HEALTH PHYSICS SITE AUDIT REPORT

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1.0 SUMMARY

This report summarizes the U.S. Nuclear Regulatory Commission (NRC) staff's travel to Somervell County, Texas, during the period of June 23 - 24, 2009, to conduct a Health Physics Site Safety Audit of the Luminant Generation Company, LLC (Luminant), Comanche Peak Nuclear Power Plant (CPNPP), Units 3 and 4 combined license (COL) application. The NRC staff had requested this audit to support the review of Chapter 11, "Radioactive Waste Management System" for Part 2 of the COL Final Safety Analysis Report (FSAR). Specifically, the NRC staff wanted to obtain additional information on the calculations of effluent releases and radiological doses, and the designs for the evaporation pond and interim waste storage facility, which is necessary for the performance of the NRC staff's confirmatory calculations and design reviews.

2.0 BASIS

The information below lists the bases for the audit.

- Title 10 *Code of Federal Regulations* (10 CFR) 20, "Standards for Protection Against Radiation"
- 10 CFR 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material"
- 10 CFR 50, Appendix A, General Design Criterion (GDC) 60, "Control of Releases of Radioactive Materials to the Environment"
- 10 CFR 50, Appendix A, GDC 64, "Monitoring Radioactivity Releases"
- 10 CFR 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"
- 10 CFR 50.34a, "Design Objectives for Equipment to Control Releases of Radioactive Material in Effluents - Nuclear Power Reactors"
- 10 CFR 50.9, "Completeness and Accuracy of Information"

- Regulatory Guide (RG) 8.8, “Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be As Low As Is Reasonably Achievable”

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

- RG 8.10, “Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable”

- 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”

- RG 1.112, “Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light-Water-Cooled Power Reactors”

- RG 1.143, “Design Guidance for Radioactive Waste Management Systems, Structures and Components Installed in Light-Water-Cooled Nuclear Reactor Power Plants”

- RG 1.206, “Combined License Applications for Nuclear Power Plants (LWR Edition)”

- NUREG-0017, “Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Pressurized Water Reactors (PWRs) (PWR-GALE Code)”

- NUREG-0800, “Standard Review Plan,” Chapter 11, Radioactive Waste Management” and Chapter 12, “Radiation Protection”

- NUREG/CR-4653, “GASPAR II - Technical Reference and User Guide”

- NUREG/CR-4013, “LADTAP II - Technical Reference and User Guide”

- NRC Generic Letter 81-038, “Storage of Low Level Radioactive Wastes at Power Reactor Sites”

3.0 OBSERVATIONS AND RESULTS

The NRC staff began the audit activities with an extensive site tour of the proposed locations for CPNPP, Units 3 and 4. The tour included the locations for the CPNPP, Units 3 and 4 evaporation pond and the interim waste storage facility, as well as the CPNPP, Units 1 and 2 radioactive waste storage facilities.

After the site tour, Luminant and the NRC staff discussed the COL application, Part 2, FSAR, Chapter 11, “Radioactive Waste Management System.” Luminant described the process for discharging the treated radioactive effluent from the liquid waste management system (LWMS) to Squaw Creek Reservoir (SCR), and from the LWMS to the evaporation pond.

Luminant informed the NRC staff, that pursuant to the "Offsite Dose Calculation Manual (OCDM) for CPNPP, Units 1 and 2, Revision 26", it is required to maintain the tritium level in the SCR at a level below 30,000 pCi/L.

However, Luminant has determined that the operation of all four units could result in the SCR exceeding the 30,000 pCi/L limit. As such, Luminant plans to divert a portion of the treated radioactive effluent from the CPNPP, Units 3 and 4 LWMS to the evaporation pond. The discharge line from the LWMS to SCR would connect to the discharge line from CPNPP, Units 1 and 2. Additionally, the evaporation pond would have a discharge line that also connects to the discharge line from CPNPP, Units 1 and 2. Luminant explained that up to 50 percent of the treated radioactive effluent from either CPNPP, Unit 3 or 4 could be diverted to the evaporation pond to maintain a 20 percent margin below the ODCM, whereas, 100 percent of the treated radioactive effluent could be diverted to the evaporation pond on a temporary basis. In order to determine the quantity of treated effluent that would be diverted to the evaporation pond, Luminant assumed in its tritium calculations that CPNPP, Units 1 and 2 commenced operation on the same date, and that CPNPP, Units 3 and 4 also commenced operation on the same date. Additionally, Luminant explained that it had used a tritium distribution factor (TDF) of 0.6 in calculating the tritium concentration from CPNPP, Units 1 and 2 to SCR. However, Luminant believes that a TDF of 0.47, which was obtained from operating data, is more realistic when determining the tritium concentration in the SCR when all four units are operational. Luminant plans to use the evaporation pond during refueling outages or at the end of core life for CPNPP, Units 3 and 4.

Luminant provided details on the design features of the evaporation pond. The design of the evaporation pond would meet or exceed State of Texas and Federal requirements. The design assumes a flow rate of 2,000 gallons per day from the CPNPP, Units 3 and 4 LWMS. The size of the evaporation pond is 43,560 square feet and 4 feet deep. This pond will be lined with two high-density polyethylene liners, with each liner at least 30-mil thick. A 40-mil mesh will be installed between the two 30-mil liners, in conjunction with a leak detection system. Luminant noted that the minimum State of Texas requirement, is a 30-mil liner for a similar pond. Luminant mentioned its existing onsite low-level radioactive waste pond uses a 60-mil liner, and this liner has an estimated 20-year life.

For CPNPP, Units 3 and 4, the NRC staff questioned Luminant on its current reactive approach to liner inspections. Luminant's maintenance and inspection criteria, which was based on the operating experience data collected for license extension, was obtained from the existing 60-mil liners and applying this data to the thinner 30-mil liners. The NRC staff and Luminant engaged in a discussion on whether an Inspections, Tests, Analyses, and Acceptance Criteria would be used to ensure the acceptable construction and operation of the evaporation pond system. The NRC staff also discussed whether the evaporation pond was part of the LWMS.

Luminant's position is that the evaporation pond is not part of the LWMS, while the NRC staff noted that Regulatory Guide (RG) 1.143, which states the NRC's regulatory position on this issue, defines a radioactive waste system terminating at the point of controlled discharge to the

environment. Based on the guidance in RG 1.143, the NRC staff noted that it could classify the evaporation pond as part of the LWMS. The NRC staff stated that additional evaporation pond design information is necessary.

The NRC staff had additional discussions concerning radiation monitoring and sampling locations and whether the pond would be seismically qualified.

Luminant stated that stainless-steel (SS)-304 piping would be used for the evaporation pond system and that the piping would either be double walled or buried in a trench to allow for visual inspection.

The NRC staff noted that SS-304 may not be the best material to use for this application based on industry operating experience regarding pitting corrosion of stainless steel used in radioactive waste systems with impurity content. Luminant agreed to look at this matter in further depth. Luminant clarified the dotted lines in the COL application, Part 2, FSAR, Chapter 11, Figure 11.2-201, representing the proposed evaporation pond and existing piping for CPNPP, Units 1 and 2 with connections to CPNPP, Units 3 and 4, and discharge into the SCR.

Luminant stated its plans to allow the contents inside the evaporation pond to evaporate dry in between refueling outages. The NRC staff asked Luminant if its radiological dose assessment for the evaporation pond included a scenario for the liquid completely evaporating during drought periods. This scenario could create a postulated release of dust containing corrosion and fission products that results in onsite and offsite doses. Luminant responded they had not addressed this particular scenario. The NRC staff and Luminant discussed a potential method to eliminate dust emissions into the atmosphere by maintaining a minimum level of liquid in the evaporation pond.

Luminant discussed its use of the PWR-GALE, GASPAR II, RATAF, and LADTAP II computer codes. The outputs from the PWR-GALE code are used as inputs to the GASPAR II and LADTAP II codes for calculation of doses from gaseous and liquid effluent releases in the COL application, Part 2, FSAR, Chapter 11, Sections 11.2.3.1 and 11.3.3.1, respectively. Mitsubishi Heavy Industries (MHI), the Design Certification Applicant, used the RATAF code to calculate effluent release concentrations from a postulated radioactive waste tank failure. Luminant evaluated the liquid tank failure analysis, as described in MHI's responses to questions generated by the NRC staff's review of the Design Certification Document, and determined that the analysis was bounding for the site-specific application.

During the course of their discussion, the NRC staff discovered that MHI had made another modification that involved changing the ANSI N18.1 source term specification in the PWR-GALE code (based on GALE86). MHI also modified the built-in leakage rate parameter value in the PWR-GALE code from the version approved by the NRC, which was discussed in a closed session of a public meeting with MHI, Luminant, and NRC staff on May 18, 2009.

As a result, the NRC staff was unable to confirm whether the effluent concentrations calculated using the modified version of the PWR-GALE code complies with 10 *Code of Federal Regulations* (10 CFR) Part 50, Appendix I, and whether the resulting doses, which impact the COL application, meet the requirements of 10 CFR 20.1302.

Luminant was informed that the NRC staff would have to review and approve the changes to the modified PWR-GALE code. The NRC staff also noted that design information was absent on the shape of flow orifices and locations of connections into circulating water discharge header with consideration for sharing of structures, systems, and components identified in the COL application, Part 2, FSAR, Chapter 11, Section 11.2.3.1 as "is determined [or developed] in the detail design phase." Luminant acknowledged the need for this high-level design information in the COL application.

The NRC staff discussed, with Luminant, the absence of design information in the COL application, Part 2, FSAR, Chapter 11, Section 11.4.2.3, for the proposed onsite interim waste storage facility that will be used to store Class A, B, and C wastes for up to ten years.

In addition, the NRC staff questioned Luminant's use of the ODCM for CPNPP, Units 1 and 2 to develop the ODCM for CPNPP, Units 3 and 4. The CPNPP, Units 3 and 4 COL application, Part 2, FSAR, Chapter 11, Section 11.5.2.9, commits to following the guidance in Nuclear Energy Institute (NEI) 07-09, "Generic FSAR Template Guidance for Offsite Dose Calculation Manual Program Description," Revision 1, to develop the ODCM for CPNPP, Units 3 and 4. Since the ODCM for CPNPP, Units 1 and 2 does not address all aspects of NEI 07-09, the NRC staff questioned its applicability to CPNPP, Units 3 and 4 ODCM.

The NRC staff and Luminant then discussed the COL application, FSAR, Part 2, Chapter 12, "Radiation Protection." The NRC staff inquired about the radiation monitoring program for construction workers onsite to support the construction of CPNPP, Units 3 and 4. The NRC staff was concerned about how Luminant would ensure compliance with 10 CFR Part 20, as construction workers are considered members of the public. The NRC staff inquired about the radioactive waste storage facility for CPNPP, Units 1 and 2 since the radiation levels at the fence were authorized up to 0.5 mrem/hour. The NRC staff asked how Luminant would keep construction workers away from this fence to prevent unauthorized exposure. Based on the site tour, the NRC staff expressed a concern about the existing onsite radioactive storage facility for CPNPP, Units 1 and 2. Because there will be construction workers by the waste water outfall by CPNPP, Units 1 and 2, they may also be exposed by the receipt, movement and temporary storage of radioactive material generated from outage work and other related activities. This potential exposure path is not described in the construction worker dose analyses. Luminant was not able to provide any information regarding any planned activities with respect to steam generator, reactor head or pressurizer replacement at CPNPP, Unit 2 (Unit 1 had been completed) during the estimated construction period for CPNPP, Units 3 and 4.

In the existing dose analysis for construction workers, the closest radiation source to the workers listed was the location of the future independent spent fuel storage installation (ISFSI).

There are also other existing radioactive material areas onsite with another facility planned, and these areas were not considered in the construction worker dose estimate.

Luminant informed the NRC staff that the interim radioactive waste storage facility for CPNPP, Units 3 and 4 would be constructed after the new units are operational. Thus, the construction workers would not be subject to unauthorized exposure from the second facility. The NRC staff also asked about Luminant's plans to construct an ISFSI to confirm that it would be at least 1,000 feet from the nearest construction area for CPNPP, Units 3 and 4.

The NRC staff noted that the design information provided for the mobile liquid waste processing system did not appear to adequately address the requirements of 10 CFR 20.1406 and the guidance of RG 4.21, with regards to design features to prevent leakage to the environment. This was especially evident as the mobile waste processing system was located at the same elevation as a truck bay opening at grade level, and the COL application does not adequately discuss design features to prevent spills and leaks from leaving through the grade level building entries.

The NRC staff noted that zinc injection was discussed as one of the as low as reasonably achievable (ALARA) features considered by MHI, and the NRC staff asked Luminant about their intentions of applying this same method of dose reduction. Luminant stated that since this method was stated in the COL application, FSAR, Part 2, Chapter 12, the use of zinc injection was a requirement of the dose reduction features.

At the conclusion of the audit, the NRC staff conducted an exit meeting, where the NRC staff discussed its observation findings and concerns with Luminant. These observations are discussed in Enclosure 4. The NRC staff has documented its concerns as requests for additional information.

4.0 CONCLUSION

The NRC Health Physics Audit, at the CPNPP site, allowed the NRC staff to conduct its review of the CPNPP, Units 3 and 4 COL application FSAR Chapters 11 and 12 more efficiently. Specifically, the NRC staff gained a better understanding of the bases underlying the formal application and identified areas that will be used to develop requests for additional information.