

January 20, 2012

MEMORANDUM TO: Ronaldo Jenkins, Chief
Licensing Branch 3
Division of New Reactor Licensing
Office of New Reactors

FROM: Michael Eudy, Project Manager */RA/*
Licensing Branch 3
Division of New Reactor Licensing
Office of New Reactors

SUBJECT: UNITED STATES NUCLEAR REGULATORY COMMISSION AUDIT
REPORT AND AUDIT PLAN IN SUPPORT OF EVALUATION OF
SOUTH TEXAS PROJECTS, UNITS 3 AND 4, COMBINED LICENSE
APPLICATION CHAPTER 19 AND SECTION 17.4

The audit report and audit plan (Enclosures 1 and 2) have been provided by the Office of New Reactors, Division of Safety System and Risk Assessment, Probabilistic Risk Assessment and Severe Accidents Branch staff to Licensing Branch 3 in order to finalize their audit findings. The audit was conducted at the Westinghouse Electric Company's Twinbrook office located in Rockville, Maryland, on November 4, 12 and 24, 2009; January 13 and 28, 2010; and March 31 and October 27, 2010; and February 23, April 7 and June 9, 2011. The audit was conducted by a team of staff knowledgeable in South Texas Projects Units 3 and 4, Final Safety Analysis Report Chapter 19 and Section 17.4S.

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Docket Nos.: 52-012
52-013

Enclosures:
As stated

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**NRC AUDIT REPORT
IN SUPPORT OF EVALUATION OF
SOUTH TEXAS PROJECT, UNITS 3 AND 4,
COMBINED LICENSE APPLICATION, CHAPTER 19 AND SECTION 17.4**

The U.S. Nuclear Regulatory Commission (NRC) staff conducted an audit of the South Texas Project (STP), Units 3 and 4, probabilistic risk assessment (PRA) during the period of September 22-23, 2009, at the Nuclear Energy Institute office in Rockville, Maryland. From the audit's exit meeting on September 23, 2009 between the staff and STP Nuclear Operating Company ("the applicant"), the applicant agreed to provide a copy of the STP Units 3 and 4 PRA description and results at the Westinghouse Twinbrook office in Rockville, Maryland for the staff to further review. As part of the safety evaluation of Chapter 19 ("Response to Severe Accident Policy Statement") of the STP Units 3 and 4 Final Safety Analysis Report (FSAR) [1] and to facilitate the staff's determination that the Tier 1 and Tier 2 departures for the STP Units 3 and 4 design are adequately addressed in the STP Units 3 and 4 plant-specific PRA, the staff conducted an audit to further review the STP Units 3 and 4 PRA description and results provided at the Westinghouse Twinbrook office. Also, as part of the safety evaluation of Section 17.4S ("Reliability Assurance Program") of the STP Units 3 and 4 FSAR [1] and to facilitate the staff's determination that the process for updating the list of risk-significant systems, structures, and components (SSCs) described in FSAR Section 17.4S would effectively populate the D-RAP list, the staff conducted an audit of the records and procedures associated with STP Units 3 and 4 design reliability assurance program (D-RAP) that were provided at the Westinghouse Twinbrook office.

The staff conducted the audit in accordance with the Office of New Reactors (NRO) Office Instruction NRO-REG-108 [2]. In accordance with NRO-REG-108, the staff composed an audit plan and shared it with the audit team members and the applicant so they could prepare for the regulatory audit.

The audit was conducted at the Westinghouse Electric Company's Twinbrook office located in Rockville, Maryland, on November 4, 12 and 24, 2009; January 13 and 28, 2010; March 31, 2010; October 27, 2010; February 23, 2011; April 7, 2011; and June 9, 2011. The audit was conducted by a team of staff knowledgeable in STP Units 3 and 4 FSAR Chapter 19 and Section 17.4S. The following staff members from the Division of Safety Systems and Risk Assessment in NRO and the Office of Nuclear Regulatory Research participated in the audit:

- Todd Hilsmeier (Audit Team Leader, Risk & Reliability Engineer)
- John Lai (Risk & Reliability Engineer)
- Keith Tetter (Risk & Reliability Engineer)
- Michelle Gonzalez (Risk & Reliability Engineer)

Audit activities involved reviewing the STP Units 3 and 4 PRA description, PRA results, D-RAP procedures, and D-RAP records. The detailed scope of this audit included the review of the information in Part III of the audit plan, which is provided in Attachment 1 of this memorandum. The following discussion summarizes the audit conclusions.

- The applicant reconstituted the ABWR, Level 1, Internal Events PRA model using the PRA information from the ABWR Standard Safety Analysis Report (SSAR) [3]. This model is called the Reconstituted Model of Record (MOR) [4] and includes credit for the containment over-pressurization system and control rod drive system. The core damage frequency (CDF) calculated by the Reconstituted MOR model compared favorably to the CDF published in the ABWR SSAR. Based on the discussion in ABWR SSAR Appendix 19D.8 (“Dependent Failure Treatment”), the applicant developed the ABWR PRA model of reference [4] by incorporating in the Reconstituted MOR model the common cause failures of the Reactor Service Water, Reactor Building Cooling Water, High Pressure Core Flooder, and Residual Heat Removal systems. The CDF using this model is on the order of $2E-7$ /year. The STP Units 3 and 4 Plant-Specific, Level 1, Internal Events PRA model [5] was developed by updating the ABWR PRA model of reference with the STP Units 3 and 4 design departures. The CDF using the STP Units 3 and 4 Plant-Specific PRA model (with the loss of offsite power frequency based on that of the ABWR SSAR) is 3.8 percent lower than the CDF from the ABWR PRA model of reference. The cumulative risk impact of the changes resulting from the applicant’s departures is less than a 10 percent change in CDF from the ABWR PRA model of reference. Therefore, according to the guidelines described in DC/COL-ISG-03 [6], the quantitative results do not need to be provided in the STP Units 3 and 4 FSAR. The staff examined the various PRA models developed by the applicant and the corresponding results (e.g., fault trees, event trees, cutsets results) and found them to be adequate.
- The staff audited the applicant’s document titled “South Texas Project, Units 3 and 4, Project Requirements Document: Design Reliability Assurance Program,” dated February 9, 2011 [7]. This document is a coordinating procedure that identifies the organizational responsibilities, interfaces, and total set of requirements necessary to collectively implement the D-RAP. The development and approval of this procedure was accomplished under the cognizance of the applicant’s D-RAP expert panel and is consistent with the D-RAP description in STP Units 3 and 4 FSAR Section 17.4S.
- The staff audited the applicant’s document titled “South Texas Project, Units 3 and 4, Design Report: Design Reliability Assurance Program Plan,” dated February 14, 2011 [8]. This document is the D-RAP implementing plan. The development and approval of this plan was accomplished under the cognizance of the applicant’s D-RAP expert panel. The staff found this plan to be consistent with the D-RAP description in STP Units 3 and 4 FSAR Section 17.4S, with the exception of the deterministic criteria for ranking SSCs described in FSAR Section 17.4S.1.4.2 (“Deterministic Risk Ranking”). More specifically, the D-RAP implementing plan states in two places that a weighted score of 25 on any one question results in a “High” risk categorization, and a weighted score of 9-12 on any one question results in a minimum risk categorization of “Low.” This statement is not consistent with FSAR Section 17.4S.1.4.2, which states that a weighted score of 15 or more on any one

question results in a “High” risk categorization. The staff communicated this finding to the applicant via a telecom on March 10, 2011. Based on a subsequent audit, the applicant had applied their corrective action process and corrected the deterministic criteria in the D-RAP implementing plan to be consistent with FSAR Section 17.4S.1.4.2.

- Based on the staff’s audit of the meeting records of the applicant’s D-RAP expert panel, the expert panel has been thoroughly engaged in the D-RAP process and in implementing the D-RAP essential elements to enhance the process, such as clarifying D-RAP procedures and clarifying instructions for implementing the deterministic method.
- The applicant identified the risk-significant systems that are within the scope of D-RAP using the risk ranking methodology described in STP Units 3 and 4 FSAR Section 17.4S.1.4 (“Methods of Analysis for Risk Significant SSC Identification”). Numerous non-PRA modeled systems were added to the D-RAP based on the deterministic method described in FSAR Section 17.4S.1.4.2. Also, a focused example was performed to identify the risk-significant components in the High Pressure Core Flooder (HPCF) system. The staff examined the list of risk-significant systems and the list of risk-significant components for the HPCF system and found the lists to be comprehensive. While there are subjective elements in the deterministic method (such as the weighting factors and the deterministic criteria), the applicant appears to have applied sound and reasonable judgment in implementing the methodology.

References:

1. STP Nuclear Operating Company, “South Texas Project, Units 3 and 4, Final Safety Analysis Report,” Revision 5, January 26, 2011.
2. Nuclear Regulatory Commission, Office of New Reactors (NRO) Office Instruction, “Regulatory Audits,” NRO-REG-108, April 2, 2009.
3. General Electric, “Response to Severe Accident Policy Statement,” ABWR Standard Safety Analysis Report, Chapter 19.
4. STP Nuclear Operating Company, “South Texas Project, Units 3 and 4, Probabilistic Risk Assessment, Establishment of Models to Evaluate Plant-Specific Changes,” Revision 1, December 2009.
5. STP Nuclear Operating Company, “South Texas Project, Units 3 and 4, Plant-Specific Model,” Revision 3, December 2009.
6. Nuclear Regulatory Commission, “Interim Staff Guidance, Probabilistic Risk Assessment Information to Support Design Certification and Combined License Applications,” DC/COL-ISG-03, June 11, 2008.
7. STP Nuclear Operating Company, “South Texas Project, Units 3 and 4, Project Requirements Document: Design Reliability Assurance Program,” 7A98-0301-0003, Revision 0, February 9, 2011.

8. STP Nuclear Operating Company, "South Texas Project, Units 3 and 4, Design Reliability Assurance Program Plan," DP-RAM-II-09-001, Revision 0, February 14, 2011. An update of this document was issued as Revision 1, March 25, 2011.

**Audit Plan for Nuclear Regulatory Commission Staff Audit of
South Texas Project (STP), Units 3 and 4,
Chapter 19 and Section 17.4S of the STP COL Application**

I. PURPOSE

The purposes of this audit are for the U.S. Nuclear Regulatory Commission (NRC) staff to:

- Conduct a review of South Texas Project (STP), Units 3 and 4, probabilistic risk assessment (PRA) description and results that are provided at the Westinghouse Twinbrook office located in Rockville, Maryland. This audit will facilitate the staff's review of Chapter 19 ("Response to Severe Accident Policy Statement") of the STP Units 3 and 4 Final Safety Analysis Report (FSAR).
- Conduct a review of the records and procedures associated with STP Units 3 and 4 design reliability assurance program (D-RAP) that are provided at the Westinghouse Twinbrook office. This audit will facilitate the staff's determination that the list of risk-significant systems, structures, and components (SSCs) within the scope of D-RAP is being developed appropriately and in accordance with the methodology described in Subsection 17.4S.1.4 ("Methods of Analysis for Risk Significant SSC Identification") of FSAR Section 17.4S ("Reliability Assurance Program").

II. BACKGROUND AND AUDIT BASES

The NRC staff conducted an audit of the STP Units 3 and 4 PRA during the period of September 22-23, 2009 at the Nuclear Energy Institute (NEI) NPOC office in Rockville, Maryland. From the audit's exit meeting on September 23, 2009, between the staff and STP Nuclear Operating Company ("the applicant"), the applicant agreed to provide a copy of the STP Units 3 and 4 PRA description and results at the Westinghouse Twinbrook office for the staff to further review. In order to complete the technical review of Chapter 19 of the STP Units 3 and 4 FSAR, the staff is planning an audit to further review the STP Units 3 and 4 PRA description and results provided at the Westinghouse Twinbrook office. This audit will facilitate the staff's determination that the Tier 1 and Tier 2 departures for the STP Units 3 and 4 design are adequately addressed in the STP Units 3 and 4 PRA, which was developed based on the reconstituted ABWR PRA.

In accordance with 10 CFR 52.79(d)(1), the initial list of risk-significant SSCs in Appendix 19K of FSAR Chapter 19 incorporates by reference Appendix 19K of the certified ABWR DCD and updated to account for site-specific design information and design departures. Based on FSAR Section 17.4S and associated FSAR Commitment 17.4-1, as D-RAP enters the detailed design, procurement, fabrication and construction phases, the list of risk-significant SSCs will be updated, revised, and maintained in accordance with the methodology described in FSAR Section 17.4S.1.4. STP is currently updating the list of risk-significant SSCs in accordance with this methodology. This audit will facilitate the staff's determination that the list of risk-significant

SSCs is being developed appropriately and in accordance with the methodology described in FSAR Subsection 17.4S.1.4.

III. SCOPE

The scope of this audit includes the review of the following information:

- STP Units 3 and 4 PRA description and results, including the Level-1 at-power PRA and the PRA for shutdown operation. This part of the audit will focus on those areas that are considered especially important to the risk assessment of the STP Units 3 and 4 design, including:
 - Initiating Events
 - Data Analysis (including human error probabilities)
 - Accident Sequence Analysis
 - Success Criteria
 - Systems Analysis
 - Results and Insights
 - External Events
 - Shutdown PRA

These specific areas of review have been selected based on the STP Units 3 and 4 design departures and the topics that have been the subject of Requests for Additional Information (RAI).

- STP Units 3 and 4 D-RAP records and procedures that include:
 - STP Units 3 and 4 D-RAP coordinating procedure that identifies the organizational responsibilities, interfaces and total set of procedures necessary to collectively implement the D-RAP. The development of this procedure is in compliance with STP Units 3 and 4 FSAR Section 17.4S.6 (“Procedure Control”) and is further discussed in STP’s response to RAI 17.04-8, dated September 28, 2009.
 - STP Units 3 and 4 procedure(s) used for determining the risk-significant SSCs in accordance with the methodology described in FSAR Section 17.4S.1.4. The development of this procedure is in compliance with FSAR Section 17.4S.1.2.4 (“Engineering Design Controls for SSC Identification”) and FSAR Section 17.4S.6.
 - For selected systems in which the system reviews have been completed, STP Units 3 and 4 D-RAP records (e.g., records of expert panel decisions and supporting documents) that document the evaluations for categorizing the risk significance of SSCs in accordance with the methodology described in FSAR Section 17.4S.1.4 (which includes the use of the new PRA risk categorization criteria and an expert panel to augment PRA techniques using the deterministic categorization process). These records should also document the qualifications of the expert panel. Maintaining these records is in compliance with FSAR Section 17.4S.7 (“Records”).

IV. AUDIT ACTIVITIES

The audit will be conducted by a team of NRC staff knowledgeable in STP Units 3 and 4 FSAR Chapter 19 and Section 17.4S. The team will perform the audit at the Westinghouse Twinbrook office in Rockville, MD. The team will review, as needed, the documentation and records described under Part III of this audit plan, which should be provided at the Westinghouse Twinbrook office. The team members will write RAIs, as deemed appropriate, and assist in preparing, editing and finalizing the audit report.

V. SCHEDULE AND DELIVERABLES

The audit of the documentation and records described under Part III of this audit plan is scheduled to take place during the period of November 4, 2009 to July 29, 2011 at the Westinghouse office located at 12300 Twinbrook Parkway, Suite 150, Rockville, MD. The staff should contact and make arrangements with the Westinghouse Twinbrook office at least 24 hours prior to each visit to review the documentation and records. Over the duration of this audit, the staff will communicate with the applicant, as necessary, any preliminary findings and potential issues. A written audit report will be completed 90 days following completion of the audit.

VI. PROPOSED TEAM

The proposed team is made up of the following individuals:

- Todd Hilsmeier NRC (Lead, Level-1 PRA, External Events, D-RAP)
- John Lai NRC (Level-1 PRA, External Events)
- Don Dube NRC (Senior Level Advisor)
- Edward Fuller NRC (Level-2 PRA, Severe Accidents)
- Keith Tetter NRC (Level-1 PRA)
- Marie Pohida NRC (Shutdown PRA)
- Michelle Gonzalez NRC (Level-1 PRA results)

VII. REQUIRED REFERENCE MATERIAL (FROM APPLICANT)

The following documentation should be available at the Westinghouse Twinbrook office to the audit team.

- STP Units 3 and 4 PRA description and results, including internal events, low-power shutdown, and external events.
- STP Units 3 and 4 D-RAP coordinating procedure that identifies the organizational responsibilities, interfaces and total set of procedures necessary to collectively implement the D-RAP.

- STP Units 3 and 4 procedure(s) used for determining the risk-significant SSCs in accordance with the methodology described in FSAR Section 17.4S.1.4.
- For selected systems in which the system reviews have been completed, STP Units 3 and 4 D-RAP records (e.g., records of expert panel decisions and supporting documents) that document the evaluations for categorizing the risk significance of SSCs in accordance with the methodology described in FSAR Section 17.4S.1.4. These records should also document the qualifications of the expert panel.