

June 14, 2011

MEMORANDUM TO: Mark Tonacci, Chief
BWR Projects Branch
Division of New Reactor Licensing
Office of New Reactors

FROM: Rocky Foster, Project Manager */RA/*
BWR Projects Branch
Division of New Reactor Licensing
Office of New Reactors

SUBJECT: REGULATORY AUDIT SUMMARY OF SOUTH TEXAS PROJECT
UNITS 3 AND 4 COMBINED LICENSE APPLICATION –
RADIOLOGICAL HABITABILITY DOSE CALCULATIONS FOR
TECHNICAL SUPPORT CENTER

By letter dated September 20, 2007, STP Nuclear Operating Company (STPNOC) submitted South Texas Project (STP) Units 3 and 4 Combined License Application (COLA). On January 24, 2011, Nuclear Innovation North America (NINA) became the primary applicant for the license for these two units. To support the review of STP Units 3 and 4 COLA, the U.S Nuclear Regulatory Commission (NRC) staff performed an audit of the STP Technical Support Center radiological habitability dose calculations prepared by Westinghouse. The audit occurred at the Westinghouse Offices in Rockville, Maryland on April 29 and May 5, 2011. The detailed results of the audit are provided in the attached enclosure.

Docket Nos.: 52-012
52-013

Enclosure:
As stated

CONTACT: Rocky Foster, NRO/DNRL
301-415-5787

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**SOUTH TEXAS PROJECT UNITS 3 AND 4 COMBINED LICENSE APPLICATION
TECHNICAL SUPPORT CENTER HABITABILITY DOSE CALCULATIONS
AUDIT SUMMARY**

1. Background

The staff performed an audit of the South Texas Project (STP) Technical Support Center (TSC) radiological habitability dose calculations prepared by Westinghouse to support the STP Units 3 and 4 Combined License Application (COLA). This audit follows an audit on the same subject matter that was conducted on June 25, 2010 (ML102010690). The purpose of this follow-on audit is to review supplemental calculations prepared by Westinghouse, as stated in a letter dated March 31, 2011 (ML110950045).

To ensure that the TSC meets dose guidelines in Standard Review Plan (SRP) Section 6.4, Acceptance Criteria 6.A.i, "Radiation Hazards," the applicant must perform a radiological dose analysis for the TSC for postulated design basis accidents (DBAs). In Request for Additional Information (RAI) 13.03-73, Revision 1, the staff requested, among other things, that the applicant provide a radiological dose analysis. In its response dated October 7, 2009, to RAI 13.03-73, the applicant stated that a radiological dose analysis for the TSC would be completed and provided to the U. S. Nuclear Regulatory Commission (NRC) in a supplemental response by May 31, 2010. The applicant provided its supplemental responses on June 1, 2010 (ML101550064), and June 21, 2010 (ML101750071). In its June 1, 2010, response, the applicant stated that it had identified two additional changes to the Service Building (S/B) heating ventilation and air conditioning (HVAC) unit design. These changes include a design upgrade for the filtration efficiency of the charcoal filter bed from 95 percent (5.1 cm (2 inch) charcoal bed depth) to 99 percent (10.2 cm (4 inch) charcoal bed depth), and automatic start of the emergency filter train. Proposed changes to Final Safety Analysis Report (FSAR) Section 9.4.8.2 were included in the applicant's June 1, 2010, response.

As noted above, on June 25, 2010, the staff completed an audit of the radiological dose calculations that support the applicant's June 1, 2010 and June 21, 2010, responses. During the June 25, 2010 audit, the staff observed that the 5 rem total effective dose equivalent (TEDE) dose guideline was met for all DBAs, so long as 99 percent efficient filters are used in the emergency filtration train of the S/B HVAC, instead of 95 percent efficient filters as described in STP FSAR Section 9.4.8.2 (Rev. 3).

On March 7, 2011, the staff issued RAIs 09.04.03-2 and 09.04.03-3, asking the applicant to, among other things, provide a justification for the absence of site-specific inspections, tests, analyses and acceptance criteria (ITAAC) to verify the 99% efficiency charcoal filter, and to explain why a Tier 1 exemption under Part 52, Appendix A, Section VIII.A.4 is not appropriate. In its March 31, 2011, response, the applicant stated that the Tier 1 Section 2.15.5 and Table 2.15.5m, ITAAC 4 requires that the Service Building (S/B) clear air filtration unit have at least 95 percent removal for all forms of iodine. The applicant stated that the choice of a 99 percent efficient filter for the STP satisfies this ITAAC. The applicant stated that it had also completed additional calculations which demonstrate that either a 95 percent or 99 percent efficient filter will ensure that radiological doses in the TSC remain below the 5 rem TEDE dose guideline.

Enclosure

The purpose of this follow-on audit was for the staff to review the radiological consequence dose calculations for the STP TSC design.

The staff performed this audit at the Westinghouse Offices in Rockville, Maryland on April 29 and May 5, 2011. The audit team consisted of the NRC staff members identified in Table I.

Table I: NRC Staff	
NAME	POSITION
David Brown	Sr. Health Physicist
Michelle Hart	Sr. Reactor Engineer

2. Regulatory Basis

This regulatory audit is based on Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix E.IV.E.8, 10 CFR 50.47(b)(8), and Supplement 1 to NUREG-0737, and SRP Sections 6.4 and 15.0.3.

3. Audit Activities

The staff audited the Westinghouse calculations and its assumptions used to estimate radiological consequences in the STP Units 3 and 4 TSC for DBAs. The calculations were based on the fission product releases listed in the General Electric Advanced Boiling Water Reactor (ABWR) Design Control Document (DCD). The calculations were performed using an NRC computer code provided in NUREG/CR-6604, "RADTRAD: A simplified Model for Radionuclide Transport and Removal and Dose Estimation," Version 3.0.3. The RADTRAD computer code was developed by the Sandia National Laboratories for the NRC and it calculates the radionuclide transport and removal and dose at selected receptors.

The calculations reviewed by the staff are listed in Table II.

Table II. Calculations reviewed by NRC staff

Calculation Number	Title
CN-CRA-10-1, Rev. 0	South Texas 3 & 4 Technical Support Center Doses for non-LOCA Design Basis Accident Based on Releases Stated in the ABWR DCD
CN-CRA-10-2, Rev. 0	South Texas 3 & 4 Technical Support Center Doses for LOCA Based on Releases Listed in the ABWR DCD, dated May 18, 2010
CN-CRA-11-13, Rev. 0	South Texas 3 & 4 Technical Support Center LOCA Doses Based on ABWR DCD Releases and 95 Percent Filter Efficiency, dated March 21, 2011
CN-CRA-11-14, Rev. 0	South Texas 3 & 4 Technical Support Center non-LOCA Doses Based on ABWR DCD Releases and 95 Percent Filter Efficiency, dated March 24, 2011

4. Audit Results

In its June 1, 2010, RAI response, the applicant described the applicable dose acceptance criteria for the TSC:

“In accordance with NUREG-0696, ‘Functional Criteria for Emergency Response Facilities,’ the dose acceptance criteria for the TSC are consistent with those for the Control Room, which are in the SRP, NUREG-0800 Section 6.4, ‘Control Room Habitability,’ Revision 3, March 2007. Acceptance Criteria 6.B is applicable, specifically the radiation exposures shall not exceed 0.05 Sv (5 rem) total effective dose equivalent (TEDE). This is also consistent with GDC 19. This TSC dose limit is met for all events.”

The staff notes that, contrary to the applicant’s statement in the June 1, 2010, RAI response, Acceptance Criteria 6.B does not apply to STP Units 3 and 4. The ABWR is certified to the control room habitability dose guidelines in Acceptance Criteria 6.A.i. In fact, during its April 29, 2011, and May 5, 2011, audit, the staff noted that Westinghouse calculations CN-CRA-10-1, Rev. 0, and CN-CRA-10-2, Rev. 0 cited the dose guidelines in Acceptance Criteria 6.A.i (the same guidelines used for the ABWR control room), as well as the 5 rem TEDE and 25 rem committed dose equivalent (CDE) thyroid dose guideline cited in Section G.3 of STP’s Emergency Plan for radiological habitability in the TSC. For all DBAs, the 25 rem CDE to the thyroid appears to be the most restrictive dose guideline.

The staff observed that Westinghouse concluded in its calculations that the 5 rem TEDE guideline is met for all DBAs, for both the 95 percent and 99 percent efficient charcoal filters. However, Westinghouse also concluded that the 25 rem CDE thyroid dose guideline is not met for the main steam line break (Case 2, pre-accident iodine spike) and the loss of cooling accident (LOCA) if a 95 percent filter is used in the emergency filter train. The applicant’s proposed departure to upgrade the S/B HVAC design to include a 99 percent efficient charcoal filter reduces the LOCA DBA thyroid dose below the 25 rem CDE, but the main steam line break (Case 2) result is still above the guideline at 38.6 rem thyroid CDE. As a result, Westinghouse noted in its calculation that the S/B HVAC would need to be re-designed to meet the TSC dose guidelines.

The staff also observed that one of the flow rates assumed in the TSC radiological habitability calculations is inconsistent with a flow rate described in the applicant’s June 1, 2010, response. The normal mode exhaust flow from the S/B clean area is described as 2400 m³ per hour in the June 1, 2010, response (which is consistent with information provided in COL FSAR Table 9.4-7b, but Westinghouse assumed in its calculations that the normal mode exhaust flow is 7,700 m³ per hour. The latter flow rate exceeds by more than a factor of 3 the capacity of the S/B clean area exhaust fans.

Also, the emergency mode exhaust flow from the TSC is assumed in the calculations to equal the maximum capacity of two emergency filtration supply fans (i.e., 5300 m³/hour) plus 10 CFM unfiltered inleakage into the TSC. This appears to be inconsistent with the proposed revised system description at STP FSAR 9.4.8.2(7)(d), which states that:

“On manual or automatic initiation, the Service Building HVAC System can be put into high radiation mode. On switchover, the normal air intake damper closes, the minimum outside air intake damper opens, the exhaust fans stop [emphasis added] and the ventilation air for the clean area is routed through the emergency filter train. System pressurizes clean areas of the service building.”

It is not clear how exhaust flow rates from the TSC to the environment would exceed the capacity of the S/B Clean Area exhaust fans (2400 m³ per hour) by more than a factor of two when the exhaust fans are stopped. It seems more likely that the emergency filter train fans will run up to the flow rate that maintains the required pressure differential between the S/B clean area and S/B controlled area (and not more), which could be less flow than the maximum rated flow rate of both emergency filter train fans. A lower exhaust flow rate would decrease air exchange rates in the TSC, and could result in higher calculated doses as a result of prolonged holdup of fission products. Therefore, the assumption that the TSC exhausts at the maximum flow rate of the emergency filter train fans appears to be non-conservative.

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