description of exposure pathways and the small increase to population doses from the shoreline recreation pathway in FSAR Table 11.2-15R due to public use of the SCR; **Confirmatory Item 11.02-7, RAI 5374, Question 11.02-12, Item 8** related to a note in FSAR Tables 11.2-12R and 11.2-13R qualifying the built-in capacity factor of 80 percent in the PWR-GALE code has no impact on liquid effluent releases and doses; **Confirmatory Item 11.02-1, RAI 5374, Question 11.02-11** related to the site-specific LWMS CBA; **Confirmatory Item 11.02-11, RAI 5374, Question 11.02-16** related to implementation milestones on operating procedures in the ODCM for the evaporation pond; and **Confirmatory Item 11.02-9, RAI 5374, Question 11.02-14** related to the Epoxy Coating Program. The staff will confirm that these items are incorporated in a future revision of the CPNPP, Units 3 and 4 FSAR.

11.3 Gaseous Waste Management System

11.3.1 Introduction

The GWMS is designed to monitor, control, collect, process, handle, temporarily store, and dispose of radioactive gaseous waste generated as the result of normal operation and including AOOs. The stored gas that is not reused is treated and discharged providing the gas meets the release criteria. The GWMS manages radioactive gases collected from the off-gas system (including charcoal delay beds), holdup and gas surge tanks, and other tank vents containing radioactive materials. Gaseous wastes from these sources are treated prior to their release to the environment. The GWMS in the US-APWR design is comprised of two gas compressors, a gas dryer skid, four charcoal delay beds, four gas surge tanks, two hydrogen analyzer units (each with one hydrogen and one oxygen analyzer), and an oxygen analyzer unit containing dual oxygen analyzers. The main sources of plant radioactive gaseous into GWMS are waste gases from the volume control tank, the containment vessel reactor coolant drain tank, and the holdup tanks (HT). Nitrogen is used as a cover gas for the HT and is returned back to the HT after decay for reuse. The majority of the waste gas entering the GWMS during normal operation is composed of nitrogen cover gas, a small amount of radioactive gaseous isotopes of krypton and xenon, hydrogen and oxygen. Any liquid generated from the operation of the GWMS is collected and routed to the waste HTs in the LWMS for further processing. The only GWMS release point for the gaseous system and heating, ventilation, and air conditioning (HVAC systems associated with the R/B, Auxiliary Building (A/B), and access building is the site-specific vent stack. The GWMS is housed in the A/B which is designed to seismic Category II requirements as described in US-APWR DCD Section 3.2.

11.3.2 Summary of Application

Section 11.3, "Gaseous Waste Management System," of the CPNPP, Units 3 and 4 COL FSAR, Revision 1, incorporates by reference, with supplemental information, Section 11.3, "Gaseous Waste Management System," of the US-APWR DCD, Revision 2. The applicant provided additional information in response to the COL information items identified in US-APWR DCD Section 1.8 and Table 1.8-2.

The staff reviewed the COL application and evaluated the referenced DC application for any outstanding issues related to the review of the GWMS. The staff's review determined that there were some outstanding issues, as discussed in this section of this SE.

US-APWR COL Information Items

- STD COL 11.3(1) Deleted from the DCD.

(The deletion of this COL information item is not evaluated in the staff review of the CPNPP, Units 3 and 4 COL FSAR.)
- STD COL 11.3(2) Deleted from the DCD.

(The deletion of this COL information item is not evaluated in the staff review of the CPNPP, Units 3 and 4 COL FSAR.)

- CP COL 11.3(3) Onsite Vent Stack Design Parameters.

The applicant provided additional information in CP COL 11.3(3) to satisfy COL Information Item 11.3(3) in DCD, Revision 2, regarding the site-specific vent stack design parameters and release point specific characteristics.

- STD COL 11.3(4) Deleted from the DCD.

(The deletion of this COL information item is not evaluated in the staff review of the CPNPP, Units 3 and 4 COL FSAR.)

- CP COL 11.3(5) Offsite Dose Calculation Manual.

The applicant provided additional information in CP COL 11.3(5) to satisfy COL Information Item 11.3(5) in DCD, Revision 2, regarding the ODCM.

- CP COL 11.3(6) Site-Specific Dose Calculation.

The applicant provided additional information in CP COL 11.3(6) to satisfy COL Information Item 11.3(6) in DCD, Revision 2, regarding the calculation of public doses from operation of the GWMS.

- STD COL 11.3(7) Deleted from the DCD.

(The deletion of this COL information item is not evaluated in the staff review of the CPNPP, Units 3 and 4 COL FSAR.)

- CP COL 11.3(8) Site-Specific Cost-Benefit Analysis.

The applicant provided additional information in CP COL 11.3(8) to satisfy COL Information Item 11.3(8) in DCD, Revision 2, regarding the site-specific CBA.

- STD COL 11.3(9) Piping and Instrumentation Diagrams.

The applicant provided additional information in STD COL 11.3(9) to satisfy COL Information Item 11.3(9) in DCD, Revision 2, regarding site-specific P&IDs for the GWMS.

Interface Requirements

The US-APWR DCD Tier 2, Section 1.8, Table 1.8-1, "Significant Site-Specific Interfaces with the Standard US-APWR Design," identifies significant interfaces between the US-APWR standard design and the COLA. This table does not specify any interfaces related to Section 11.3 of the DCD.

11.3.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the US-APWR DCD. In addition, the relevant requirements of the NRC regulations for site-specific information regarding the GWMS, and the associated acceptance criteria, are provided in SRP Section 11.3. The following lists the basis for which site-specific information was evaluated, either because the applicant provided site-specific information, or the staff's review determined that supplemental information was necessary in the CPNPP, Units 3 and 4 COL FSAR. The regulatory basis includes:

1. 10 CFR 20.1301, "Dose limits for individual members of the public," as it relates to limits regarding doses to members of the public and gaseous ECLs 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 gaseous ECLs 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 CBA in reducing population doses from gaseous 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 EPA generally applicable environmental radiation standards), as implemented under 10 CFR 20.1301(e), as it relates to controlling doses within the EPA's generally applicable environmental radiation standards.

The following RG and NRC documents contain regulatory positions and guidance in demonstrating compliance with the relevant requirements of the regulations identified above:

1. 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," Revision 1, issued October 1977, as it relates to demonstrating compliance with the numerical guidelines for dose design objectives and the ALARA criteria of Appendix I to 10 CFR Part 50.
2. RG 1.110, "Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors," issued March 1976, as it relates to methods and assumptions applied in performing CBA 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, "Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants," Revision 2, issued November 2001, 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. RG 4.21, "Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning," dated June 2008, as it relates to minimizing the contamination of equipment, plant facilities, and environment, and minimizing the generation of radioactive waste during plant operation.
6. SRP Section 11.3, "Gaseous Waste Management System," and BTP 11-5, "Postulated Radioactive Releases Due to a Waste Gas System Leak or Failure," as they relate to the assessment of radiological impacts associated with gaseous effluent releases.
7. 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.
9. RG 1.206, Combined License Applications for Nuclear Power Plants (LWR Edition), issued June 2007

11.3.4 Technical Evaluation

The staff reviewed Section 11.3 of the CPNPP, Units 3 and 4 COL FSAR and checked the referenced US-APWR DCD to ensure that the combination of the DCD and information in the FSAR represent the complete scope of information relating to the review of the GWMS. The staff is reviewing Section 11.3 of the US-APWR DCD for Docket No. 52-021. The staff's technical evaluation of the information incorporated by reference relating to GWMS will be documented in the staff SE on the DC for the US-APWR design.

The staff reviewed Section 11.3 of the CPNPP, Units 3 and 4 COL FSAR against Section 11.3 of the SRP to determine if the information contained in FSAR Section 11.3 met the requirements of the NRC regulations and SRP acceptance criteria and guidance. The staff also reviewed conformance of Section 11.3 of the FSAR to the guidance in RG 1.206, Section C.III.1, Chapter C.1.11.3. The staff's review confirmed that the information contained in the COL application and incorporated by reference in the FSAR addresses the required information related to the GWMS. However, the staff's review determined that there were some site-specific issues, as discussed below.

Combined License Information Items:

- CP COL 11.3(3) Onsite Vent Stack Design Parameters.

The applicant provided additional information in CP COL 11.3(3) to satisfy COL Information Item 11.3(3). COL Information Item 11.3(3) states:

The COL applicant is to provide a discussion of the onsite vent stack design parameters and release point specific characteristics.

The applicant addressed this COL information item in FSAR Section 11.3.2 and provided the release point of vent stack elevation of 1051' 5", which is same height of the top of the containment. The applicant's release point assumptions for determining atmospheric dispersion factors are evaluated by the staff in Section 2.3 of the SE. The staff found the applicant's response acceptable because the site-specific release point of vent stack was provided.

- CP COL 11.3(5) Offsite Dose Calculation Manual.

The applicant provided additional information in CP COL 11.3(5) to satisfy COL Information Item 11.3(5). COL Information Item 11.3(5) states:

The COL applicant is to prepare a plan for offsite dose calculation manual in accordance with the guidance of NUREG-1301, NUREG-0133, and RG 1.109, RG 1.111, or RG 1.113, containing site-specific requirements.

The applicant addressed this COL information item in FSAR Section 11.3.3.3 and adopted NEI ODCM Template 07-09A. The staff evaluated the COL information item on the ODCM in Section 11.5.4 of this SE.

- CP COL 11.3(6) Site-Specific Dose Calculation.

The applicant provided additional information in CP COL 11.3(6) to satisfy COL Information Item 11.3(6). COL Information Item 11.3(6) states:

The COL applicant is to calculate doses to members of the public following the guidance of RG 1.109 and RG 1.111, and compare the doses due to the gaseous effluents with the numerical design objectives of Appendix I to 10 CFR 50, and compliance with 10 CFR 20.1302 and 40 CFR 190.

The applicant addressed this COL information item in FSAR, Revision 0, Section 11.3.3.1 and Tables 11.3-8R, 11.3-9R, 11.3-201, 11.3-202, 11.3-203, 11.3-204 and 11.2-205. To comply with 10 CFR Part 20, Appendix I to 10 CFR Part 50, and 40 CFR Part 190, the applicant performed plant and site-specific dose calculations from gaseous effluent releases with the GASPAR II code using the site-specific input parameters in FSAR Table 11.2-14R which considers parameters such as the source term, atmospheric diffusion and deposition factors, midpoint of plant life, food production, residence distance, and population distribution in FSAR Table 11.3-201; and default age-specific usage and consumption input parameters on applicable food pathways and other parameters in FSAR Table 11.3-8R based on the guidance in RG 1.109. The basis and assumptions for these input parameters used in the GASPAR II code

calculation of doses to the MEI and population are described in TXUT-001-ER-5.4-CALC-010, Revision 0, "Estimated Annual Dose Due to Normal Liquid Effluents" (ML0933800260) and provided in response to **RAI 3398, Question 11.02-9**, dated September 14, 2009, discussed in Section 11.2.4 of this SE.

The applicant considered bounding long-term annual average atmospheric dispersion factors given in DCD Section 2.3.5, Table 2.0-1, and usage parameter values including the total production of vegetables, milk, and meat in the 50-mile area around the site. FSAR Section 11.3.3.1 reports an air gamma dose of $5.77\text{E-}03$ mrad/yr (10 mrad/yr dose criterion) and air beta dose of $4.46\text{E-}02$ mrad/yr (20 mrad/yr dose criterion). Individual doses of $4.72\text{E-}02$ mrem/yr (Total Body - 5 mrem/yr dose criterion), $8.55\text{E-}02$ mrem/yr (Skin - 15 mrem/yr dose criterion), and 1.40 mrem/yr (Child's Bone - 15 mrem/yr dose criterion), and population doses within 50-mi of the site of 1.58 person-rem (Total Body) and 1.98 person-rem (Thyroid) were also calculated by the applicant to comply with 10 CFR 20.1302, Appendix I to 10 CFR Part 50, and 40 CFR Part 190.

The applicant used the GASPAR II code to calculate individual and population doses from the evaporation pond conservatively assuming half the treated liquid effluent in the pond is discharged to the atmosphere as aerosol and vapor. The applicant considered a bounding long-term annual average atmospheric dispersion factors given in DCD Section 2.3.5, Table 2.0-1, and usage parameter values including the total production of vegetables, milk, and meat in the 50-mile area around the site. Population doses of 1.01 person-rem (Total Body) and 0.995 person-rem (Thyroid), and total individual doses from the vent stack and the evaporation pond of 2.59 person-rem (Total Body) and 2.97 person-rem (Thyroid) were reported by the applicant, which are well below the dose criteria in 10 CFR Part 50, Appendix I, and 40 CFR Part 190. However, the staff reviewed the additional information included in FSAR Section 11.3.3.1 and found that information provided in regards to the site-specific parameter values and its basis to support the applicant's conclusions was not fully described. Additionally, the staff was not able to independently confirm the applicant's calculated effluent concentrations and resulting doses because the DC applicant used its own modified version of the NRC staff approved PWR-GALE code referred to as the MHI PWR-GALE code. The MHI PWR-GALE code is evaluated in the staff's SE for the US-APWR DCD Chapter 11 (ADAMS Accession Number ML110660127). As a result, the staff in **RAI 3400, Question 11.03-2** requested that the applicant provide a full description and supporting rationale for all modifications made to the code subroutines and submit the PWR-GALE input/output files for the site-specific application.

In response to **RAI 3400, Question 11.03-2, Item 1** dated October 15, 2009, the applicant described the basis for the site-specific annual liquid effluent release from the LWMS, gaseous effluent release from the GWMS, and gaseous effluent release from the evaporation pond. The sites-specific gaseous effluent release from the plant vent stack in FSAR Table 11.3-8R is the same as the US-APWR DCD calculation.

In response to **RAI 3398, Question 11.02-5**, dated October 19, 2009, the applicant stated that the site-specific annual gaseous effluent release from the evaporation pond was conservatively assumed as half of the site-specific annual liquid effluent release from the LWMS diverted to the evaporation pond. The staff evaluated the LWMS in Section 11.2.5 of this SE. The staff has reviewed the applicant's response and found it acceptable because it clarified the basis for the site-specific gaseous effluent releases. **RAI 3400, Question 11.03-2, Item 1** is closed.

In **RAI 3400, Question 11.03-2, Item 2**, the staff requested that the applicant provide the GASPARD II input/output code files. Because this item is addressed in the applicant's response to **RAI 3400, Question 11.03-2, Item 3, RAI 3400, Question 11.03-2, Item 2** is closed.

In response to **RAI 3400, Question 11.03-2, Item 3**, dated October 15, 2009, the applicant provided the GASPARD II code calculation in TXUT-001-ER-5.4-CALC-011, Revision 2, "CPNPP Offsite Dose due to Normal Gaseous" (ADAMS Accession Numbers ML093090183, ML093090184, and ML093090185). TXUT-001-ER-5.4-CALC-011, Revision 2, provides the technical basis and assumptions for the site-specific input parameter values used in the GASPARD II code to calculate offsite doses to the population and MEI from gaseous effluents expected to be released from CPNPP, Units 3 and 4 to demonstrate compliance with 10 CFR Part 20 and Appendix I to 10 CFR Part 50, and all four operating units (CPNPP, Units 1 through 4) at the CPNPP site to demonstrate compliance with 40 CFR Part 190. The staff found the technical basis supports the site-specific parameter input values in the GASPARD II code calculation of the doses to the population and MEI in FSAR Tables 11.2-14R (Sheets 1 and 2) and 11.2-15R. However, because the dose contribution from public access to the SCR was not sufficiently described in FSAR Chapter 11 and since the staff had other questions related to the PWR-GALE code assumptions and site-specific parameter value in the calculation of effluent releases, the staff closed **RAI 3400, Question 11.03-2, Item 3**, and in follow-up **RAI 5375, Question 11.03-4** requested that the applicant to provide this information. The applicant's response to **RAI 5375, Question 11.03-4** is evaluated later in this section.

In response to **RAI 3400, Question 11.03-2, Item 4**, dated October 15, 2009, the applicant revised FSAR Section 11.3.3.1 to correct the inconsistency with Table 11.3-9R in the reported doses for Total Body and Organ (Skin). The staff confirmed that the corrected doses of 3.69E-03 mrem/yr (Total Body) and 3.45E-02 mrem/yr (Skin) were incorporated into Revision 1 to FSAR Section 11.3.3.1. **RAI 3400, Question 11.03-2, Item 4** is closed.

RAI 3400, Question 11.03-2, Item 5, dated October 15, 2009, stated that "Section 11.3.3.1 indicates doses calculated from site-specific parameters listed in Table 11.3-8R and presented in Table 11.3-201 result in a total body dose of 1.58 person-rem and thyroid dose of 1.98 person-rem. However, there is no tabulated data in Section 11.2 that presents this population dose information (similar to individual doses presented in Table 11.3-9R). Please address this inconsistency."

In response to **RAI 3400, Question 11.03-2, Item 5**, dated October 15, 2009, the applicant stated the population doses from gaseous effluents in FSAR Section 11.3.3.1 were calculated using the GASPARD II code and input parameters in FSAR Tables 11.3-8R and 11.3-201. The plant and site-specific dose calculations from gaseous effluent releases are determined with the GASPARD II code using site-specific input parameter values in FSAR Table 11.3-8R, which consider the source term, atmospheric diffusion and deposition factors, midpoint of plant life, food production, receptor distance, and population distribution in FSAR Table 11.3-201. The dose calculations, default age-specific usage, and consumption input parameters on the food pathway in FSAR Table 11.3-8R, are based on the guidance in RG 1.109. Since only two values of 1.58 person-rem (Total Body) and 1.98 person-rem (Thyroid) are reported for population doses within 50 miles, it was not considered necessary to tabulate these values. The staff confirmed that the reported population doses from gaseous effluents were those given

in the GASPAR II code calculation (TXUT-001-ER-5.4-CALC-011, "CPNPP Offsite Dose due to Normal Gaseous," Revision 2). **RAI 3400, Question 11.03-2, Item 5** is closed.

In **RAI 3400, Question 11.03-2, Item 6**, the staff requested that the applicant address the onsite and offsite dose consequences from a postulated release of windblown dust emissions containing plant-derived corrosion and fission products into the environment if the liquid from evaporation pond should dry out during drought periods experienced at the site. FSAR Section 11.3.3.1 describes that gaseous effluent doses from the evaporation pond conservatively assuming 50 percent of the liquid effluent release from the CPNPP, Units 3 and 4 is diverted to this pond and is discharged to the atmosphere as aerosol and vapor. The applicant revised FSAR Section 11.2.3.1 to include an operating requirement to wash the evaporation pond each time its contents are emptied to reduce the potential for accumulation of residual contamination, and design features such as sloping the bottom of the evaporation pond towards the discharge pit to facilitate complete drainage. The staff's evaluation has determined that the applicant's response, including these operating and design features to minimize airborne residual corrosion and fission products that could be spread by wind gusts, which would lead to onsite or offsite dose consequences is acceptable. **RAI 3400, Question 11.03-2, Item 6** is closed.

In **RAI 3400, Question 11.03-2, Item 7**, the staff stated, in part that "Section 11.3.3.3 indicates the ODCM for CPNPP, Units 3 and 4 is to be developed using guidance in NEI 07-09. This section also indicates that CPNPP, Units 1 and 2 have an existing ODCM that is to reflect the new reactor units (CPNPP, Units 3 and 4). However, it is not clear whether the existing ODCM adequately addresses all elements in NEI 07-09A (Revision 0) approved by the NRC in March 2009. Please clarify this statement."

In response to **RAI 3400, Question 11.03-2, Item 7**, dated October 15, 2009, FSAR Section 11.3.3.3 was deleted in FSAR UTR, Revision 0 (ADAMS Accession Number ML091120280) to reflect the combination of COL Information Items 11.5(2) and 11.5(3) in the DCD. In FSAR UTR, Revision 4 (ML092520125), FSAR Section 11.5.2.9 was revised to reflect that the ODCM will be re-written to apply to all four CPNPP units (CPNPP, Units 1 through 4) and conform with NEI ODCM Template 07-09A. The site-wide ODCM will be accomplished before receipt of radioactive material in the CPNPP, Unit 3 as described in the implementation milestones in FSAR Table 13.4-201. The plant and site-specific ODCM is evaluated by the staff in Section 11.5.5 of this SE. The staff evaluation of the applicant applying one ODCM to all four units is that this will update the current ODCM to reflect existing guidance and to make all four units consistent in their ODCM guided effluent program. **RAI 3400, Question 11.03-2, Item 7** is closed.

Based on its review of FSAR, Revision 1, Section 11.3 and Tables 11.3-8R, 11.3-9R (Sheets 1 and 2), 11.3-201, 11.3-202, 11.3-203, 11.3-204, and 11.3-205, UTR (Revisions 3 and 4), and response to RAI 3400, Question 11.03-2, dated October 15, 2009, the staff found that information on the calculated gaseous effluent releases and doses, as it relates to the evaporation pond and the SCR, to address CP COL 11.3(6) was not fully described. As a result, the staff in **RAI 5375, Question 11.03-4**, requested that the applicant provide this information.

In response to **RAI 5375, Question 11.03-4, Item 1** dated April 11, 2011, the applicant stated the site-specific liquid effluent releases for the CPNPP, Units 3 and 4 do not include the detergent waste release; whereas, the liquid effluent releases for the DCD includes the

detergent waste release as a conservative assumption. The applicant further stated the gaseous effluent releases for the CPNPP, Units 3 and 4 is same as the DCD because these effluent releases are not dependent on the detergent waste operation and since there are no departures from the DCD regarding other systems related to the GWMS and HVAC system which affect the gaseous effluent releases. The staff found that the applicant's response was acceptable because FSAR, Revision 1, Table 11.3-8R indicates gaseous effluent releases are taken from DCD Table 11.3-5 (Sheet 1 through 3) without departure. **RAI 5375, Question 11.03-4, Item 1** is closed.

FSAR Section 11.3.3.1 describes annual average gaseous effluent releases are taken from DCD Table 11.3-5 (Sheets 1 through 3) to calculate population doses from gaseous effluents resulting from normal operation for a plant referencing the US-APWR design at the CPNPP site. In **RAI 5375, Question 11.03-4, Item 2** the staff requested that the applicant confirm whether the doses to the population from gaseous effluent releases in FSAR Table 11.3-9R (Sheets 1 and 2) are calculated using a plant-specific gaseous effluent releases and address Ba-137m identified in DCD Table 11.3-5 (Sheet 3 of 6), but was not included in the GASPARI code library.

In response to **RAI 5375, Question 11.03-4, Item 2**, dated April 11, 2011, the applicant added Note 2 to FSAR Table 11.3-8R indicating Ba-137m is not included in the library. The staff found the response acceptable because this note was added and because the applicant confirmed that the doses to the population from gaseous effluent releases in the FSAR are calculated using plant-specific gaseous effluent releases in the DCD (i.e., gaseous effluent releases are incorporated by reference). **RAI 5375, Question 11.03-4, Item 2** is closed. These expected annual average and maximum gaseous effluent releases, incorporated by reference, comply with the ECLs in Table 1 of Appendix B to 10 CFR Part 20 using the sum-of-fractions as evaluated in the staff's SE for the US-APWR DCD Chapter 11 (ADAMS Accession Number ML110660127). Further, the applicant's assessment on the postulated radiological consequences of the failed gaseous tank and charcoal bed leak analysis, also incorporated by reference, comply with the regulatory requirements in 10 CFR Part 50, Appendix A, GDC 60 and 10 CFR Part 50, Appendix I; and the guidance in BTP 11.5 and SRP Section 11.3.

In response to **RAI 5375, Question 11.03-4, Item 3**, dated April 11, 2011, the applicant added a footnote to FSAR Tables 11.3-9R, 11.3-205, and 11.3-206 to indicate the calculated gaseous doses are for a single new unit, where applicable. The staff found the proposed revision to FSAR Tables 11.3-9R, 11.3-205, and 11.3-206, which present doses to the population from gaseous effluents due to normal operations including AOOs, total doses from gaseous effluents due to the plant vent stack and evaporation pond, and total doses to the MEI from public use of the SCR, respectively, acceptable. **RAI 5375, Question 11.03-4, Item 3** is being tracked as **Confirmatory Item 11.03-2** pending verification that the applicant incorporates the change into a future revision of the CPNPP, Units 3 and 4 FSAR.

In response to **RAI 5375, Question 11.03-4, Item 4** dated April 11, 2011, the applicant added references to the MHI PWR-GALE code and MHI Technical Reports MUAP-10019P/NP (R1), which describe the methodology, basis, and assumptions for the calculation of expected and maximum annual gaseous effluent releases during normal operation including AOOs for plants referencing the US-APWR design, in FSAR Section 11.2.5 and a discussion on the MHI PWR-GALE code in FSAR Section 11.2.3.1. MHI Technical Reports MUAP-10019P/NP (R1) were

revised by the DC applicant as part of the response to RAI 711, Question 11.03-4, item 4, in the DCD, by letter dated March 30, 2011. The staff reviewed the proposed mark-ups which includes references to the MHI PWR-GALE code and MHI Technical Reports MUAP-10019P/NP (R1) in FSAR Sections 11.2.3.2 and 11.2.5 and found them acceptable. **RAI 5375, Question 11.03-4, Item 4** is closed since this item is being tracked in response to **RAI 5374, Question 11.02-12, Item 5** as **Confirmatory Item 11.02-5** in Section 11.2 of this SE.

FSAR Section 11.3.3.1 describes the gaseous effluent releases in FSAR Table 11.3-202 for the evaporation pond as determined, as half of the liquid effluent releases (except noble gases) in FSAR Table 11.2-10R (Sheets 1 and 2) assumed to be diverted into the evaporation pond and conservatively discharged into the atmosphere as aerosol vapor. In **RAI 5375, Question 11.03-4, Item 5**, the staff requested that the applicant confirm whether the doses to the population from the evaporation pond are calculated using plant-specific liquid effluent releases. In response to **RAI 5375, Question 11.03-4, Item 5**, dated April 11, 2011, the applicant stated that half of the liquid effluent is assumed to be diverted to the evaporation pond. Since the liquid effluents are plant-specific, the population doses given in FSAR Table 11.2-10R for the evaporation pond aerosol release are calculated from plant-specific effluents. The staff found the response acceptable because the applicant confirmed that doses to the population from the evaporation pond in the FSAR are calculated using plant-specific effluent releases. **RAI 5375, Question 11.03-4, Item 5** is closed.

FSAR Section 11.3.3.1 and Table 11.3-206 of UTR, Revision 3, provide GASPAR II code calculations of doses to the population from public use of the SCR. In **RAI 5375, Question 11.03-4, Item 6**, the staff requested that the applicant confirm whether the doses to the population are calculated using plant-specific gaseous effluent releases.

In response to **RAI 5375, Question 11.03-4, Item 6**, dated April 11, 2011, the applicant stated that the values presented in FSAR 11.3.3.1 and FSAR Table 11.3-206 are calculated with the gaseous effluent release values given in DCD Table 11.3-5 (Sheets 1 through 3). The staff found the response acceptable because the applicant confirmed that the doses to the population from gaseous effluent releases in the FSAR are calculated using plant-specific gaseous effluent releases. **RAI 5375, Question 11.03-4, Item 6** is closed.

In response to **RAI 5375, Question 11.03-4, Item 7**, dated April 11, 2011, the applicant previously discussed in its response to **RAI 5375, Question 11.03-4, Item 3**, that the CPNPP, Units 3 and 4 gaseous effluent releases are the same as the DCD releases. The staff evaluated the impact on the built-in capacity factor of 80 percent in Section 11.2.5 of this SE and in Sections 11.2 and 11.3 of the US-APWR DCD Chapter 11 SE (ADAMS Accession Number ML110660127). **RAI 5375, Question 11.03-4, Item 7** is closed since this item is being tracked in response to **RAI 5374, Question 11.02-12, Item 8** as **Confirmatory Item 11.02-7** in Section 11.2 of this SE.

In response to **RAI 5375, Question 11.03-4, Item 8**, dated April 11, 2011, the input/output files on the MHI PWR-GALE code calculations of annual gaseous effluent releases and the GASPAR II code calculation of population doses from gaseous effluents were provided in the DCD review. **RAI 5375, Question 11.03-4, Item 8** is closed.

The estimated site-specific dose calculations from gaseous effluent releases for a single unit (or all four units) to address CP COL 11.3(6) and demonstrate compliance with the dose limits to members of the public specified in 10 CFR 20.1302 and 40 CFR Part 190 as referenced in 10 CFR 20.1301(e), and the dose objectives in Appendix I to 10 CFR Part 50 are summarized in Table 11.3-1 of this SE.

Table 11.3.1. Estimated site-specific gaseous effluent dose calculations.

Description	Design Objective ¹ or Dose Limit ²	Site-Specific Calculated Dose ³
Doses to the MEI from gaseous effluent release ^{1,3} (CPNPP, Unit 3 or 4)	10 mrad/yr (Air-gamma) 20 mrad/yr (Air-beta) 5 mrem/yr (Total Body) 15 mrem/yr (Skin) 15 mrem/yr (Organ) 15 mrem/yr (Organ)	0.1 mrad/yr (Air-gamma) 0.7 mrad/yr (Air-beta) 0.1 mrem/yr (Total Body) 0.5 mrem/yr (Skin) 1.4 mrem/yr (Child-Bone) 1.0 mrem/yr (Infant-Thyroid)
Doses to the MEI from gaseous effluent release ^{1,3} (plant vent stack only)	15 mrem/yr (Organ) 15 mrem/yr (Organ)	1.5 mrem/yr (Child-Bone) 1.1 mrem/yr (Infant-Thyroid)
Doses to the MEI from gaseous effluent release ^{1,3} (evaporation pond only)	15 mrem/yr (Organ) 15 mrem/yr (Organ)	2.4 mrem/yr (Adult-GI Tract) 0.6 mrem/yr (Child-Thyroid)
Doses to the population from gaseous effluent release ³ (CPNPP, Unit 3 or 4)	- -	1.6 person-rem/yr (Total Body) 2.0 person-rem/yr (Thyroid)
Doses from gaseous effluent releases ² (CPNPP, Units 1 through 4)	25 mrem/yr (Whole Body) 25 mrem/yr (Organ) 75 mrem/yr (Thyroid)	0.7 mrem/yr (Whole Body) 4.2 mrem/yr (GI Tract) 5.0 mrem/yr (Thyroid)

Notes:

1. Numerical design objectives in 10 CFR Part 50, Appendix I for estimating annual doses above background from gaseous effluents for any individual in an unrestricted area, for one unit, from all exposure pathways are 5 mrem/yr (Total Body) or 15 mrem/yr (Organ).
2. Dose limits specified in 40 CFR Part 190 as implemented under 10 CFR Part 20.1301(e), for an individual member of the public are 25 mrem/yr (Whole Body), 25 mrem/yr (Organ), and 75 mrem/yr (Thyroid).
3. Gaseous effluent doses from FSAR Section 11.3.3.1 and/or Tables 11.3-9R, 11.3-204, and 11.3-205.

- CP COL 11.3(8) Site-Specific Cost-Benefit Analysis.

The applicant provided additional information in CP COL 11.3(8) to satisfy COL Information Item 11.3(8). COL Information Item 11.3(8) states:

The COL applicant is to perform a site-specific cost benefit analysis to demonstrate compliance with the regulatory requirements.

The applicant addressed this COL information item in FSAR, Revision 1, Section 11.3.1.5, which indicates the site-specific calculated doses due to the release of radioactive gaseous effluents to the environment during normal operations, including AOs, results in a public dose of less than 1 person-rem/yr and a dose cost of less than \$1,000/yr in 1975 dollars. Based on a population doses of 2.59 person-rem/yr (Total Body), 2.97 person-rem/yr (Thyroid) and the equipment and operating costs using guidance of RG 1.110, the applicant concluded that the addition of processing equipment of reasonable treatment technology is not favorable or cost beneficial, and that the site-specific GWMS design complies with Appendix I of 10 CFR Part 50.

The staff reviewed the additional information included in FSAR Sections 11.2.1.5, 11.3.1.5, 11.4.1.5, and 11.5.2.11 and found that the values, bases and assumptions for the site-specific CBA for the LWMS and GWMS was not provided. As a result, the staff in **RAI 3401, Question 11.04-3** requested that the applicant provide this information.

In response to **RAI 3401, Question 11.04-3** dated October 19, 2009, the applicant described the site-specific CBA for the LWMS and GWMS assumes liquid effluent population doses of five person-rem/yr (Total Body) and five person-rem/yr (Thyroid) and gaseous effluent population doses of four person-rem/yr (Total Body) and four person-rem/yr (Thyroid), respectively. Although some site-specific inputs to determine the CRF and LCCF were provided, the augment(s) listed in Table A-1 to RG 1.110 and other associated costs described in Appendix A to RG 1.110 applied in the site-specific CBA calculation were not identified. Further, because the liquid effluent population doses of 2.14 person-rem/yr (Total Body) and 2.04 person-rem/yr (Thyroid) in FSAR Section 11.2.1.5 and gaseous effluent population doses of 2.59 person-rem/yr (Total Body) and 2.97 person-rem/yr (Thyroid) in FSAR Section 11.3.1.5 appeared to be evaluated prior to restricted public use of the SCR at the CPNPP site which resulted in a small increase to the calculated population doses from effluent releases, the staff closed **RAI 3401, Question 11.04-3**, and in follow-up **RAI 5375, Question 11.03-3** the staff requested that the applicant confirm the site-specific population doses to the Thyroid and Total Body from gaseous effluents in FSAR Section 11.3.1.5. These effluent population doses evaluated within 50 miles and evaluated prior to restricted public use of the SCR and specifically identify the GWMS augment(s) and all costs considered in the site-specific CBA for the GWMS. In addition, the effluents provide sufficient information for the staff to evaluate the bases and assumptions of these costs in order to verify compliance with 10 CFR Part 50 and conformance to RG 1.110.

In its response to **RAI 5375, Question 11.03-3** dated April 11, 2011, the applicant stated the site-specific population doses from gaseous effluents which include public access to the SCR are 3.77 person-rem/yr (Total Body) and 4.29 person-rem/yr (Thyroid). FSAR Section 11.3.1.5 was revised to assume conservative site-specific population doses of five person-rem/yr (Total

Body) and five person-rem/yr (Thyroid) in the site-specific CBA for the GWMS. The applicant considered the addition of three 600 ft³ gas surge tanks and two 3-ton charcoal adsorbers as two augments listed in Table A-1 of RG 1.110 in its site-specific CBA. The applicant also referred to its response in **RAI 5374, Question 11.02-11** dated April 19, 2011, which described the basis, assumptions, and all costs used in the site-specific CBA evaluated by the staff in Section 11.2.5 of this SE.

The staff reviewed the mark-up to the proposed revision to FSAR Section 11.3.1.5 on the site-specific CBA for the GWMS for compliance with 10 CFR Part 50 Appendix I, Section II.D and found it acceptable. The staff also performed an independent CBA and concludes that the information provided to address CP COL 11.3(8) complies 10 CFR Part 50 Appendix I, Section II.D. **RAI 5375, Question 11.03-3** is being tracked as **Confirmatory Item 11.03-1** pending verification that the applicant incorporates the change in a future revision of the CPNPP, Units 3 and 4 FSAR.

- STD CP COL 11.3(9) Piping and Instrumentation Diagrams.

The applicant provided additional information in CP COL 11.3(9) to satisfy COL Information Item 11.3(9). COL Information Item 11.3(9) states:

The COL applicant is to provide piping and instrumentation diagrams (P&IDs).

The applicant addressed this COL information item in FSAR Section 11.3.2 and provided P&IDs for the site-specific GWMS in Figure 11.3-201 (Sheets 1 through 3). Regulatory Position 2.3 of RG 1.143 states that portions of the gaseous radwaste treatment system that are intended to store or delay the release of gaseous radioactive waste, including portions of structures housing these systems, should be classified as described in Regulatory Position 5 and designed in accordance with Regulatory Position 6. From its review of Figure 11.3-201 (Sheets 1 through 3); the staff observed an inconsistency between the notes of Sheets 1, 2 and 3 of Figure 11.3-201, "GWMS P&IDs." As a result, the staff in **RAI 2748, Question 11.03-1**, requested that the applicant explain why Figure 11.3-201 (Sheet 3) did not include the same note as Figure 11.3-201 (Sheets 2 and 3), which identified all piping valves and components in that sheet, other than specified, as being classified as equipment class 6.

In response to **RAI 2748, Question 11.03-1** dated October 15, 2009, the applicant revised FSAR Figure 11.3-201 (Sheet 3 of 3) to add the same note regarding equipment class and qualifier as given in FSAR Figure 11.3-201 (Sheets 1 and 2). The staff reviewed the applicant's response and found it acceptable because all three sheets are consistent in Figure 11.3-201. The staff confirmed that Revision 1 to FSAR Figure 11.3-201 (Sheet 3 of 3) included this information. The GWMS interface with the A/B ventilation system is evaluated by the staff in Section 9.4.3 of the SE. **RAI 2748, Question 11.03-1** is closed.

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 applicant included a commitment, under CP COL 11.5(2), to develop a plant and site-specific ODCM by endorsing NEI ODCM Template 07-09A. The staff has determined the endorsement of NRC staff approved NEI ODCM Template 07-09A to be acceptable (ADAMS Accession Number ML091050234). The staff finds the commitment to use NEI 07-09A acceptable. The staff's evaluation of the ODCM is presented in Section 11.5 of this SE.

Technical Specifications

Chapter 16 of the FSAR states that the US-APWR TS and Bases in the DCD are incorporated by reference into Section B of Part 4 of the COLA.

Departures and Exemption Requests

Part 7, "Generic DCD Departures Report," of the COL that would indicate departures or exemption requests from the information presented in US-APWR DCD associated with the design and operation of the GWMS and site-specific characteristics in monitoring gaseous effluent releases are not used and; therefore, are not evaluated by the staff.

11.3.5 Post Combined License Activities

There are no post COL activities related to this section.

11.3.6 Conclusion

Except for the confirmatory items identified below, the staff concludes that the GWMS (as a permanently installed system and in combination with other plant systems) includes the equipment necessary to control releases of radioactive materials in gaseous effluents in accordance with GDC 3, GDC 60 and GDC 61 of Appendix A to 10 CFR Part 50 and the requirements of 10 CFR 50.34a. The staff also concludes that the design of the GWMS is acceptable and meets the requirements of 10 CFR 20.1301; 10 CFR 20.1302; 10 CFR 20.1301(e); 10 CFR 20.1406; and 10 CFR 50.34a. This conclusion is based on the following:

1. The applicant has met the requirements of GDC 60 and GDC 61 with respect to controlling releases of radioactive materials to the environment by assuring that the design of the GWMS includes the equipment to monitor and control releases of radioactive materials in gaseous and particulate effluents. As demonstrated in FSAR Section 12.4 using site-specific conditions, the applicant has met the requirements of Sections II.B and II.C of Appendix I to 10 CFR 50 design objectives by maintaining releases of radioactive materials in gaseous effluents such that the calculated individual doses in an unrestricted area from all exposure pathways are less than 0.05 mSv (5 mrem) to the total body, 0.15 mSv (15 mrem) to the skin, and less than 0.15 mSv (15 mrem) to any organ from releases of radioiodines, tritium, carbon-14, and radioactive materials in particulate form; and that the calculated air doses from gaseous effluents at the EAB will be less than 0.01 cGy (10 millirads) for gamma radiation and 0.02 cGy (20 millirads) for beta radiation.

2. The applicant has met the requirements of Section II.D of Appendix I to 10 CFR 50 with respect to meeting the ALARA criterion, using site-specific conditions. The staff has considered the potential effectiveness of augmenting the GWMS using items of reasonably demonstrated technology and has determined that further effluent treatment will not affect reductions in cumulative population doses reasonably expected within an 80-km (50-mile) radius of the reactor at a cost of less than \$1,000 per man-rem or man-thyroid-rem.
3. The applicant has met the requirements of 10 CFR 20.1301 and 10 CFR 20.1302, as demonstrated in FSAR Section 12.4 using site-specific conditions. The staff has determined that the concentrations of radioactive materials in gaseous effluents in unrestricted areas will be within the limits specified in 10 CFR Part 50, Appendix, Table 2, Column 1.
4. The staff has reviewed the sources of radiation and radioactivity and associated doses to members of the public and concludes that annual doses from all sources of radioactivity and radiation from the site (using site-specific conditions), including liquid and gaseous effluents and external radiation exposures from buildings and storage tanks will not exceed the EPA generally applicable environmental radiation standards of 40 CFR Part 190 implemented under 10 CFR Part 20.1301(e), as demonstrated in FSAR Section 12.4 using site-specific conditions.
5. The applicant has met the requirements of 10 CFR 20.1406 and guidance of RG 4.21 with respect to providing a description of how facility design features and procedures for operation, described in CPNPP, Units 3 and 4 COL FSAR Sections 11.3 and 12.3 will minimize, to the extent practicable, contamination of the facility and the environment; facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of radioactive waste.
6. The applicant demonstrates compliance with the requirements of 10 CFR Part 52.80(a) and ITAAC for the GWMS. The ITAAC address the description and functional arrangement of the GWMS. Once the proposed ITAAC are performed by the COL applicant and the ITAAC meet the respective acceptance criteria, provide reasonable assurance that a plant that incorporates the US-APWR DC and establishes operational programs in accordance with the DC and site-specific conditions will meet the provisions of the NRC regulations.

For the following confirmatory items, tracked under **Confirmatory Item 11.03-1, RAI 5375, Question 11.03-3** related to site-specific CBA for the GWMS and **Confirmatory Item 11.03-2, RAI 5375, Question 11.03-4, Item 3** related to population doses from normal gaseous effluents represented in FSAR Tables 11.3-9R, 11.3-205, and 11.3-206, the staff will confirm that these items are incorporated into a future revision of the CPNPP, Units 3 and 4 FSAR.

11.4 Solid Waste Management System

11.4.1 Introduction

The SWMS is designed to provide collection, processing, packaging, and storage of radioactive wastes such as spent resins, spent carbon, sludge, oil waste, and dry active waste (DAW) produced during normal operation and AOOs including startup, shutdown, and refueling operations. The SWMS processes and packages waste from the LWMS, the chemical and volume control system, and the spent fuel pit cooling and purification system. The SWMS can receive solid waste from the condensate polishing system and the steam generator blowdown system (SGBNS). Waste from these systems consists of spent resin, spent charcoal, sludge, general contaminated plant debris, and spent filter elements. The SWMS has five subsystems in the US-APWR design to handle DAW, spent filter elements, spent resin, spent activated carbon, and oil and sludge wastes. The SWMS consists of permanently installed equipment with provisions for a vendor supplied mobile de-watering subsystem. In the referenced US-APWR design, the A/B provides 30 days temporary storage of the packaged wastes with a commitment, in the CPNPP, Units 3 and 4 COL FSAR, to build an onsite common radwaste interim storage facility to store Class A, B, and C radioactive waste from all four CPNPP units (CPNPP, Units 1 through 4) for up to 10 years, or by procuring the necessary storage space through licensed commercial waste processors in accordance with the NRC regulations and guidance.

11.4.2 Summary of Application

Section 11.4 of the CPNPP, Units 3 and 4 COL FSAR, Revision 1, incorporates by reference, with supplemental information, Section 11.4 of the US-APWR DCD, Revision 2. The applicant provided additional information in response to the COL information items identified in US-APWR DCD Section 1.8 and Table 1.8-2.

The staff reviewed the COLA and evaluated the referenced DC application for any outstanding issues related to the review of the SWMS. The staff's review determined that there were some outstanding issues, as discussed in this section of this SE.

US-APWR COL Information Items

- CP COL 11.4(1) Plant-Specific Needs for Onsite Waste Storage.

The applicant provided additional information in CP COL 11.4(1) to satisfy COL Information Item 11.4(1) in DCD, Revision 2, regarding onsite storage of Low Level Radioactive Waste (LLRW).

- STD COL 11.4(2) Deleted from the DCD.

(The deletion of this COL information item is not evaluated in the staff review of the CPNPP, Units 3 and 4 COL FSAR.)

- CP COL 11.4(3) Plan for the Process Control Program Describing the Process and Effluent Monitoring and Sampling Program.

The applicant provided additional information in CP COL 11.4(3) to satisfy COL Information Item 11.4(3) in DCD, Revision 2, regarding programmatic aspects of the process control program (PCP) describing the PERMS.

- CP COL 11.4(4) Mobile/Portable SWMS Connections.

The applicant provided additional information in CP COL 11.4(4) to satisfy COL Information Item 11.4(4) in DCD, Revision 2, regarding Inspection and Enforcement (IE) Bulletin 80-10.

- CP COL 11.4(5) Offsite Laundry Facility Processing and/or a Mobile Compaction.

The applicant provided additional information in CP COL 11.4(5) to satisfy COL Information Item 11.4(5) in DCD, Revision 2, regarding offsite laundry facility processing and onsite mobile compaction.

- STD COL 11.4(6) Site-Specific Cost Benefit Analysis.

The applicant provided additional information in CP COL 11.4(6) to satisfy COL Information Item 11.4(6) in DCD, Revision 2, regarding the site-specific CBA.

- CP COL 11.4(7) Site-Specific Solid Waste Processing Facility.

The applicant provided additional information in CP COL 11.4(7) to satisfy COL Information Item 11.4(7) in DCD, Revision 2, regarding the mobile de-watering system.

- STD COL 11.4(8) Piping and Instrumentation Diagrams.

The applicant provided additional information in CP COL 11.4(8) to satisfy COL Information Item 11.4(8) in DCD, Revision 2, regarding site-specific P&IDs for the SWMS including vendor supplied equipment (mobile de-watering subsystem).

- CP COL 11.4(9) Epoxy Coatings Program.

The applicant provided additional information in CP COL 11.4(9) to satisfy COL Information Item 11.4(9) in DCD, Revision 3, regarding the Epoxy Coatings Program for developing implementation and maintenance guidelines, and addressing the milestones for decontaminable paints. This COL information item is related to CP COL 11.2(7) to satisfy COL Information Item 11.2(7) in DCD, Revision 3, evaluated in Section 11.2.5 of this SE.

Interface Requirements

The US-APWR DCD Tier 2, Section 1.8, Table 1.8-1, "Significant Site-Specific Interfaces with the Standard US-APWR Design," identifies significant interfaces between the US-APWR standard design and the COLA. This table does not specify any interfaces related to Section 11.4 of the DCD.

11.4.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the US-APWR DCD. In addition, the relevant requirements of the NRC regulations for site-specific information about the PERMS, and the associated acceptance criteria, are provided in SRP Section 11.5. The following lists the basis for which site specific information was evaluated, either because the applicant provided site-specific information, or the staff's review determined that supplemental information was necessary in the CPNPP, Units 3 and 4 COL FSAR. The regulatory basis includes:

1. 10 CFR 20.1302 and 10 CFR 20.1301(e), as they relate to monitoring radioactivity in plant radiological effluents to unrestricted areas. 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 RWMS pursuant to 10 CFR 50.34a in ensuring that releases of radioactive materials to unrestricted areas are kept ALARA.
4. Appendix I to 10 CFR Part 50, 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 following RGs and the NRC documents contain regulatory positions and guidance in demonstrating compliance with the relevant requirements of the regulations identified above:

1. NUREG-0800, SRP Section 11.5, "Process and Effluent Radiological Monitoring Instrumentation and Sampling Systems," as it relates to SRP acceptance criteria for the design basis of process and effluent radiation monitoring instrumentation and sampling systems.
2. NUREG-0800, SRP Section 11.5, Appendix 11.5-A, "Design Guidance for Radiological Effluent Monitors Providing Signals for Initiating Termination of Flow or Other Modification of Effluent Stream Properties," as it relates to the design of instrumentation with automatic control functions.
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 and site-specific ODCM program. Alternatively, a COL applicant may use NEI

ODCM Template 07-09A (Revision 0, issued 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 FSAR Section 13.4 of a COLA. The staff has reviewed NEI ODCM Template 07-09A and determined it to be acceptable (ADAMS Accession Number ML091050234).

4. Generic Letter (GL) 89-01, dated November 14, 1990, as it relates to the restructuring of the ODCM, process control program (PCP), radiological effluent technical specification (RETS) or standard radiological effluent controls (SREC), and implementation of a radiological environmental monitoring program (REMP). (GL 89-01 is included in NUREG-1301, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls For Pressurized Water Reactors)."
5. RG 4.21, "Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning," dated June 2008, as it relates to minimizing the contamination of equipment, plant facilities, and environment, and minimizing the generation of radioactive waste during plant operation.

11.4.4 Technical Evaluation

The staff reviewed Section 11.4 of the CPNPP, Units 3 and 4 COL FSAR and checked the referenced US-APWR DCD to ensure that the combination of the DCD and information in the FSAR represent the complete scope of information relating to the review of the SWMS. The staff is reviewing Section 11.4 of the US-APWR DCD on Docket Number 52-021. The staff's technical evaluation of the information incorporated by reference relating to SWMS will be documented in the staff SE regarding the DC application for the US-APWR design.

The staff reviewed Section 11.4 of the CPNPP, Units 3 and 4 COL FSAR against Section 11.4 of the SRP to determine if the information contained in FSAR Section 11.4 met the requirements of the NRC regulations and SRP acceptance criteria and guidance. The staff also reviewed conformance of Section 11.4 of the FSAR to the guidance in RG 1.206, Section C.III.1, Chapter C.1.11.4. The staff's review confirmed that the information contained in the COL and incorporated by reference in the FSAR addresses the required information related to the SWMS. However, the staff's review determined that there were some site-specific issues, as discussed below.

US-APWR COL Information Items

- CP COL 11.4(1) Plant-Specific Needs for Onsite Waste Storage.

The applicant provided additional information in CP COL 11.4(1) to satisfy COL Information Item 11.4(1) in DCD, Revision 2. COL Information Item 11.4(1) states:

The current design meets the waste storage requirements in accordance with ANSI/ANS-55.1. When the COL applicant desires additional storage capability beyond that which is discussed in this Tier 2 document, the COL applicant will identify plant-specific needs for on-site waste storage and provide a discussion of on-site storage of low-level waste.

In FSAR, Section 11.4.2.3, the applicant proposed a radwaste interim storage facility to store Class A, B, and C wastes generated from all four CPNPP units (CPNPP, Units 1 through 4) for up to 10 years due to the uncertainty in the availability of a licensed LLRW storage disposal facility to accept Class B and C wastes. The radwaste interim storage facility design includes a separate storage area for mixed waste and temporary staging of large equipment items for maintenance.

The applicant stated, as of July 1, 2008, that the LLRW disposal facility in Barnwell, South Carolina, is no longer accepting Class B and C wastes from Texas, and that the LLRW disposal facility in Clive, Utah, is still accepting out-of-state Class A waste. Since CPNPP, Units 3 and 4 are scheduled to load fuel and begin commercial operation no earlier than 2016, these units will not be generating Class B and C wastes which constitutes a small fraction of the total generated wastes prior to that time.

The applicant stated the radwaste interim storage facility could store waste for a longer period if only Class B and C wastes were to be stored until another LLRW facility would become available to accept Class B and C wastes from Texas. In particular, Waste Control Specialists applied for a license in 2004 from the Texas Commission on TCEQ to develop an instate disposal facility for Class A, B, and C wastes, and received a draft license in August 2008, with a planned opening in about December 2010. If additional storage capacity were needed, an expansion of the common radwaste storage facility or construction of additional radwaste storage facilities in accordance with the NRC guidance, such as RIS 2008-12 and SRP Section 11.4 would be followed by the applicant.

The staff reviewed the additional information included in FSAR, Revision 0, Section 11.4.2.3 and found that the design information on the radwaste interim storage facility was not described. As a result, the staff requested in **RAI 3401, Question 11.04-4** that the applicant in FSAR Section 11.4 identify and describe the applicable the NRC regulations and guidance; design information such as ventilation exhaust system, structural requirements, shielding considerations, capacity, sizing, airborne radioactivity and area radiation monitoring, etc; provisions for leakage prevention and/or detection that will be used to minimize contamination of the facility and environment; associated programs and procedures that will be used to comply with Federal regulations and conform to the NRC regulatory guidance, communications, and industry guidance; and ITAAC that will be used to ensure acceptable construction and operation of the radwaste interim storage facility, or justify its exclusion.

In response to **RAI 3401, Question 11.04-4** dated October 19, 2009, the applicant revised FSAR Section 11.4.2.3, adding some design information for the radwaste interim storage facility such as above grade specialized shielded cell vaults for storing Class B and C waste; separate control and equipment room ventilation; radiation monitoring; fire protection systems; remotely operated bridge crane with closed circuit television (CCTV); and crane mounted storage bay lighting sources. The applicant states the radioactive mixed waste storage area is designed and constructed in accordance with the permit application for its operation received from the TCEQ. In FSAR, Revision 1, Section 11.4.2.3, the applicant added the NRC regulations and guidance for the design and operation of the radwaste interim storage facility as 10 CFR Part 20, 10 CFR Part 61, 10 CFR Part 71, 40 CFR Part 190, 49 CFR Part 173, Appendix 11.4-A to SRP Section 11.4, GL 81-38, IN 89-27, and SECY-94-0198. Although the applicant commits to following

these regulatory requirements and industry guidance, the applicant states the requested detailed design information is unavailable because “the building design is not detailed at this point in time so that the design can be flexible and adjusted to accommodate the amounts and types of radioactive waste to be stored which are not fully known yet and which are expected to change over time.”

From review of FSAR, Revision 1, Section 11.4.2.3, the staff notes that the requested detailed design information for the staff to reach a reasonable assurance of safety conclusion and verify how the interim radwaste facility storage facility meets compliance with the NRC regulatory requirements and the guidance and acceptance criteria in SRP Section 11.4 to adequately address CP COL 11.4(1) was not provided. Therefore, **RAI 3401, Question 11.04-4** is being tracked as **Open Item 11.04-1**.

- CP COL 11.4(3) Plan for the Process Control Program Describing the Process and Effluent Monitoring and Sampling Program.

The applicant provided additional information in CP COL 11.4(3) to satisfy COL Information Item 11.4(3) in DCD, Revision 2. COL Information Item 11.4(3) states:

The COL applicant is to prepare a plan for the process control program describing the process and effluent monitoring and sampling program. The plan should include the proposed implementation milestones.

In FSAR Section 11.4.3.2, the applicant adopted NEI PCP Template 07-10A. NEI 07-10A describes the administrative and operational controls used for the solidification of liquid or wet solid waste and the de-watering of wet solid waste, processing parameters, and surveillance requirements within the scope of the PCP will meet the requirements of 10 CFR 52.79. It provides the necessary controls such that the final disposal waste product meets applicable Federal regulations (10 CFR Parts 20, 50, 61, 71, and 49 CFR Part 173), State regulations, and disposal site waste form requirements for burial at a LLRW disposal site licensed in accordance with 10 CFR Part 61. Waste processing equipment and services may be provided by the plant or by third-party vendors. NEI 07-10A was determined to be acceptable by the staff (ADAMS Accession Number ML091460627) for the purpose of meeting the regulatory milestone to develop a plant-specific PCP with the format and content of the PCP, as described in NUREG-0133, until a plant-specific PCP is prepared before fuel load under the requirements of a license condition in FSAR Section 13.4.

The staff finds this item satisfactorily addressed in FSAR Section 13.4, Table 13.4-201, Item 9, which lists the milestone for development and implementation of the PCP as receipt of radioactive materials onsite, with the requirement being a license condition. Furthermore, the applicant addressed the provision for additional onsite solid radioactive waste storage in FSAR Section 11.4.2.3 previously evaluated by the staff for CP COL 11.4(1). Therefore, the staff finds the additional information included in CP COL 11.4(3) acceptable.

- CP COL 11.4(4) Mobile/Portable SWMS Connections.

The COL applicant provided additional information in CP COL 11.4(4) to satisfy COL Information Item 11.4(4) in DCD, Revision 2. COL Information Item 11.4(4) states:

The COL applicant is responsible for the identification of mobile/portable SWMS connections that are considered non-radioactive but later may become radioactive through contact or contamination with radioactive systems (i.e., a non-radioactive system becomes contaminated due to leakage, valving errors, or other operating conditions in the radioactive systems). The COL applicant is to prepare a plan to develop and use operating procedures so that the guidance and information in Inspection and Enforcement (IE) Bulletin 80-10 is followed.

In FSAR, Revision 1, Section 11.4.4.5, the applicant adopted a mobile de-watering subsystem operated based on specific requirements and station layout from the vendor. The mobile and modular design provides ease of equipment replacement due to advances in treatment technologies and/or broken equipment. DCD, Revision 2, Section 11.4.4.5 describes the mobile de-watering subsystem design on modular skids and consisting of one high-integrity container (HIC), de-watering fillhead station, pump, control console, and CCTV to monitor tank level operation. A level instrument, temperature instrument, and CCTV are included in the design as part of the fillhead assembly to prevent over flow of the HIC during waste compaction. To prevent contamination of non-radioactive plant piping, the mobile de-watering subsystem design utilizes uniquely designed connections and fittings at the interface with plant piping. Backflow inhibitors are used in plant piping as well. Operating procedures are to be developed and implemented with the PCP to follow the guidance and information in IE Bulletin 80-10.

The staff finds this item satisfactorily addressed in FSAR Section 13.4, Table 13.4-201, Item 9, which lists the following milestone for development and implementation of the PCP.

- License Condition (11-1) - The licensee shall implement the Process and Effluent Monitoring and Sampling Program, including the Process Control program prior to receipt of radioactive material on-site.

Based on the above discussion, the staff finds the additional information included in CP COL 11.4(4) acceptable.

- CP COL 11.4(5) Offsite Laundry Facility Processing and/or a Mobile Compaction.

The applicant provided additional information in CP COL 11.4(5) to satisfy COL Information Item 11.4(5) in DCD, Revision 2. COL Information Item 11.4(5) states:

The current design provides collection and packaging of dry active wastes for offsite shipment and/or disposal. Depending on site-specific requirements, the COL applicant can send the wastes for offsite laundry facility processing and/or bring in a mobile compaction unit for volume reduction. The temporary mobile compaction subsystem is a COL item.

The applicant addressed this COL information item in FSAR Sections 11.4.1.3 and 11.4.1.6. In FSAR Section 11.4.1.3, the applicant describes a vendor supplied offsite laundry services that will appropriately dispose of the processed radioactive waste. In FSAR Section 11.4.1.6, the applicant describes a contracted onsite mobile de-watering subsystem previously evaluated by the staff for CP COL 11.4(4).

The staff reviewed the additional information included in FSAR Sections 11.4.1.3 and 11.4.1.6, and finds the information provided in CP COL 11.4(5), on the adoption of appropriate vendor supplied offsite facilities for laundry services and vendor supplied onsite mobile de-watering station for volume reduction of processed waste to be acceptable.

- STD COL 11.4(6) Site-Specific Cost Benefit Analysis.

The COL applicant provided additional information in CP COL 11.4(6) to satisfy COL Information Item 11.4(6) in DCD, Revision 2. COL Information Item 11.4(6) states:

The COL applicant is required to perform a site-specific cost benefit analysis to demonstrate compliance with the regulatory requirements.

The applicant addressed this COL information item in FSAR, Revision 0, Section 11.4.1.5. FSAR Section 11.4.1.5 indicates there is no unique direct release pathway from the solid waste handling operation to the environment. The applicant stated the site-specific CBA for the SWMS is included in the site-specific CBA for the LWMS (FSAR Section 11.2) and GWMS (FSAR Section 11.3).

The staff reviewed the additional information included in CP COL 11.4(6) in FSAR Section 11.4.1.5 on the site-specific CBA for the SWMS, CP COL 11.2(5) in FSAR Section 11.2.1.5 on the site-specific CBA for the LWMS, and CP COL 11.3(8) in FSAR Section 11.3.1.5 on the site-specific CBA for the GWMS, and found that information regarding the values, bases and assumptions on the site-specific CBA for the LWMS, GWMS, and SWMS was not sufficiently described. As a result, the staff requested in **RAI 3401, Question 11.04-3** that the applicant provide the values, bases, and assumptions used in the site-specific CBA for the LWMS, GWMS, and SWMS for the staff to verify compliance with 10 CFR Part 50, Appendix I, Section II.D.

In response to **RAI 3401, Question 11.04-3** dated October 19, 2009, the applicant stated the SWMS is contained within a completely shielded area and does not include additional processing of the waste, such as removal of radioactive isotopes from the effluents, which could potentially release radioactivity into the environment. The applicant further stated the purpose of the SWMS is to provide packaging and storage of solid wastes for eventual offsite shipping. In the site-specific CBA for the LWMS and GWMS, the applicant applied the guidance in RG 1.110 and NUREG/BR-0058 on some site-specific values. For the site-specific doses, the applicant used population doses of 5.0 person-rem/yr (both Total Body and Thyroid) and 4.0 person-rem/yr (both Total Body and Thyroid) from liquid and gaseous effluents, respectively, which are reported to be bounding population doses of those listed in FSAR Sections 11.2 and 11.3.

The staff reviewed the applicant's values, basis, and assumptions described in the response; however, the calculation of the site-specific CBA for the LWMS and GWMS could not be verified. Moreover, because the population doses to the Thyroid and Total Body from liquid and gaseous effluents were not updated in FSAR Sections 11.2.1.5, 11.3.1.5, and 11.4.1.5, and because it appeared that the site-specific CBA was not re-evaluated to reflect the contribution of potential exposure as a result of restricted public use of SCR at the CPNPP site (Refer to

Luminant's letter dated March 3, 2010 ADAMS Accession Number ML100640170), the staff closed **RAI 3401, Question 11.04-3**, and in follow-up **RAI 5374, Question 11.02-11** and **RAI 5375, Question 11.03-3** requested that the applicant confirm the site-specific population doses to the Thyroid and Total Body from liquid and gaseous effluents in FSAR Sections 11.2.1.5 and 11.3.1.5, respectively, which appear to be evaluated prior to restricted public use of the SCR at the CPNPP site; and identify the augment(s) listed in Table A-1 to RG 1.110, other associated costs described in Appendix A to RG 1.110, and all costs considered in the site-specific CBA calculations for the staff to verify compliance with NRC regulations. The staff's evaluation of the applicant's responses to the above RAIs, dated April 19, 2011, and April 11, 2011, respectively, is presented in Sections 11.2 and 11.3 of this SE.

- CP COL 11.4(7) Site-Specific Solid Waste Processing Facility.

The applicant provided additional information in CP COL 11.4(7) to satisfy COL Information Item 11.4(7) in DCD, Revision 2. COL Information Item 11.4(7) states:

The COL applicant can adopt solid waste processing facility (e.g. de-watering system, compactor for reducing waste volume) depending on site-specific requirements. These facilities are COL item.

The applicant addressed this COL information item in FSAR, Revision 0, Sections 11.4.1.6 and 11.4.4.5. In FSAR Section 11.4.1.6, the applicant describes a vendor supplied onsite mobile de-watering station area and subsystem for volume reduction of processed waste. In FSAR, Revision 0, Section 11.4.4.5, the applicant commits to develop and implement operational procedures with the PCP following the guidance and information in IE Bulletin 80-10. However, from review of FSAR, Revision 0, Sections 11.4.1.6 and 11.4.4.5, the staff determined that information regarding conformance to RG 1.143 and RG 1.206 of the contracted mobile de-watering subsystem was not described. As a result, the staff requested in **RAI 2749, Question 11.04-1** that the applicant include in the FSAR discussions on how the mobile de-watering subsystem will meet the design guidance in RG 1.143 and the capability to permit inspection, testing of components, shielding, and operational procedures; and in **RAI 2749, Question 11.04-2** to describe in the FSAR how the mobile de-watering subsystem meets compliance with 10 CFR Part 50, Appendix A, GDC 61, and the guidance in SRP Section 11.4 and RG 1.143.

In response to **RAI 2749, Question 11.04-1** dated October 19, 2009, the applicant provided a mark-up to FSAR Section 11.4.4.5 adding the requirement to specify the applicable regulatory criteria, testing, inspection, interfacing requirements, and operating procedures (including the applicant's oversight of vendor personnel) in the lease or purchase document for the mobile de-watering subsystem. The applicant also provided Figure 11.04-1-01 to depict the vendor supplied de-watering station area. This figure conceptually illustrates the shielded control room; waste packaging and de-watering area containing the modular concrete shielded enclosure, fillhead stand, pump skid, sump, and piping area; Class A waste storage area; and truck bay area. The de-watering area design includes access port and shield doors to assist operation, and permits inspection and testing of components to keep radiation doses to workers ALARA. As described in DCD, Revision 1, Section 11.4.1.2, any liquids and gases from the operation of the SWMS, including the contract mobile de-watering subsystem, are routed to the LWMS and GWMS for treatment. There is no effluent release from the SWMS to the environment. Double isolation valves and special fittings (e.g., one check valve and one isolation valve) are used in

the mobile de-watering subsystem to minimize the potential for cross contamination of connected non-radioactive systems such as primary makeup water, nitrogen, and service air systems to meet compliance with 10 CFR 20.1406.

The staff reviewed the mark-up provided in response to **RAI 2749, Question 11.04-1** and found the applicant's proposed revision to FSAR Section 11.4.4.5 acceptable because it provides the additional details on the vendor supplied mobile de-watering station area and subsystem, and its compliance with the NRC regulatory requirements and conformance to the NRC guidance. **RAI 2749, Question 11.04-1** is being tracked as **Confirmatory Item 11.04-1** pending verification that the change is incorporated in a future revision of the CPNPP, Unit 3 and 4 FSAR.

In response to **RAI 2749, Question 11.04-2** dated October 19, 2009; the applicant described the mobile de-watering subsystem and operations from DCD, Revision 2, Sections 11.4.1.3, 11.4.2.2.1, and 11.4.4.5. The mobile de-watering subsystem discharges from the spent resin fillhead to the WHT for reprocessing. The de-watering (vacuuming) pump design conforms to the guidance in RG 1.143 and removes standing water to comply with waste disposal and transportation requirements. Other design features and specifications of the mobile de-watering station area and subsystem are described above. The staff found the applicant's response, as evaluated in the response to **RAI 2749, Question 11.04-1** acceptable. **RAI 2749, Question 11.04-2** is closed.

- STD COL 11.4(8) Piping and Instrumentation Diagrams.

The applicant provided additional information in CP COL 11.4(8) to satisfy COL Information Item 11.4(8) in DCD, Revision 2. COL Information Item 11.4(8) states:

The COL applicant is to provide piping and instrumentation diagrams (P&IDs).

The applicant addressed this COL information item in FSAR Section 11.4.2.2.1 and Figure 11.4-201, which depicts the configuration of the SWMS including the vendor supplied de-watering station in the P&IDs. Figure 11.4-201 includes a P&ID of the spent resin storage system with a connection for a vendor supplied de-watering system. The system includes two SRST, a modular de-watering station, and a cross-tie between the SRST. Based on the above description, the staff finds the additional information included in CP COL 11.4(8) acceptable.

- CP COL 11.4(9) Epoxy Coatings Program.

The applicant provided additional information in CP COL 11.4(9) to satisfy COL Information Item 11.4(9) in DCD, Revision 3. COL Information Item 11.4(9) states:

The COL applicant is responsible for identifying the implementation milestones for the coatings program used in the SWMS. The coatings program addresses RG 1.54 Revision 1, recognizing that more recent standards may be used if referenced in DCD Section 11.4.

The applicant addressed this COL information item in its response to **RAI 5374, Question 11.02-14**, dated April 19, 2011, as this new COL information item was generated as a result of the staff's concurrent review of DCD, Revision 2. Based on its review of DCD and FSAR, the staff found the information that required updating and needed to be addressed in FSAR Sections 11.2 and 11.4, from the US-APWR DCD design change to replace stainless-steel liners in the cells/cubicles of the LWMS and steel liners in the SRST rooms of the SWMS with epoxy coatings. Therefore, the staff in **RAI 5374, Question 11.02-14** requested that the applicant update the FSAR sections 1.9, 11.4, and 13.5, etc. to address CP COL 11.4(9) and satisfy COL Information Item 11.4(9). This item is addressed **RAI 523-4246, Question 11.02-29** in the DCD, where the staff requested information regarding the operational maintenance and assessment program (i.e., in-service coatings monitoring program), and asked the applicant to identify in the COLA the implementation milestones for the epoxy coatings program; and address the implementation milestones for decontaminable paints and suitable smooth-surface coatings applied to all areas inside the A/B including the floor under the pumps of the detergent drain subsystem for compliance with 10 CFR 20.1406 and in conformance with RG 1.54, Revision 1, or more recent industry standards and BTP 11-6.

In response to **RAI 5374, Question 11.02-14** dated April 19, 2011, the applicant provided a mark-up to FSAR Sections 11.2.4 and 11.4.6, and FSAR Tables 1.8-201, 1.9-201 and 13.4-201 with additional information to address CP COL 11.2(7) and 11.4(9) to satisfy COL Information Items 11.2(7) and 11.4(9), respectively, in DCD, Revision 3.

Specifically, the applicant proposed an operational program in Table 13.4-201 to implement the Epoxy Coatings Program prior to plant start-up.

The applicant added FSAR Sections 11.2.4 and 11.4.6 to identify the Epoxy Coatings Program used to facilitate the ALARA objective of promoting decontamination in radiologically controlled areas outside containment. The Epoxy Coatings Program serves to control the refurbishment, repair, and replacement of coatings in accordance with the manufacturers' product data sheets and good painting practices, and will be implemented as described in FSAR Table 13.4-201. In FSAR Table 1.8-201, COL Information Item 11.4(9) was added to the resolution of COL information items. In FSAR Table 1.9-201, the applicant added conformance to RG 1.54, Revision 1, with the applicable exceptions as described in the corresponding FSAR Sections 11.2 and 11.4. The staff reviewed the mark-ups to the proposed revision to FSAR Sections 11.2.4 and 11.4.6, and FSAR Tables 1.8-201, 1.9-201 and 13.4-201 which include the commitment to follow recommendations from liner manufacturers for developing epoxy coating implementation and maintenance guidelines, and to address the implementation milestones for decontaminable paints, and found them acceptable. **RAI 5374, Question 11.02-14** is being tracked as **Confirmatory Item 11.02-9** pending verification that the change is incorporated in a future revision of the CPNPP, Units 3 and 4 FSAR.

In addition to the above COL information items, the staff reviewed the entire section against SRP Section 11.4 to determine if the information in FSAR Section 11.4 met the regulatory requirements in the regulations stated in Section 11.4.3 of this SE and SRP acceptance criteria. The relevant SRP acceptance criteria are as follows:

- All effluent releases (gaseous and liquid) associated with the operation (normal and AOOs) of the SWMS will comply with 10 CFR Part 20 and RG 1.143, as they relate to

the definition of the boundary of the SWMS beginning at the interface from plant systems, including multiunit stations, to the points of controlled liquid and gaseous effluent discharges to the environment or designated onsite storage locations, as defined in the PCP and ODCM.

- Operational Programs. For COL reviews, the description of the operational program and proposed implementation milestone for the PCP aspect of the process and effluent monitoring and sampling program are reviewed in accordance with 10 CFR 20.1301; 10 CFR 20.1302; 10 CFR 50.34a; 10 CFR 50.36a; and 10 CFR Part 50, Appendix I, Sections II and IV. The operational PCP program is implemented as required by a license condition.

The staff is unable to reach the above findings until all RAIs on both the US-APWR DCD and CPNPP, Units 3 and 4 COL FSAR is satisfactorily resolved.

Operational Program

As stated in the COLA Part 2, FSAR Table 13.4-201, Item 9 and the COLA Part 10, the applicant proposed to include the following license condition regarding the process and effluent monitoring and sampling program:

- License Condition (11-1) - The licensee shall implement the Process and Effluent Monitoring and Sampling Program, including the Process Control program prior to receipt of radioactive material on-site.

The applicant provided this a commitment for the development and implementation of a plant-specific PCP in FSAR Section 13.4, 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 (ADAMS Accession Number ML091460627), and is included as a commitment under CP COL 11.4(1). The staff finds the scope of the PCP and commitment for its implementation to be 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 applicant included a commitment, under COL Information Item 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 07-09A to be acceptable (ADAMS Accession Number ML091050234). The staff finds the commitment to use NEI 07-09A acceptable. The staff's evaluation of the ODCM is presented in Section 11.5 of this SE.

Technical Specifications

Chapter 16 of the FSAR states that the US-APWR TS and Bases in the DCD are incorporated by reference into Section B of Part 4 of the COLA.

Departures and Exemption Requests

Part 7, "Generic DCD Departures Report," of the COL that would indicate departures or exemption requests from the information presented in US-APWR DCD associated with the design and operation of the SWMS and site-specific characteristics in solid waste processing are not used and; therefore, are not evaluated by the staff.

Compliance with ECLs and Doses to Members of the Public

Under Appendix B to 10 CFR Part 20 and Appendix I to 10 CFR Part 50, 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, Sections II.A, II.B, II.C, and II.C of Appendix I to 10 CFR Part 50 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 Appendix B to 10 CFR Part 20 and Appendix I to 10 CFR Part 50 for the SWMS is subsumed in FSAR Section 11.2 for the LWMS and FSAR Section 11.3 for the GWMS. Sections 11.2 and 11.3 of this SE present the results of the staff's evaluation in confirming compliance with dose and ECLs of 10 CFR Part 20 for members of the public and design objectives of Appendix I to 10 CFR Part 50.

11.4.5 Post Combined License Activities

As stated in the COLA Part 2, FSAR Table 13.4-201, Item 9 and the COLA Part 10, the applicant proposed to include the following license condition regarding the process and effluent monitoring and sampling program:

- License Condition (11-1) - The licensee shall implement the Process and Effluent Monitoring and Sampling Program, including the Process Control program prior to receipt of radioactive material on-site.

11.4.6 Conclusion

Except for the open and confirmatory items identified below, the staff concludes that the SWMS, which includes the equipment necessary to process liquid, wet, and dry solid wastes and control releases of radioactive materials associated with the operation of the SWMS, is acceptable and meets the requirements of 10 CFR 20.1301; 10 CFR 20.1302; 10 CFR 20.1301(e); 10 CFR 20.1406; 10 CFR 20.2006; 10 CFR 20.2007; 10 CFR 20.2108; 10 CFR 50.34a and 10 CFR Part 50, Appendix I; GDC 60, GDC 61, and GDC 63; 10 CFR Part 61; 10 CFR Part 71; and 49 CFR Parts 171 through 180 for the proper classification, characterization, packaging, shipment, and disposal of radioactive wastes; and applicable BTPs and RGs. This conclusion is based on the following:

- The applicant has met the requirements of GDC 60, GDC 61, and GDC 63 with respect to controlling releases of radioactive materials to the environment, containing radioactive materials, and measures to detect conditions that may result in excessive radioactivity or radiation levels. As demonstrated in the CPNPP, Units 3 and 4 COL FSAR Section 12.4 using site specific conditions, all releases are conducted via the LWMS and GWMS and comply with the design objectives of Appendix I to 10 CFR Part 50 and the requirements of 10 CFR 20.1301; 10 CFR 20.1302; and 10 CFR 20.1301(e).
- The applicant's proposed PCP for CPNPP, Units 3 and 4 and operating procedures, as they relate to classifying, processing, and disposing of wastes, meets the requirements of 10 CFR Part 61; 10 CFR 20.2006; 10 CFR 20.2007; and 10 CFR 20.2108. The staff concludes that the endorsement of NEI PCP Template 07-10A and SWMS supplemental information contained in the CPNPP, Units 3 and 4 COL FSAR Section 11.4 are consistent with the requirements of GL 89-01 and guidance of NUREG-1301 for PWR plants and NUREG-0133.
- The applicant has met the requirements of 10 CFR 20.1406, IE Bulletin 80-10, and the guidance of RG 4.21 with respect to providing a description of how facility design features and procedures for operation, described in the CPNPP, Units 3 and 4 COL FSAR Sections 11.4 and 12.3, will minimize, to the extent practicable, contamination of the facility and the environment; facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of radioactive waste.
- The applicant demonstrates compliance with the requirements of 10 CFR 52.80(a) and ITAAC for the SWMS. The ITAAC address the descriptions and functional arrangements of the SWMS. The proposed ITAAC once performed by the COL applicant and meeting their respective acceptance criteria, provide reasonable assurance that a plant that incorporates the US-APWR DC and establishes operational programs in accordance with the DC and site specific conditions will meet the provisions of NRC regulations.

For the following open item, tracked under **Open Item 11.04-1, RAI 3401, Question 11.04-4** related to the onsite common radwaste interim storage facility, the staff concludes, using the information presented in the application, that the applicant has not fully demonstrated compliance with the NRC regulations and guidance in the chosen long-term storage option(s) for the staff to evaluate compliance with the NRC regulations, including 10 CFR 20.1301; 10 CFR 20.1302; 40 CFR Part 190 as referenced in 10 CFR 20.1301(e); 10 CFR 50.34a; 10 CFR 50.59; 10 CFR 61.55; and 10 CFR 61.56 as they relate to waste classification and characteristics. Nor has the applicant demonstrated consistency with the guidance and acceptance criteria of SRP Section 11.4, RG 1.143, and industry guidance as applicable.

For the following confirmatory items, tracked under **Confirmatory Item 11.04-1, RAI 2749, Question 11.04-1** related to the mobile de-watering subsystem and **Confirmatory Item 11.02-9, RAI 5374, Question 11.02-14** related to the Epoxy Coatings Program, the staff will confirm that these items are incorporated into a future revision of the CPNPP, Units 3 and 4 FSAR.

11.5 Process Effluent Radiological Monitoring and Sampling Systems (PERMS)

11.5.1 Introduction

The PERMS are used to monitor liquid and gaseous process streams and effluent releases from RWMS during normal operation, AOOs, and post-accident conditions. The systems include radiation monitors to detect and measure radioactivity and radiation levels and to provide indication of radioactive release rates or concentration levels in process and effluent streams. The PERMS include sampling systems to extract samples from process or effluent streams and to provide the means to collect samples on filtration and in adsorbent media. The PERMS provide the means to establish alarm set points for the purpose of indicating when excessive radioactivity levels are present, track and record rates of radioactivity releases, and initiate protective isolation actions, such as terminating or diverting process or effluent flows. Typically, the system consists of skid-mounted radiation monitoring equipment and permanently installed sampling lines with the equipment being 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 in confirming measurement results recorded by radiation monitors and determining radioactivity levels associated with 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 control rooms. The PERMS 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 to 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

Section 11.5, "Process Effluent Radiological Monitoring and Sampling Systems," of the CPNPP, Units 3 and 4 COL FSAR, Revision 1, incorporates by reference, with supplemental information, Section 11.5, "Process Effluent Radiological Monitoring and Sampling Systems," of the US-APWR DCD, Revision 2. The applicant provided additional information in response to the COL information items identified in US-APWR DCD Section 1.8 and Table 1.8-2. The applicant provided information in FSAR Section 10.4 on the SGBN return water radiation monitor evaluated by the staff in this section of the SE.

The staff reviewed the COLA and evaluated the referenced DC application for any outstanding issues related to the review of the PERMS. The staff's review determined that there were some outstanding issues, as discussed in this section of the SE.

US-APWR COL Information Items

- CP SUP 11.5(1) Essential Service Water (ESW) Pipe Tunnel Structure.

The applicant added supplemental information in CP SUP 11.5(1) regarding a change in the ESW pipe tunnel structure pipe tunnel structure at elevation 793'-1".

- CP COL 11.5(1) Site-Specific Aspects.

The applicant provided additional information in CP COL 11.5(1) to satisfy COL Information Item 11.5(1) in DCD, Revision 2, regarding site-specific aspects of the PERMS.

- CP COL 11.5(2) Offsite Dose Calculation Manual.

The applicant provided additional information in CP COL 11.5(2) to satisfy COL Information Item 11.5(2) in DCD, Revision 2, regarding the site-specific aspects of the ODCM.

- CP COL 11.5(3) Radiological and Environmental Monitoring Program.

The applicant provided additional information in CP COL 11.5(3) to satisfy COL Information Item 11.5(3) in DCD, Revision 2, regarding the site-specific aspects of the REMP.

- CP COL 11.5(4) Inspection, Decontamination, and Replacement and
- CP COL 11.5(5) Analytical Procedures.

The applicant provided additional information in CP COL 11.5(4) to satisfy COL Information Items 11.5(4) and CP COL 11.5(5) to satisfy COL Information Item 11.5(4) in DCD, Revision 2, regarding the development of site-specific procedures related to equipment inspection, calibration, and maintenance of monitoring and sampling equipment, radioactive waste systems, analytical procedures, and regulated record keeping implemented under a quality assurance (QA) program.

- CP COL 11.5(6) Site-Specific Cost Benefit Analysis.

The applicant provided additional information in CP COL 11.5(6) to satisfy COL Information Item 11.5(6) in DCD, Revision 2, regarding the site-specific CBA.

- CP COL 10.4(2) Steam Generator Blowdown System.

The applicant provided additional information in CP COL 10.4(2) to satisfy, in part, COL Information Item 10.4(2) in DCD, Revision 2, regarding the site-specific SGBD return water radiation monitor located in the piping downstream of the demineralizers.

Interface Requirements

The applicant provided additional information to address the significant site specific interfaces described in US-APWR DCD Revision 2, Tier 2, Section 1.8, Table 1.8-1, "Significant Site-Specific Interfaces with the Standard US-APWR Design." The applicant in COL FSAR Revision 1, Section 1.8, Table 1.8-1R, "Significant Site-Specific Interfaces with the Standard US-APWR Design," described the interface, "Effluent Monitoring and Sampling."

11.5.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the US-APWR DCD. In addition, the relevant requirements of the NRC regulations for site-specific information regarding the PERMS, and the associated acceptance criteria, are provided in SRP Section 11.5. The following lists the basis for which site specific information was evaluated, either because the applicant provided site-specific information, or the staff's review determined that supplemental information was necessary in the CPNPP, Units 3 and 4 COL FSAR. The regulatory basis includes:

1. 10 CFR 20.1302 and 10 CFR 20.1301(e), related to monitoring radioactivity in plant radiological effluents to unrestricted areas. 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 52.80(a), as it relates to inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act of 1954, and the NRC's regulations.
5. Appendix I to 10 CFR Part 50, 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 following RG and the NRC documents contain regulatory positions and guidance in demonstrating compliance with the relevant requirements of the regulations identified above:

1. NUREG-0800, SRP Section 11.5, "Process and Effluent Radiological Monitoring Instrumentation and Sampling Systems," as it relates to SRP acceptance criteria for the design basis of process and effluent radiation monitoring instrumentation and sampling systems.
2. NUREG-0800, SRP Section 11.5, Appendix 11.5-A, "Design Guidance for Radiological Effluent Monitors Providing Signals for Initiating Termination of Flow or Other Modification of Effluent Stream Properties," as it relates to the design of instrumentation with automatic control functions.
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 and site-specific ODCM program. Alternatively, a COL applicant may use NEI

ODCM Template 07-09A (Revision 0, issued 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 FSAR Section 13.4 of a COLA. The staff has reviewed NEI 07-09A and determined it to be acceptable (ADAMS Accession Number ML091050234).

4. GL 89-01 as it relates to the restructuring of the ODCM, PCP, RETS or SREC, and implementation of a REMP. (GL 89-01 is included in NUREG-1301).
5. ANSI/ANS-55.6-1993 (R2007), "Liquid Radioactive Waste Processing for Light Water Reactor Plants," as it relates to process and effluent radiation monitor sensitivity to assure that discharges are within established limits and allow determination of the integrated quantity of radioactivity.
6. RG 1.21, "Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste," Revision 1, issued June 1974, as it relates to guidance for the design, implementation, and QA of effluent monitoring and sampling systems.
7. RG 1.33, "Quality Assurance Program Requirements (Operation)," Revision 2, issued February 1978, as it relates to QA for the operation of the LWMS provisions for the sampling and monitoring of radioactive materials in process and effluent streams and control of radioactive effluent releases to the environment.
8. RG 4.15, "Quality Assurance for Radiological Monitoring Programs (Inception Through Normal Operations to License Termination) - Effluent Streams and the Environment," Revision 2, issued July 2007, as it relates to the design, implementation, and QA of effluent monitoring and sampling systems.
9. RG 4.21, "Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning," issued June 2008, as it relates to minimizing the contamination of equipment, plant facilities, and environment, and minimizing the generation of radioactive waste during plant operation.

11.5.4 Technical Evaluation

The staff reviewed Section 11.5 of the CPNPP, Units 3 and 4 COL FSAR and checked the referenced US-APWR DCD to ensure that the combination of the DCD and information in the FSAR represent the complete scope of information relating to the review of the PERMS. The staff is reviewing Section 11.5 of the US-APWR DCD on Docket Number 52-021. The staff's technical evaluation of the information incorporated by reference relating to PERMS will be documented in the staff's SE regarding the DC application for the US-APWR design.

The staff reviewed Section 11.5 of the CPNPP, Units 3 and 4 COL FSAR against Section 11.5 of the SRP to determine if the information contained in FSAR Section 11.5 met the requirements of the NRC regulations and SRP acceptance criteria and guidance. The staff also reviewed conformance of Section 11.5 of the FSAR to the guidance in RG 1.206, Section C.III.1, Chapter C.1.11.5. The staff's review confirmed that the information contained in the COL and

incorporated by reference in the FSAR addresses the required information related to the PERMS. However, the staff's review determined that there were some site-specific issues, as discussed below.

The NEI ODCM Template 07-09A has been reviewed and found acceptable by the staff (ADAMS Accession Number ML091050234). NEI 07-09A also addresses the SREC and REMP. The description of the implementation of its administrative and operational programs for the SREC, ODCM, and REMP were found consistent with the requirements of GL 89-01; and the guidance of NUREG-1301, NUREG-0133, RG 1.21, RG 1.33, RG 4.1, RG 4.8, RG 4.15, and the Radiological Assessment BTP. The results of the staff's SE, dated January 27, 2009, are presented under ADAMS Accession Number ML083530745.

Combined License Information Items

- CP SUP 11.5(1)

The applicant added supplemental information in CPNPP, Units 3 and 4 COL FSAR Section 11.5 and Figure 1.2-2R, and provided a change on the site-specific ESW pipe tunnel structure at elevation 793'-1".

Since the site-specific modification of the ESW pipe tunnel structure does not result in a change of location for the process effluent radiation monitors presented in the US-APWR DCD, Chapter 11, the staff has determined that CP SUP 11.5(1) is acceptable.

- CP COL 11.5(1) Site-Specific Aspects

The applicant provided additional information in CP COL 11.5(1) to satisfy COL Information Item 11.5(1). COL Information Item 11.5(1) states:

The COL applicant is responsible for the additional site-specific aspects of the process and effluent monitoring and sampling system beyond the standard design, in accordance with RGs 1.21, 1.33 and 4.15. Furthermore, the COL applicant is responsible for assuring the fulfillment of the guidelines issued in 10 CFR 50, Appendix I regarding the offsite doses released through gaseous and liquid effluent streams.

The applicant addressed this COL information item in FSAR Sections 11.5.2.9 and 11.5.2.5.3 (evaluated later in this section of the SE), and commits to describe in the ODCM, methods used to derive doses for members of the public and demonstrate compliance with the dose objectives in Appendix I to 10 CFR Part 50, as they relate to liquid and gaseous effluent releases. The milestones for the development and implementation of the ODCM are addressed in FSAR Section 13.4.

- CP COL 11.5(2) Offsite Dose Calculation Manual.

The applicant provided additional information in CP COL 11.5(2) to satisfy COL Information Item 11.5(2). COL information item 11.5(2) states:

The COL applicant is to prepare an offsite dose calculation manual to provide specific administrative controls and liquid and gaseous effluent source terms to limit the releases to site-specific requirements containing a description of the methods and parameters that drive to arrive radiation instrumentation alarm setpoint. The COL applicant is to commit to follow the NEI generic template 07-09 as an alternative to providing the offsite dose calculation manual at the time of application.

The applicant addressed this COL information item in FSAR Section 11.5.2.9, and adopted NEI 07-09A, which addresses the ODCM. The ODCM provides the rationale for compliance with the radiological effluent TS and for the calculation of appropriate set-points for effluent monitors. The milestones for the development and implementation of the ODCM are addressed in FSAR Section 13.4. NEI 07-09A presents the functional elements of an ODCM that, if met, would demonstrate compliance with 10 CFR 50.34a; 10 CFR 50.36a; and 10 CFR Part 50, Appendix I. NEI 07-09A 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 set-points, dose limits for members of the public, requirements for process and effluent sampling in various plant systems, requirements limiting effluent releases, surveillance requirements, methods for calculating effluent release rates and doses, radiological environmental monitoring, QA 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 CPNPP, Units 3 and 4 ODCM and supporting procedures, and record keeping.

Based on a review of the above COL information items, the staff found that CP COL 11.5(1) and CP COL 11.5(2) are addressed in FSAR Section 13.4, Table 13.4-201, item 9, which lists the milestones for the development and implementation of the ODCM as receipt of radioactive materials onsite, with the requirement being a license condition. However, because FSAR, Revision 0, Sections 11.5.2.9 and 11.3.3.3 indicated the existing ODCM (CPNPP, Units 1 and 2) was to reflect the new units (CPNPP, Units 3 and 4), it was not clear whether the ODCM for the existing units adequately addressed all elements in NEI 07-09A approved by the NRC in March 2009. Therefore, the staff in **RAI 3402, Question 11.05-1** requested that the applicant clarify this statement.

In response to **RAI 3402, Question 11.05-1** dated September October 19, 2009, the applicant referred to its response to **RAI 3400, Question 11.03-2 Item 7**. In response to **RAI 3400, Question 11.03-2, Item 7**, the applicant stated FSAR Section 11.3.3.3 was deleted in FSAR UTR, Revision 0 (ADAMS Accession Number ML091120280) to reflect the combination of COL Information Items 11.5(2) and 11.5(3) in the DCD. In addition, FSAR UTR, Revision 4 (ADAMS Accession Number ML092520125), Section 11.5.2.9 was revised to reflect that the ODCM will be re-written to apply to all four CPNPP units and conform with NEI 07-09A. The applicant stated the ODCM re-write to all four CPNPP units will be accomplished before receipt of radioactive material in CPNPP, Unit 3 in accordance with FSAR Table 13.4-201. The staff reviewed the applicant's response and found it acceptable because NEI 07-09A will be followed for all four CPNPP units to demonstrate compliance with 10 CFR 50.34a; 10 CFR 50.36a; and 10 CFR Part 50, Appendix I. **RAI 3402, Question 11.05-1** is closed.

- CP COL 11.5(3) Radiological Environmental Monitoring Program.

The applicant provided additional information in CP COL 11.5(3) to satisfy COL Information Item 11.5(3). COL Information Item 11.5(3) states:

The COL applicant is to develop a radiological and environmental monitoring program taking into consideration local land use and census data in identifying all potential radiation exposure pathways. The program shall take into account associated radioactive materials present in liquid and gaseous effluents and direct external radiation from SSCs. The COL applicant is to follow the guidance outlined in NUREG-1301, and NUREG-0133 when developing the radiological effluent monitoring program. The COL applicant is to commit to follow the NEI generic template 07-09 as an alternative to providing the radiological effluent monitoring program at the time of application.

The applicant addressed this COL information item in FSAR Section 11.5.2.10, and adopted NEI 07-09A, which addresses the REMP. The REMP describes a process and methods for monitoring, sampling, and analyzing environmental samples representative of expected radionuclide distributions and concentrations in environmental media and associated exposure pathways. The REMP also identifies types, numbers, and sampling locations, and sampling and analytical frequencies of environmental samples. The REMP follows the guidance of GL 89-01, NUREG-1301, NUREG-0133, and the Radiological Assessment BTP.

The staff found this item satisfactorily addressed in FSAR Section 13.4, Table 13.4-201, Item 9, which lists the milestone for development and implementation of the REMP as receipt of radioactive materials onsite, with the requirement being a license condition.

- CP COL 11.5(4) Inspection, Decontamination, and Replacement.

The applicant provided additional information in CP COL 11.5(4) to satisfy COL Information Item 11.5(4). COL Information Item 11.5(4) states:

The COL applicant is to develop procedures which are of inspection, decontamination, and replacement related to radiation monitoring instruments.

- CP COL 11.5(5) Analytical Procedures.

The applicant provided additional information in CP COL 11.5(5) to satisfy COL Information Item 11.5(5). COL Information Item 11.5(5) states:

The COL applicant is to provide analytical procedures and sensitivity for selected radioanalytical methods and type of sampling media for site-specific matter.

The applicant addressed this COL information item in FSAR Sections 11.5.2.6 and 11.5.2.8, and described the development of site-specific procedures for acquiring and evaluating samples

of radioactive effluents, and inspection, calibration, and maintenance of the monitoring and sampling equipment in accordance with RG 1.21 and RG 4.15. The applicant described procedures for the radioactive waste systems and analytical procedures are to be developed in accordance with RG 1.33 and RG 1.21, respectively. Site-specific procedures on equipment inspection, calibration, maintenance, and regulated record keeping are to be developed to comply with 10 CFR 20.1301; 10 CFR 20.1302; and Appendix I to 10 CFR 50. The applicant states these site-specific procedures are prepared and implemented under the QA program in FSAR Chapter 17.

The staff reviewed the additional information included in FSAR, Revision 0, Sections 11.5.2.6 and 11.5.2.8 and found an inconsistency in regards to implementation of site-specific procedures to satisfy CP COL 11.5(4) and CP COL 11.5(5) under the QA Program in FSAR Chapter 17. FSAR Sections 11.5.2.6 and 11.5.2.8 indicate site-specific procedures are prepared and implemented under the QA Program described in FSAR Chapter 17. However, FSAR Section 17.5.3 discusses use of an existing NRC approved QA Programs for CPNPP, Units 1 and 2 (based on ANSI/ASME N45.2-1971) which differs from SRP Section 17.5 (based on ASME NQA-1-1994, RG 1.8, RG 1.28, and RG 1.33). As a result, the staff requested the applicant in **RAI 3602, Question 11.05-3** to justify the use of ANSI/ASME N45.2-1971 (Revised in 1977 - inactive standard) and departure from SRP Section 17.5 on the QA Program for CPNPP, Units 3 and 4.

In response to **RAI 3602, Question 11.05-3** dated September 15, 2009, the applicant stated that it will transition activities to the QA Program Document based on NQA-1, RG 1.8, RG 1.28, and RG 1.33 sometime during the construction of CPNPP, Units 3 and 4, but no later than 30 days before fuel load of CPNPP, Unit 3. The description of the CPNPP, Units 3 and 4 QA Program including the transition process is provided in response to **RAI 2996, Question 17.5-1** which resulted in changes to FSAR Chapter 17 and evaluated by the staff in Chapter 17 of the SE. Also, FSAR Section 11.5.2.6 was revised to state the [analytical] procedures described in FSAR Section 13.5.2 are prepared and implemented under the QA Program referenced in FSAR Chapter 17. The staff confirmed that Revision 1 to the FSAR included this information. The staff's evaluation regarding procedures is presented in Section 13.5 of the SE. The applicant stated the site-specific procedures for radioactive effluents, analytical procedures, instrument calibration, and regulated records will be developed before CPNPP, Unit 3 fuel load, and will comply with the CPNPP, Units 3 and 4 QA Program Document, NQA-1, and relevant RG as discussed in the FSAR. Because the QA Program is evaluated by the staff in Chapter 17 of the SE, **RAI 3602, Question 11.05-3** is closed.

- CP COL 11.5(6) Site-Specific Cost Benefit Analysis.

The COL applicant provided additional information in CP COL 11.5(6) to satisfy COL Information Item 11.5(6). COL Information Item 11.5(6) states:

The COL applicant is to perform a site-specific cost benefit analysis to demonstrate compliance with the regulatory requirements.

The applicant replaced the content of DCD Section 11.5.2.11 to state the results of the site-specific CBA are described in FSAR Sections 11.2.1.5 and 11.3.1.5 to satisfy COL Information Items 11.2(5) and 11.3(8) for the LWMS and GWMS, respectively. The staff found this

acceptable because the PERMS do not generate additional sources of radioactive materials associated with its operation that would result in doses to members of the public and require a CBA.

Based on its review of FSAR, Revision 1; UTR, Revision 4, and response to **RAI 2747, Question 11.02-4**, by letter dated September 24, 2009, the staff found that information regarding in-line process liquid effluent radiation monitor (RE-035) sensitivity for compliance with 10 CFR Part 50, Appendix A, GDC 60 and GDC 64, and conformance to SRP Sections 11.2 and 11.5 was not fully described.

In response to **RAI 2747, Question 11.02-4, Item 3**, dated September 24, 2009, the applicant states a portion of the [liquid] flow will go through the in-line process liquid effluent radiation monitor (RE-035) in the unlikely event that the bypass valve (VLV-531) which is normally locked-closed and tagged is left open or partially open. The in-line process liquid effluent radiation monitor (RE-035) is to initiate pump shutdown, valve closure, and operator actions when the monitor reaches the high set-point, but can be bypassed along with discharge control valves (RCV-035A/B) to ensure the discharge operation is not interrupted by either failure of control valves and/or radiation monitor. Because Section 5.5 of ANSI/ANS-55.6-1993 (R2007), referenced in SRP Section 11.2, states that process and effluent radiation monitors shall have sensitivity sufficient to establish that discharges are within established limits and allow determination of the integrated quantity of radioactivity, the staff closed **RAI 2747, Question 11.02-4, Item 3** and requested, in follow-up **RAI 5377, Question 11.05-4**, that the applicant provide a detailed analysis with the methodology, basis, and assumptions which demonstrates that the in-line process liquid effluent radiation monitor (RE-035) has adequate sensitivity to meet its design objectives under the operation condition with reduced liquid discharge flow rates.

In response to **RAI 5377, Question 11.05-4** dated April 13, 2011, the applicant stated, as discussed also in response to **RAI 3402, Question 11.05-2**, dated April 13, 2011, the bypass valve (VLV-531) is administratively controlled and normally maintained in the locked-closed position, which that can only be opened with a key controlled by CPNPP Operations, and its position status is verified by two technically-qualified members of CPNPP Operations such that there is no anticipated flow path through bypass valve (VLV-531). To demonstrate that the in-line process liquid effluent radiation monitor (RE-035) has adequate sensitivity, the applicant considered a conservative analysis in which the bypass valve (VLV-531) is inadvertently left fully open. The applicant calculated the average liquid effluent radionuclide concentration using the annual liquid effluent releases from two waste streams (shim bleed and misc. wastes) for major gamma-emitting radionuclides selected in DCD, Revision 2, Table 11.2-10 derived from ANSI/ANS-N18.1-1999, "Radioactive Source Term for Normal Operation of Light Water Reactors," and the MHI PWR-GALE code (evaluated in Chapter 11 of the SE for the DCD), and volume flow rates for the two sources of liquid effluents (waste monitor tank (WMT) via the HT and WHT in DCD, Revision 2, Table 11.2-9.

The staff reviewed the applicant's methodology, basis, and assumptions and confirmed that the calculated average radionuclide concentration meets the lower range of $1E-07\mu\text{Ci}/\text{cm}^3$ for the process liquid effluent radiation monitor (RE-035) and allows for the determination of the integrated quantity of radioactivity. Further, the applicant commits to revise the FSAR and include administrative and procedural requirements which includes bypass valve (VLV-035)

verification and sampling of the WMT (ATK-006A/B) contents prior to its release to ensure that the liquid ECLs in 10 CFR Part 20, Appendix B are not exceeded for the batch releases. **RAI 5377, Question 11.05-4** and part of **RAI 3402, Question 11.05-2** related to the in-line process liquid effluent radiation monitor (RE-035) sensitivity are closed.

Steam Generator Blowdown System Radiation Monitor (RMS-RE-110)

The staff also reviewed a COL information item in which the applicant is to address in FSAR Section 11.5, design information on the site-specific SGBD return water radiation monitor.

- CP COL 10.4(2) Steam Generator Blowdown System.

The applicant provided additional information in CP COL 10.4(2) to satisfy COL Information Item 10.4(2) which states:

The Combined License applicant is to address the discharge to Waste Water System including site-specific requirements.

In FSAR, Revision 0, Section 10.4, the applicant provided additional information in CP COL 10.4(2) to satisfy COL Information Item 10.4(2), in part, regarding the site-specific SGBD return water radiation monitor located in piping downstream of the demineralizers.

From review of FSAR, Revision 0, Sections 10.4 and 11.5, and information provided on CP COL 10.4(2) and CP COL 11.5(1), the staff found that sufficient design information regarding the SGBD radiation monitor used in the blowdown system was not provided. CP COL 10.4(2) in FSAR, Revision 0, Section 10.4.8.2.1 states:

A radiation monitor located downstream of the startup SG blowdown heat exchanger measures radioactive level in the blowdown water. When an abnormally high radiation level is detected, the blowdown lines are isolated and the blowdown water included in the SGBDS is transferred to waste holdup tank in the LWMS. The location and other technical details of the monitor will be developed during the detail design phase.

COL 10.4(2) in the DCD (Revision 2) instructs the COL applicant to address the discharge to Waste Water System including site-specific requirements for the SGBDS.

As a result of the staff not finding sufficient design information regarding the SGBD radiation monitor used in the blowdown system, the staff requested in **RAI 3402, Question 11.05-2** that the applicant provide in FSAR Section 11.5 the location and design details regarding the SGBD radiation monitor; describe how the SGBD radiation monitor design complies with TS 3.4.13, "RCS Operational Leakage," and TS 5.5.9, "Steam Generator Program," conforms to NEI 97-06 and Electric Power Research Institute (EPRI) Guidelines, and satisfies ITAAC and preoperational testing for sensitivity, response time, and alarm limit; tabulate the SGBD radiation monitor design information consistent as other process radiation monitors; revise CP COL 10.4(2) to remove the statement that details of the SGBD radiation monitor will be developed during the detail design phase; and explain the bypass around the SGBD radiation monitor in FSAR Figure 10.4.8-201

In the response to **RAI 3402, Question 11.05-2** dated October 19, 2009, to address CP COL 11.5(1) and CP COL 10.4(2), in part, the applicant provided a mark-up adding Part 2 FSAR Section 11.5.2.5.3, "Startup Steam Generator Blowdown Heat Exchanger Downstream Radiation Monitor (RMS-RE-110)," Table 11.5-201, "Effluent Liquid Monitors (Site-Specific)," Figure 11.5-201, "Typical Process In-Line Radiation Monitor Schematic," and Part 10 ITAAC and Proposed License Conditions, Appendix A.5, "Plant-Specific Process Effluent Radiation Monitoring and Sampling (PERMS)," and Tables A.5.1, "Process Effluent Radiation Monitoring and Sampling (Perms) System Inspections, Tests, Analyses, Acceptance Criteria," and A.5.2, "Process Effluent Radiation Monitoring and Sampling System Equipment Characteristics." The staff's review of the provided information found all design information acceptable for the SGBDS radiation monitor.

In DCD, Revision 2, Section 11.5.2.4.2, "Condenser Vacuum Pump Exhaust Line Radiation Monitors (RMS-RE-043A, RMS-RE-043B, RMS-RE-081A and RMS-RE-081B)," states that the condenser vacuum pump exhaust line radiation monitors are the primary monitors are used to estimate the primary-to-secondary leakage rate. Because Surveillance Requirement (SR) 3.4.13.2 relating to primary-to-secondary leakage applies during startup and not until after establishment of steady state operations, SR 3.4.13.2, TS 3.4.13, and TS 5.5.9 are not applicable to the startup SGBD heat exchanger downstream radiation monitor (RMS-RE-110). However, the applicant stated the startup SGBD heat exchanger downstream radiation monitor (RMS-RE-110) will conform to NEI 97-06 and the EPRI Guidelines for startup requirements.

The non-safety related startup SGBD heat exchanger downstream radiation monitor (RMS-RE-110) in the SGBDS detects the presence of radioactivity in the blowdown sample line from SG tube leakage. FSAR Section 11.5.2.5.3 states when an abnormally high radiation level is detected, blowdown lines are isolated, and the blowdown water in the SGBNS is transferred to a WHT in the LWMS. The applicant added FSAR Table 11.5-201 and Figure 11.5-201 on the design details and process schematic of the startup SGBD heat exchanger downstream radiation monitor (RMS-RE-110). Additionally, the applicant added Tables A.5-1 and A.5-2 in Appendix A.5 to Part 10 ITAAC and Proposed License Conditions to identify the ITAAC and PERMS characteristics required for the startup SGBD heat exchanger downstream radiation monitor (RMS-RE-110). CP COL 10.4(2) was revised to remove the statement that details of the SGBD radiation monitor will be developed during the detail design phase.

In regards to the bypass line and valve depicted in FSAR Figure 10.4.8-201, the applicant states these components are for maintenance of the startup SGBD heat exchanger downstream radiation monitor (RMS-RE-110) and for personnel protection when work is being performed, and states the bypass valve is normally locked closed and not used during normal operation or startup.

Based on the above, the staff found the applicant's proposed FSAR changes acceptable because it addresses the site-specific design of the startup SGBD heat exchanger downstream radiation monitor (RMS-RE-110) in Part 2 FSAR and Part 10 ITAAC and Proposed License Conditions consistent with the other PERMS monitors to meet compliance with 10 CFR 50.34a and 10 CFR 52.80(a). Therefore, part of **RAI 3402, Question 11.05-2** related to the SGBDS radiation monitor site-specific design is being tracked as **Confirmatory Item 11.05-2** pending

verification that the change is incorporated in a future revision of the CPNPP, Units 3 and 4 FSAR.

Evaporation Pond Discharge Radiation Monitor (RMS-RE-111)

The staff issued **RAI 2747, Question 11.02-3** which requested the following: (1) Describe in the FSAR how the effluent holdup (evaporation) pond will meet the guidance of SRP Section 11.2, "Liquid Waste Management System," and RG 1.143, "Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants," Revision 2, issued November 2001, or justify an alternative; (2) Justify why radiation monitors downstream of the effluent holdup pond are not included, and further describe how releases from the effluent holdup pond are suitably controlled; (3) Discuss provisions for sampling of the effluent holdup pond or justify why these provisions are not discussed; (4) Clarify how the requirements of 10 CFR 20.1406, "Minimization of Contamination," are met; (5) Discuss in the FSAR the seismic and quality group classification of the effluent holdup pond and explain how it meets the other recommendations of RG 1.143, or justify an alternative.

In response to **RAI 2747, Question 11.02-3**, dated September 24, 2009, the applicant added an evaporation pond discharge radiation monitor (RMS-RE-111) in the evaporation pond design, evaluated in Section 11.2.5 of the SE, to manage the H-3 concentration in the SCR which has a TS limit of 30,000 pCi/L (H-3) by providing temporary holdup of treated liquid effluent for discharge. The evaporation pond discharge radiation monitor (RMS-RE-111) alarms in the radwaste control room and MCR for operator action in the event that the liquid effluent discharge exceeds the radiation setpoint, and simultaneously turns off the evaporation pond discharge pump and closes the discharge valve as depicted in the revised Figure 11.2-201 (Sheet 9 of 10). The applicant also added a design description in FSAR Section 11.5.2.5.4 and design information in FSAR Table 11.5-201. The proposed Table 11.5-201 includes information such as detector type (gamma), range ($1\text{E-}7$ $\mu\text{Ci}/\text{cm}^3$ to $1\text{E-}2$ $\mu\text{Ci}/\text{cm}^3$), calibration isotope (Cs-137), source check, and schematic and drawing information. The staff reviewed the mark-up to the proposed design description and specifications in FSAR Section 11.5.2.4 and Table 11.5-201, respectively, and found it acceptable because the site-specific design information on the evaporation pond discharge radiation monitor (RMS-RE-111) was provided. **RAI 2747, Question 11.02-3** regarding the design description and information on the evaporation pond discharge radiation monitor (RMS-RE-111) is being tracked as **Confirmatory Item 11.05-1**, pending verification that the change is incorporated in a future revision of the CPNPP, Units 3 and 4 FSAR.

Operational Program

As stated in the COLA Part 2, FSAR Table 13.4-201, Item 9 and the COLA Part 10, the applicant proposed to include the following license conditions regarding the process and effluent monitoring and sampling program:

- License Condition (11-2) - The licensee shall implement the Process and Effluent Monitoring and Sampling Program, including the RETS/SREC prior to receipt of radioactive material on-site.

- License Condition (11-3) - The licensee shall implement the Process and Effluent Monitoring and Sampling Program, including the ODCM prior to receipt of radioactive material on-site.
- License Condition (11-4) - The licensee shall implement the Process and Effluent Monitoring and Sampling Program, including the REMP prior to receipt of radioactive material on-site.

The applicant provided an implementation schedule addressing the development and implementation of a plant and site-specific process and effluent monitoring and sampling program in FSAR Section 13.4, Table 13.4-1, Item 9. The elements of the program consist of the RETS/ SREC, the ODCM, and the REMP. The program and its elements are included in NEI 07-09A, which the staff has determined to be acceptable (ADAMS Accession Number ML091050234), and is included as a commitment under CP COL 11.5(2). The staff finds the scope of the program and commitment for its implementation to be acceptable.

Technical Specifications

A review of CPNPP, Units 3 and 4 COL FSAR Chapter 16 shows that US-APWR DCD TS and Bases such as TS 5.5.1, "Offsite Dose Calculation Manual," TS 5.5.4, "Radioactive Effluent Controls Program," and TS 5.6.1, "Annual Radiological Environmental Operating Report," are incorporated by reference into Section B of Part 4 of the COLA. The use of an ODCM is mandated as one of the operational programs described in CPNPP, Units 3 and 4 COL FSAR Section 13.4 and 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 11.5(2), as described in US-APWR DCD Section 1.8 and Table 1.8-2, and under CP COL 11.5(2), as described in CPNPP, Units 3 and 4 COL FSAR Section 1.9.1 and Table 1.8-2.

Departures and Exemption Requests

Part 7, "Generic DCD Departures Report," of the COL that would indicate departures or exemption requests from the information presented in US-APWR DCD associated with the design and operation of the PERMS and site-specific characteristics in monitoring liquid and gaseous effluent releases are not used and; therefore, are not evaluated by the staff.

11.5.5 Post Combined License Activities

As stated in the COLA Part 2, FSAR Table 13.4-201, Item 9 and the COLA Part 10, the applicant proposed to include the following license conditions regarding the process and effluent monitoring and sampling program:

- License Condition (11-2) - The licensee shall implement the Process and Effluent Monitoring and Sampling Program, including the RETS/SREC prior to receipt of radioactive material on site.

- License Condition (11-3) - The licensee shall implement the Process and Effluent Monitoring and Sampling Program, including the ODCM prior to receipt of radioactive material on-site.
- License Condition (11-4) - The licensee shall implement the Process and Effluent Monitoring and Sampling Program, including the REMP prior to receipt of radioactive material on-site.

11.5.6 Conclusions

Except for the confirmatory items identified below, the staff concludes that the designs and operation of the PERMS necessary to monitor process and effluent streams and control releases of radioactive materials associated with the operation of the LWMS, GWMS, and SWMS to be acceptable and meet the applicable requirements of 10 CFR 20.1301; 10 CFR 20.1302; 10 CFR 20.1301(e); 10 CFR 20.1406; 10 CFR 50.34a; 10 CFR 50.36a; 10 CFR 50.34(f)(2)(xvii); 10 CFR 50.34(f)(2)(xxvii); 10 CFR Part 50, Appendix I; 10 CFR Part 50, Appendix A, GDC 60, GDC 63, and GDC 64; and 10 CFR 50.80(a). The staff conclusion is based on the following:

1. The PERMS includes the instrumentation for monitoring and sampling radioactivity for contaminated liquid, gaseous, and solid waste process and effluent streams under a broad range of routine operations and AOOs. The staff evaluated the provisions proposed to sample and monitor all appropriate process streams and effluent release points, including non-radioactive systems that could become contaminated through interfaces with radioactive systems.
2. The applicant has met the requirements of 10 CFR Part 50, Appendix A, GDC 60 and GDC 61 with respect to controlling releases of radioactive materials to the environment and associated offsite doses to members of the public by assuring that the design of the PERMS includes features to monitor and control releases of radioactive materials in liquid and gaseous effluents. As demonstrated in the CPNPP, Units 3 and 4 COL FSAR Section 12.4 using site-specific conditions, all releases are conducted via the LWMS and GWMS and comply with the design objectives of 10 CFR Part 50, Appendix I and the requirements of 10 CFR 20.1301; 10 CFR 20.1302; and 10 CFR 20.1301(e).
3. The applicant has met the requirements of 10 CFR 50.34(f)(2)(xvii) and 10 CFR 50.34(f)(2)(xxvii), as they relate to monitoring gaseous effluents from all potential release points under a broad range of routine and accident conditions.
4. The applicant's proposed ODCM for the CPNPP, Units 3 and 4 COL FSAR and operating procedures, as they relate to controlling and monitoring effluent releases and doses to members of the public, meet the requirements of 10 CFR Part 50, Appendix I; 10 CFR 20.1301; 10 CFR 20.1302; and 10 CFR 20.1301(e). The staff concludes that the endorsement of the NEI ODCM Template 07-09A and the PERMS supplemental information contained in the CPNPP, Units 3 and 4 COL FSAR Section 11.5 are consistent with the requirements of GL 89-01 and the Radiological Assessment BTP

(Revision 1, issued November 1979), and the guidance of NUREG-1301 for pressurized water reactor plants, NUREG-0133, RG 1.21, RG 1.33, RG 4.15, RG 4.8, and RG 4.15.

5. The applicant demonstrates compliance with the requirements of 10 CFR 52.80(a) and ITAAC for the PERMS. The ITAAC address the descriptions and functional arrangements of the PERMS for safety and non-safety related subsystems. The proposed ITAAC once performed by the COL applicant and meeting their respective acceptance criteria, provide reasonable assurance that a plant that incorporates the US-APWR DC and establishes operational programs in accordance with the DC and site-specific conditions will meet the provisions of the NRC regulations.

The staff will confirm that **Confirmatory Item 11.05-2**, which relates to the SGBDS radiation monitor site-specific design and **Confirmatory Item 11.05-1**, which relates to the site-specific design description and information on the evaporation pond discharge radiation monitor (RMS-RE-111), are incorporated into the applicant's next revision of the CPNPP, Units 3 and 4 FSAR.