October 21, 2009

Mr. Mark McBurnett, Vice President
Regulatory Affairs
South Texas Project Nuclear Operating Company
P.O. Box 289
Wadsworth, TX 77483

SUBJECT: REGULATORY AUDIT SUMMARY OF SOUTH TEXAS PROJECT UNITS 3 AND 4 COMBINED LICENSE APPLICATION REVISION 2, EMERGENCY CORE COOLING SYSTEMS SUCTION STRAINERS REVIEW

Dear Mr. McBurnett:

By letter dated September 24, 2008, South Texas Project Nuclear Operating Company (STPNOC) submitted South Texas Project (STP) Units 3 and 4 Combined License Application (COLA), Revision 2. To support the review of STP Units 3 and 4 COLA, the U. S. Nuclear Regulatory Commission (NRC) staff participated in an on-site audit of the STP and Toshiba supporting documentation for the STP Emergency Core Cooling Systems (ECCS) Suction Strainers. The audit occurred at the Westinghouse Offices in Rockville, Maryland on June 30 and July 1, 2009. The detailed results of the audit are provided in the attached Enclosure.

Should you have any questions, please contact Stacy Joseph, Project Manager for the STP COLA at (301) 415-2849 or Stacy.Joseph@nrc.gov.

Sincerely,

/RA/

Mark Tonacci, Chief
ESBWR/ABWR Projects Branch 2
Division of New Reactor Licensing
Office of New Reactors

Docket Nos. 52-012 and 52-013

cc: See next page

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ACCESSION NO. ML092670380 **NRO-002**

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SOUTH TEXAS PROJECT UNITS 3 AND 4 COMBINED LICENSE APPICATION REVISION 2

EMERGENCY CORE COOLING SYSTEMS SUCTION STRAINER REVIEW

AUDIT SUMMARY

1. Background

The staff performed an audit of the South Texas Project (STP) Units 3 and 4 Combined License Application (COLA) and the STP and Toshiba supporting documentation for the STP Emergency Core Cooling System (ECCS) Suction Strainers. STP incorporates by reference the advanced boiling water reactor (ABWR) design with departure, STD DEP 6C-1, Containment Debris Protection for ECCS Strainers. This departure from Appendix 6C incorporates the new-complex ECCS strainers (e.g., cassette type strainer) design per NUREG/CR-6224, NUREG/CR-6808, and Utility Resolution Guidance (URG) for ECCS Strainer Blockage, NEDO-32868-A. In Section 6C.1 of the STP COLA, the applicant has committed to designing the ECCS suction strainers in accordance with Regulatory Guide (RG) 1.82 Revision 3. The purpose of the audit was for the staff to review the supporting STP and Toshiba documentation to ensure that the STP suction strainers meet the guidance in RG 1.82 Revision 3.

The staff performed this audit at the Westinghouse Offices in Rockville, Maryland on June 30, and July 1, 2009. The audit team consisted of the U. S. Nuclear Regulatory Commission (NRC) staff members identified in Table I. The applicant's staff that participated in various audit discussions over the course of the two days at Westinghouse is identified in Table II.

Table I: NRC Staff	
NAME	**AFFILIATION**
Hanry Wagage	NRC Audit Team Lead (Containment)
Michael Snodderly	NRC Technical Branch Chief
Gregory Makar	NRC Staff (Materials)
Eduardo Sastre-Fuentes	NRC Staff (Materials)
Eric Miller	NRC Staff (Containment)
James Gilmer	NRC Staff (Reactor Systems)
Stacy Joseph	NRC Licensing

Table II: Applicant's Staff			
NAME	**AFFILIATION**	**NAME**	**AFFILIATION**
Caroline Schlaseman	Toshiba/MPR	Fumihiko Ishibashi	Toshiba/TANE
Jim Tomkins	STPNOC	Koichi Kondo	Toshiba/TANE
Scott Head	STPNOC	Hirohide Oikawa	Toshiba
Aaron Heinrich	STPNOC	Brad Maurer	Westinghouse

2. Objective

The objective of the audit was for the staff (1) to gain a better understanding of how STP's suction strainer design meets regulations (2) to determine which supporting information the staff will need to be placed on the docket in order to make a safety finding regarding the STP ECCS suction strainers, (3) to identify potential requests for additional information in the areas that are not adequately covered in the available documentation.

3. Regulatory Basis

This regulatory audit was based on the following:

- COLA, Rev. 2, Section 6C Containment Debris Protection for ECCS Strainers
- 10 CFR 50.46(b)(5) Long-term cooling
- Regulatory Guide 1.82, Rev. 3, "Water Sources for Long-Term Recirculation Cooling following a Loss-of-Coolant Accident"
- Standard Review Plan Section 6.2.2 Containment Heat Removal Systems
- SRP Section 6.3 Emergency Core Cooling System

4. Documents Audited

The NRC staff reviewed the following documents during the audit:

- Toshiba Project Document No. 7A31-0903-0001, Rev. 0 (STP Doc. No. U7-RHR-M-RPT-DESN-0001, Rev. A), "The Evaluation Report for Net Positive Suction Head of Pump in Emergency Core Cooling System," May 27, 2009. (This is a summary report of the design of debris strainers for Hamaoka Nuclear Power Plant, Unit 5, dated October 25, 2005.)
- Toshiba Project Document No. 7A31-0903-0002, Rev. 0 (STP Doc. No. U7-RHR-M-RPT-DESN-0002, Rev. A), "The supplementary document for the head loss evaluation report of Japanese ABWR emergency core cooling system suction strainer," May 27, 2009.
- Toshiba Project Document No. 7A31-0903-0003, Rev. 0 (STP Doc. No. U7-RHR-M-RPT-DESN-0003, Rev. A), "The Evaluation Report for Net Positive Suction Head of Pump in Emergency Core Cooling System."
- Toshiba Document PDR-2009-100417, Rev. 2, "Study of Chemical Effects for ECCS Suction Strainer," June 25, 2009.

5. Audit Activities

The audit began on June 30th, 2009, with three separate presentations by STP and Toshiba. The three presentations are publically available in ADAMS as follows:

- ECCS Strainer Agenda and Overview of Bounding Evaluation (ML092230571)
- 12 issues from GSI – 191 (ML092230561)
- Downstream Effects (ML092230547)

Following the STP presentation, the NRC Audit team broke up into groups and reviewed the documents listed in the section above.

The staff identified the following issues:

1. During the audit STP indicated that it planned to eliminate all fiber insulation from the primary containment. STP's cleanliness programs should support the presence of zero fiber or STP should include a limited amount of fiber that cleanliness programs could support in the calculation of strainer debris head loss.

2. During the audit STP indicated that it would eliminate all fiber in primary containment and would minimize other debris by adopting INPO and EPRI guidance for cleanliness and foreign material exclusion. However, it was not clear to the staff how STP would implement INPO and EPRI guidance.

3. The staff determined that the documents reviewed during the audit lacked sufficient details for the staff to complete its review. The staff requested that STP submit a calculation report on sizing of suppression pool recirculation pumps suction debris strainers for the staff review to determine that they meet the guidance of Regulatory Guide 1.82, Revision 3. The staff requested that STP provide relevant details as stated in Revised Content Guide for Generic Letter 2004-02 Supplemental Responses, November 21, 2007 (NRC Agencywide Documents Access and Management System (ADAMS) package Accession No. ML073110278) and Revised Content Guide for Generic Letter 2004-02 Supplemental Responses, March 28, 2008 (ADAMS Package Accession No. ML080230234).

4. The analyses reported in the documents reviewed during the audit assumed 85 pounds coatings debris following the Utility Resolution Guidance, NEDO-32686. However, STP did not justify that this value was conservative and did not provide particle size distribution for containment coatings debris, including coating types and locations.

5. On the potential effects of chemical debris on the ECCS strainers for STP, it was not clear to the staff how STP (1) plans to control materials important in chemical debris generation (e.g., aluminum); (2) addresses the interactions between chemical reactants, including all acid and base sources (e.g., sodium pentaborate, nitric acid, and hydrochloric acid), insulation material, latent debris, and any other debris sources; and (3) analyzes chemical debris effects and what supporting test data were used.

6. It was not clear to the staff how STP will evaluate the effects of debris on downstream components for STP 3 and 4.

7. It was not clear to the staff how STP will evaluate the effects of debris that passes the ECCS pumps suction strainer on fuel cooling.

6. <u>Request for Additional Information</u>

After the audit the staff issued Requests for Additional Information (RAI) to the applicant to address the issues identified above. The following RAIs are quoted from letters that have been sent to the applicant:

1) RAI 3334 – Question 06.06.02-4

During STP ABWR Units 3 and 4 audit conducted on June 30 and July 1, 2009, STP stated in a presentation titled "12 Issues from GSI-191, STP 3&4 ECCS Strainer Audit, June 30, 2009," that the plant would eliminate all fiber in primary containment . STP plans to provide head loss calculations in accordance with 10 CFR 50.46 to show sufficient NPSH margin using zero fiber. Provide evidence that the INPO and EPRI guidance for cleanliness and Foreign Material Exclusion (FME) will maintain zero fiber. If the program cannot demonstrate zero fiber, provide a maximum amount of fiber that would be expected as a result of implementing the cleanliness and FME program.

2) RAI 3334 - Question 06.06.02-5

During STP ABWR Units 3 and 4 audit conducted on June 30, 2009 and July 1, 2009 STP stated in a presentation titled "12 Issues from GSI-191, STP 3 and 4 ECCS Strainer Audit, June 30, 2009" that the plant would eliminate all fiber in primary containment and minimize other debris by adopting INPO and EPRI guidance for cleanliness and foreign material exclusion (FME). Any change in that amount of assumed latent debris or zero fiber may impact NPSH calculations in support of 10 CFR 50.46. Please provide INPO and EPRI guidance in a cleanliness program, and also include it as an operational program and fully describe its implementation in FSAR Section 13.4 in accordance with Section C.IV.4.4 of RG 1.206.

3) RAI 3392 - Question 06.06.02-6

During an audit conducted at Westinghouse Office in Rockville, Maryland, on June 30 and July 1, 2009, the staff reviewed a summary report of the analyses Toshiba prepared for the replacement of ECCS suction strainers at a Japanese ABWR as stated in STP response to RAI 2042. The staff reviewed the following documents, including the summary report (the first one listed):

- The Evaluation Report for Net Positive Suction Head of Pump in Emergency Core Cooling System, Proprietary, STP Doc. U7-RHR-M-RPT-DESN-0001, Rev. A, May 27, 2009.
- The Supplementary Documentation for the Head Loss Evaluation Report of Japanese ABWR ECCS Suction Strainer, Proprietary, STP Doc. U7-RHR-M-RPT-DESN-0002, Rev. A, June 24, 2009.
- The Evaluation Example of the Head Loss of the ECCS Suction Strainer and Pipe in the ECCS Pump Run-out Flow Condition, Proprietary, STP Doc. U7-RHR M RPT DESN-0003, Rev. A, May 27, 2009.

The above documents lack sufficient details for the staff to complete its review. The staff expects relevant details to be provided as stated in Revised Content Guide for Generic Letter 2004-02 Supplemental Responses, November 21, 2007 (NRC Agencywide Documents Access and Management System (ADAMS) package Accession No. ML073110278) and Revised Content Guide for Generic Letter 2004-02 Supplemental Responses, March 28, 2008 (ADAMS Package Accession No. ML080230234).

A. Submit a calculation report on sizing of suppression pool recirculation pumps suction debris strainers for the staff review to determine that they meet the guidance of RG 1.82, Revision 3. This document should provide sufficient design details as requested in the guidance documents stated above, or justify an alternative approach.
B. The documents that the staff reviewed during the audit did not account for miscellaneous debris (equipment tags, tape, and stickers or placards affixed by adhesives) that was considered during the resolution of GSI 191 program. Describe how you accounted for miscellaneous debris.
C. During the audit STP stated that subsequent to RAI 2042 response, Toshiba had decided to eliminate all fiber insulation from STP 3 and 4 primary containment. As the staff stated during the audit, STP should account for the possibility of having some fiber in the containment in terms of latent debris or confirm with a foreign material exclusion program that would eliminate all fiber from the STP 3 and 4 primary containment.

D. During the audit STP stated that the thermal insulation in STP 3 and 4 primary containment will be all stainless steel RMI. STP should account in the debris strainer design a possibility that it may not be able to use RMI for some small bore piping because of their locations, and thus, may have to use small quantities of other types of insulation like CalSil and fiber.
E. The STP's RAI 2042 response states that "the latent debris defined in the URG (which was used for the Hamaoka 5 testing) is considered bounding for STP 3 and 4." The URG proposed generic values were based on operating experience of boiling water reactors. Considering that ABWR is a newer plant of which operating experience was not considered in determining the URG proposed values, STP should confirm the values used in the design with operating experience of ABWRs or propose a plan to confirm these values later.
F. The documents that the staff reviewed during the audit showed that the latent debris assumed in the design of the debris strainers include 195 lb of sludge. However, the STP's presentation on Downstream Effects at the audit included only four types of debris considered for downstream effects (fibrous debris, paint chips, concrete dust, and RMI shard), which does not include sludge. Justify not considering sludge as a downstream component of debris.
G. Provide a table listing how the STP ECCS suction debris strainer meets each regulatory position for BWRs that is stated in RG 1.82, Revision 3, or justify an alternative approach.
H. STP should provide summary information of the calculation report stated in item A above in STP 3 and 4 FSAR and incorporate the report by reference in the FSAR.
I. Update FSAR as needed to reflect the response to this RAI (e.g., the commitment to use stainless steel reflective metallic insulation).

4) RAI 3497 - Question 06.06.02-8

Please provide the following information about the potential effects of protective coatings debris on the ECCS strainers for STP Units 3 and 4:

a. According to FSAR Section 6C.1, the design will follow the guidance in RG 1.82 and the Utility Resolution Guidance (URG) NEDO-32686. The response to RAI 06.02.02-1 for coatings debris (Part B, Item 8 in the table) states there was no indication that 85 pounds (based on the URG) is nonconservative. This implies, based on RG 1.82 Position 2.3.1.4, that the amount of coatings debris in the designated zone of influence is less than 85 pounds. Please describe how you determined a zone of influence (ZOI) for coatings and corresponding debris quantity to determine the amount of coatings debris is conservative.

b. Please discuss your evaluation of the particle size distribution for containment coatings debris, including all coating types and locations (RG 1.82 Position 2.3.1.4). Discuss how the coating particle size distribution was used in your evaluation of debris transport, downstream effects, and head loss.

5) RAI 3497 - Question 06.06.02-9

Please provide the following information about the potential effects of chemical debris on the ECCS strainers for STP Units 3&4:

a. Discuss the controls in place to ensure that materials important in chemical debris generation (e.g., aluminum) will not exceed the limits imposed in your licensing basis.

b. Discuss how the chemical effects evaluation addresses the interactions between all chemical reactants, including all acid and base sources (e.g., sodium pentaborate, nitric acid, and hydrochloric acid), insulation material, latent debris, and any other debris sources. Discuss how the evaluation includes the effects over time of the environment on degradation (e.g., corrosion of metals and dissolution of concrete), and formation of chemical debris.

c. Provide the analyses and test data used to evaluate chemical debris effects for STP 3 and 4. For test data include at least the following information: test description, materials tested, materials description, test conditions, detailed test procedures, results, and conclusions.

6) RAI 3497 - Question 06.06.02-10

Section 6C.1 of STP FSAR Revision 2 states that the ABWR design has committed to following the guidance provided in RG 1.82 Rev 3 and the Utility Resolution Guide NEDO-32686-A.

In RAI Question 06.02.02-1, the staff requested that STP describe how they will address the additional issues identified in RG 1.82 Rev 3 (including downstream effects). In STP Response letter U7-C-STP-NRC-090038 (ML091270491), STP stated that Toshiba will select and evaluate downstream components consistent with the methodology in WCAP-16406, as adapted by the BWROG for BWRs. However, the staff understands that the BWROG has not yet determined if it is appropriate to take this approach.

Please clarify your plans for evaluating the effects of debris on downstream components for STP 3 and 4, including a discussion of the methodology and the acceptance criteria. If planning to use WCAP-16406, please describe why this methodology is appropriate for Boiling Water Reactor (BWR) evaluations. This information has to be provided in sufficient detail in the COL application for the staff to make a reasonable assurance finding. (RAI 3497)

7) RAI 3207 - Question 06.06.02-2

Section 6C.1 of the STP FSAR Rev 2 states that the ABWR Design has committed to following the guidance provided in RG 1.82 Rev. 3 and the Utility Resolution Guide NEDO-32686. In the STP FSAR Section 6C.3, the applicant stated: “If required, downstream effects of material predicted to pass through the suction strainers will be evaluated in accordance with RG 1.82”.

In RAI Question 06.02.02-1, the staff requested that STP describe how they will address the additional issues identified in RG 1.82 Rev 3 (including downstream effects). In STP response letter U7-C-STP-NRC-090038 (ML091270491), STP stated that an evaluation of downstream effects on fuel will be included in a future license amendment for fuel. During the June 30 – July 1 2009 audit of the STP suction strainers, STP stated that they planned to

revise this approach. Please provide the following or describe how you plan to address the following items related to downstream fuel effects in the STP FSAR:

1) Provide an evaluation of the effects of debris that passes through the ECCS pumps suction strainer during long term cooling. Quantify the effects of downstream debris flow. Show what analyses have been completed or will be completed for debris in the core, and within valves or other restricting components, including fuel bundle debris filters. The debris may include chemical products, latent debris, or insulation that has passed through the suppression pool debris strainers. In this analysis, report the thermal conductivity and thickness of potential chemical products and debris on fuel rods and the increase in fuel rod temperature due to deposition and blockage in the core.

2) Report the change in the core flow with bounding blockages of valves and other components.

    (a) Submit the flow blockage calculation results for the reactor fuel used in STP showing the critical power as a function of percent strainer blockage. Identify the percent blockage the fuel elements will experience at full power and what the effect on MCPR/PCT would be. Provide a figure showing CPR vs. fuel channel orifice flow area.

    (b) Provide a list of assumptions made in the calculation of MCPR/PCT vs. % flow blockage.