

AUDIT REPORT
THE SOUTH TEXAS PROJECT, UNITS 3 AND 4, APPENDIX 12B SHIELDING AND DOSE
CALCULATIONS

NRC Audit Team:

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1.0 PURPOSE

The purpose of the audit was to verify that the shielding and dose rate calculations in Appendix 12B of the Final Safety Analysis Report (FSAR) of the South Texas Project (STP), Units 3 and 4 combined license application (COLA), remain conservative with the new spent fuel racks (SFR) design described in FSAR Subsection, “Spent-Fuel Storage (Related to RG 1.206, Sections 9.1.1, “Criticality Safety of Fresh and Spent Fuel Storage Handling,” and 9.1.2, “New and Spent Fuel Storage”),” and in the Holtec Report No. HI-2135462, “Licensing Report for South Texas Project Units 3 and 4 ABWR Spent Fuel Racks,” Revision 1 (see ADAMS Accession Number ML13218A291). The audit was conducted at the Westinghouse Twinbrook office in Rockville, Maryland between February 10, 2015, and February 11, 2015.

This audit follows the guidelines in Office of New Reactors (NRO) Office Instruction NRO-REG-108, “Regulatory Audits.”

2.0 BACKGROUND AND AUDIT BASES

On September 20, 2007, South Texas Project Nuclear Operating Company (STPNOC) submitted to the U.S. Nuclear Regulatory Commission (NRC), a COLA FSAR to construct and operate two additional units (Units 3 and 4) based on the United States Advanced Boiling-Water Reactor (ABWR) Certified Design Control Documents at the STP Nuclear Power Plant site located in the county of Matagorda near Bay City, Texas. On January 24, 2011, Nuclear Innovation North America, LLC (NINA) became the primary applicant for the license for these two units.

During the Phase 6 safety evaluation report review of FSAR Chapter 12, the NRC staff found that the contents for Chapter 9 and Appendix 12B were inconsistent. The spent fuel pool (SFP) geometry and dose rate calculation in Appendix 12B did not reflect the new SFR design described in FSAR Subsection 9.1.2 and Holtec report H12135462. Prior to the audit, the staff held two meetings with the applicant on January 20, 2015, (ML15022A657), and February 3, 2015, (ML15062A053), to discuss the discrepancies in FSAR Appendix 12B and the fuel design description in FSAR Subsection 9.1.2 and Holtec Report HI2135462. During these meetings the applicant acknowledged the concerns and agreed to update the FSAR to ensure consistency. In addition, the applicant agreed to review the referenced calculations in Appendix 12B and compare the parameters in Holtec report H12135462 to ensure the Appendix 12B calculations are bounding and no revision is needed.

The NRC staff has identified a need to audit the shielding and dose calculations developed by NINA with the new SFR design. Specifically, the audit would allow the staff to verify that the information in FSAR Section 12B, including associated calculations were accurate and consistent, and that the conclusions remain valid and conservative with FSAR Subsection 9.1.2

and Holtec Report HI2135462. This would also allow the staff to identify additional information necessary for the applicant to supplement its response to Request for Additional Information (RAI) 12.02-20 in order for the staff to reach a licensing decision.

3.0 OBJECTIVES

The objectives of the staff's audit was to review the assumptions, calculations, and conclusions of the shielding and dose rate calculations in FSAR Appendix 12B were accurate and conservative for the new SFR design.

4.0 AUDIT ACTIVITIES

A summary of the applicant's audit to address the NRC staff's concerns is provided below.

4.1 Source Term for Fuel Seated Within the SFR

The staff verified that the new SFR design specified in Holtec Report HI2135462 made little difference to the source term calculations for fuel seated within the SFR. For example, the new SFR design allows space for 2380 assemblies to be stored in the SFP. Paragraph 12B in Appendix 12B states that the SFR has a capacity of 2365 fuel assemblies. The 15 assembly difference would make an insignificant difference in the total source term of the pool since the current source term already accounts for an entire core offload (i.e., only one day post operation), as well as all of the existing fuel expected to be in the SFP from the most recently discharged batches. Therefore, the extra 15 assemblies would be at least 10 years old and would be insignificant compared to the original 2365 assemblies assumed in the calculation.

Finally, the source term calculations assumed a 24 month cycle which would result in higher activity fuel than the 18 month cycle specified in the application.

4.2 SFP Shielding Analysis

As discussed above, differences between the number of assemblies assumed in the Appendix 12B calculations and the actual number discussed in Chapter 9 would result in an insignificant change to the source term. In addition, Holtec Report HI2135462 indicates that the SFP will be administratively limited to 2354 assemblies, which is conservative compared to the 2365 assemblies assumed in the source term and shielding calculations of Chapter 12. Finally, the source term calculation did not account for the water located between the fuel and the SFP walls and floor, which would add additional shielding for the SFP beyond what was accounted for in the calculation. Therefore, the staff determined that the changes needed to FSAR Appendix 12B in order to conform to FSAR Chapter 9, would not invalidate the shielding calculations previously performed for fuel seating within the SFP racks.

While the applicant's SFP source term is modeled as fuel homogenously spread throughout the SFR (i.e., the calculation does not account for the possibility of a higher source term in certain areas of the SFP where fresh fuel assemblies are located), confirmatory calculations performed by the NRC staff indicate that the two meters of concrete shielding provided by the SFP walls and floor (as indicated in FSAR Chapter 12) should be adequate to maintain dose rates around the SFP to within the radiation zones, even if an entire recently dispatched core was placed in one area of the SFP. Therefore, the two meters of concrete shielding specified in Chapter 12, along with the current SFP rack configuration provides adequate shielding for the areas surrounding the SFP.

4.3 Maximum Assembly Source Term and Shielding

The staff verified that the dose rate from a raised fuel assembly was calculated with a distance of 8.5 feet (2.6 meters) from the top of the active fuel region of the assembly to the water surface. This distance will allow enough clearance to move the assemblies in the SFP while maintaining the appropriate amount of shielding. However, during the review of the calculations and discussions with the applicant, the staff determined that some of the information in FSAR Appendix 12B related to the maximum spent fuel assembly source term was unclear and inaccurate. Specifically, FSAR Appendix 12B indicated that 30 percent was added to the maximum assembly for conservatism, when in fact 30 percent was added to the average first burned assembly, to represent the maximum assembly. While this information did not impact the calculation results, FSAR changes are still necessary to correct this issue.

5.0 CONCLUSION

The staff concluded that none of the information provided FSAR Subsection 9.1.2 and Holtec report H12135462 invalidate the source term and shielding calculations for the SFP provided in FSAR Appendix 12B. The staff determined that the inconsistencies between FSAR Appendix 12B, including the associated calculations, were either minor with respect to their effect on the source terms and shielding or conservative. The staff also determined that any differences between FSAR Appendix 12B (including the associated calculations) and other FSAR sections do not result in the source terms and shielding being inadequate.

During the exit meeting with the applicant, the staff identified the following additional issues that the staff would like the applicant to address in a revised response to RAI 12.02-20 (which addressed previous staff questions related to the SFP):

1. Correct or remove, as appropriate, any relevant information in FSAR Appendix 12B that is inconsistent with the new SFR design described in FSAR Chapter 9.
2. Specify that the maximum fuel assembly dose was measured 8.5 feet (2.6 meters) above the top of the active fuel region and to clarify how the maximum fuel assembly source term was determined.
3. Provide additional information in the response explaining why differences between Appendix 12B and other FSAR Sections are acceptable.

In response to the additional NRC staff concerns listed above, the applicant agreed to submit a revised response to RAI 12.02-20 to the NRC staff within 30 days of this audit.

Additional information related to the staffs review of the SFP sources and shielding can be found in Chapter 12 of the SER.

6.0 REFERENCES

1. NRO Office Instruction NRO-REG-108, (Revision 0), "Regulatory Audits."