UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

August 9, 2010

Mr. R.W. Borchardt
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: INTERIM LETTER: SAFETY EVALUATION REPORT WITH OPEN ITEMS RELATED TO THE SOUTH TEXAS PROJECT COMBINED LICENSE APPLICATION REFERENCING THE CERTIFIED ADVANCED BOILING WATER REACTOR DESIGN

Dear Mr. Borchardt:

During the 574th meeting of the Advisory Committee on Reactor Safeguards, July 14-16, 2010, we reviewed the staff's Safety Evaluation Report (SER) with open items related to Revision 3 of the South Texas Project Nuclear Operating Company (STPNOC) Combined License Application (COLA) referencing the certified Advanced Boiling Water Reactor (ABWR) design. During our 567th meeting, November 5-7, 2009, we discussed the significant technical and licensing issues related to this COLA; qualification of the alternate engineering, procurement and construction vendor (Toshiba); and the scope and schedule of the staff's COLA review. Our ABWR Subcommittee held five meetings between March 2, and June 24, 2010, to review Chapters 1, 4 through 8, and 10 through 19 of the COLA and the staff's SER with open items. Our reviews did not address security matters or their impact on other aspects of the COLA. During these meetings, we had the benefit of discussions with representatives of the NRC staff, STPNOC and their supporting vendors. We also had the benefit of the documents referenced.

CONCLUSION AND RECOMMENDATION

1. The STPNOC COLA and the staff's SER with open items for the chapters we reviewed are acceptable subject to satisfactory closure of open items and resolution of our remaining questions and comments.

2. A process for the identification and resolution of 10 CFR Part 21 notifications issued between the design certification rulemaking and COLA submittals should be developed and applied to all design centers and COLAs.

BACKGROUND

The ABWR design was certified by the NRC on May 12, 1997; the design certification rule is codified in 10 CFR Part 52, Appendix A. On September 20, 2007, STPNOC (the applicant) submitted a COLA to build and operate two units of the certified ABWR design (STP Units 3 and 4) at the existing site of two Westinghouse PWRs (STP Units 1 and 2) in Matagorda County, Texas. Since this application is the first COLA referencing the certified ABWR design, it is

considered the “Reference COLA” (RCOLA). In the COLA, STPNOC addressed the differences from the certified ABWR design as “departures” and provided plant-specific and supplementary information as required by the Design Control Document (DCD).

We have agreed to review the staff’s SER with open items on a chapter-by-chapter basis to identify technical issues that merit further consideration. We have reviewed the SER with open items except for Chapters 2, 3, and 9, which have not yet been completed by the staff.

DISCUSSION

On November 29, 2007, the STPNOC COLA was formally accepted for docketing by the NRC. Since then, three revisions to the COLA have been submitted by the applicant.

In 2008, STPNOC selected Toshiba as the engineering, procurement and construction contractor. This “alternate vendor” does not have access to all of the licensing topical/technical reports (LTRs) used by General Electric (GE) in the design certification. Hence, several new LTRs have been submitted by the applicant to support the COLA. Application of the methodologies in these LTRs to STP Units 3 and 4 was reviewed by the staff and documented in the applicable SER sections. Since staff decisions pertaining to the RCOLA will apply to all subsequent COLAs, we intend to review the staff’s evaluation of these LTRs for generic applicability.

The COLA references the fuel design prescribed in the certified design. STPNOC plans to submit an amendment to the COL to load the initial core with a different fuel design. LTRs prepared by Westinghouse and STPNOC to support this COL amendment are being submitted for NRC review. We intend to review these LTRs and associated safety evaluations.

We understand that STP Units 3 and 4 have been designated as pilot plants for implementation of the NRC Design Acceptance Criteria (DAC) closure inspection process. Our July 24, 2009, letter on Regulatory Guide 1.215, “Guidance for ITAAC Closure under 10 CFR Part 52,” discussed our concerns related to the DAC closure process. Our concerns regarding the DAC closure process have been elucidated further in our recent letter, dated August 9, 2010. We intend to review the DAC closure inspection process as it pertains to the STPNOC COLA.

Prior to our review, neither the applicant nor the staff had identified, evaluated, or addressed pertinent Part 21 notifications issued during the more-than-ten-year period between the ABWR design certification and submittal of the STPNOC COLA. Subsequently, the applicant prepared a list of pertinent Part 21 notifications issued since 1995, and is developing a program to address them. Independently, the staff prepared a list of Part 21notifications issued since 1997 applicable to the ABWR design, that included additional issues beyond those identified by the applicant. The applicant has agreed to address the additional Part 21 issues identified by the staff. The fact that the two reviews yielded different results suggests that this evaluation needs further review. More importantly, the staff should develop a process to ensure that all applicable Part 21 reports are addressed by all design centers and COLAs. We plan to review both the generic and specific resolution of this issue as it pertains to the STPNOC COLA.

Applicable experience from currently operating plants will be incorporated by STP Units 3 and 4 following the STPNOC’s operating experience program in effect for Units 1 and 2. However, unlike the operating Units 1 and 2, the pre-construction status of Units 3 and 4 allows for design-based solutions to some of the issues, for example preventing or mitigating underground

piping leaks that have been experienced by the industry in recent years. In a June 30, 2010, response to a request for additional information, the applicant committed to locate all below-grade piping containing radioactive liquids within pipe tunnels. The staff should encourage such design-based solutions.

Use of mixed unit systems (Metric and English) in design, engineering, maintenance and operational documents and procedures has led to undesirable events detrimental to safety in several engineering applications. The STPNOC COLA and the staff's SER with open items include many examples where mixed units are used. We are concerned that this practice enhances the opportunity for human error. The applicant's proposed plan to address this issue is acceptable. However, we have a generic concern that use of mixed unit systems by applicants and licensees may lead to undesirable consequences which may impact plant safety.

Our review of the electrical power system design resulted in several questions. STP Units 3 and 4 have two Combustion Turbine Generators (CTGs) to mitigate Station Blackout (SBO) conditions. Since STPNOC chose not to perform an SBO coping analysis, they must demonstrate that the CTGs are capable of powering at least one safety bus within 10 minutes after the onset of an SBO (10 CFR 50.63 (c)(2)). This scenario requires operator actions to manually shed non-safety loads, connect the CTG to a safety bus, and repower required shutdown equipment within 10 minutes after the onset of the SBO. The applicant needs to demonstrate that operators can reliably complete the necessary actions within this 10-minute window.

Consistent with industry practice, each circuit breaker in the STP switchyard contains a single closing coil. This requires a careful configuration of the DC power supplies to the closing coils to ensure that failure of one DC train does not prevent the closing of breakers that are needed to reconnect offsite power to the plant. This issue has been brought to the attention of the applicant and the staff.

The applicant described the elements of the Design Reliability Assurance Program (DRAP). This program ensures that: (1) the plant is designed and constructed consistent with the key assumptions and risk insights of the PRA and deterministic analyses; (2) the risk-significant structures, systems and components (SSCs) are identified considering operations, maintenance, and monitoring activities; (3) appropriate quality controls are in place to maintain these SSCs; and (4) information is communicated to the appropriate organizations to ensure that the maintenance and testing activities address the dominant failure modes of these SSCs.

The PRA that has been used to identify risk-significant SSCs for the DRAP is the "STP COLA PRA." That PRA has been reconstituted following the format, scope and methodology of the PRA in the original DCD. This process appears to meet the regulatory requirements. However, the rudimentary nature of the reconstituted PRA, with simplified and limited models for many systems (e.g., condensate and feedwater), may not adequately support the intended objective to completely and consistently identify risk-significant SSCs for the DRAP process. The STPNOC methodology for populating the list of risk-significant SSCs compensates for this limitation by using an expert panel to identify additional SSCs based on deterministic evaluations. We are concerned that the overall process may still not be adequate.

The DCD includes an "Inspections, Tests, Analyses, and Acceptance Criteria" (ITAAC) to require inspections to verify adequacy of the scope, purpose, objectives, and the process used to develop the DRAP list and to determine dominant failure modes considering industry

experience, analytical models, and applicable requirements. We intend to review the closure process for this ITAAC.

Significant differences exist between the turbine generator system design for STP Units 3 and 4 and the certified ABWR design. These include integral rotor forgings rather than rotors with shrunk-on discs, higher fracture appearance transition temperature (FATT), and lower Charpy V-notch energy (C_v energy). The staff conducted an audit and concluded that the applicant had conducted appropriate technical evaluations to justify these departures. The technical bases for acceptance of these departures, particularly the higher FATT and lower C_v energy values, were not documented by the staff. We plan to pursue this issue at a later meeting.

The applicant indicated that the main turbines of STP Units 3 and 4 are "favorably oriented" with regard to their respective units. However, turbine missiles from one unit may damage SSCs at the other unit. The applicant also indicated that there is a small possibility that turbine missiles from Units 3 and 4 could impact SSCs at Units 1 and 2. The applicant is expected to submit a turbine system maintenance program, including a turbine missile analysis, based on the as-built turbine design, within three years after issuance of the COL. We plan to review the applicant's turbine missile analysis and the associated staff evaluation.

Standard Review Plan (SRP) guidance calls for both a primary mechanical turbine overspeed protection device and an emergency backup electrical system to assure redundancy and diversity. The design for STP Units 3 and 4 departs from the certified ABWR design by using two electrical overspeed systems. The staff continues to review this issue focusing on the redundancy and diversity of the overspeed systems based on SRP guidance. Our concerns regarding this issue stem from a review of the proposed system description and associated ITAAC. The ITAAC incorporated inspections and acceptance criteria that are very general in scope and do not include the attributes and types of analyses necessary to assure that the final design meets the independence and diversity criteria. The ITAAC should be revised.

In a Staff Requirements Memorandum (SRM) dated May 8, 2008, the Commission directed us to advise the staff and the Commission on the adequacy of the design basis long-term core cooling approach for each new reactor design. We have not completed our review of this issue for this design due to the continuing review of generic issues including the emergency core cooling system (ECCS) sump strainer blockage and gas accumulation in emergency core cooling, decay heat removal, and containment spray systems. We plan to review the applicant's resolution of these issues and the associated staff evaluations.

The proposed resolution of the issue of ECCS sump strainer blockage for STP Units 3 and 4 was presented by both the applicant and the staff. The applicant's approach is well thought out. It provides a large strainer area and uses only qualified coatings and reflective metallic insulation for piping inside the containment. No fiber insulation, aluminum, or other reactive materials are used. However, the issue of downstream effects can only be resolved by prototypical testing of the actual BWR fuel design to be used in STP Units 3 and 4. Accordingly, the staff has imposed a license condition requiring STPNOC to submit, as a part of the license amendment for the initial fuel load, a test plan and acceptance criteria to demonstrate satisfactory fuel performance during a loss of coolant accident when downstream effects of containment debris are considered. In order to adequately respond to the May 8, 2008, SRM, we plan to review the issue of downstream effects and the associated test program for the actual fuel design to be used in STP Units 3 and 4.

The STPNOC COLA and the staff's SER with open items for the chapters we reviewed are acceptable subject to satisfactory closure of open items and resolution of our remaining questions and comments.

Sincerely,

/RA/

Said Abdel-Khalik
Chairman

References:

1. Memorandum to Edwin M. Hackett, "Safety Evaluation Report with Open Items Regarding the South Texas Project Units 3 and 4 Combined License Application – Chapters 1, 4, 11, 12, 15, and 18," 01/29/10 (ML100290349)

2. Memorandum to Edwin M. Hackett, "Safety Evaluation Report with Open Items Regarding the South Texas Project Units 3 and 4 Combined License Application – Chapters 5, 8, 16, and 17," 02/19/2010 (ML100341172)

3. Memorandum to Edwin M. Hackett, "Safety Evaluation Report with Open Items Regarding the South Texas Project Units 3 and 4 Combined License Application – Chapters 7 and 14," 04/21/2010 (ML101090507)

4. Memorandum to Edwin M. Hackett, "Safety Evaluation Report with Open Items Regarding the South Texas Project Units 3 and 4 Combined License Application – Chapter 19," 05/07/2010 (ML101241046)

5. Memorandum to Edwin M. Hackett, "Safety Evaluation Report with Open Items Regarding the South Texas Project Units 3 and 4 Combined License Application – Chapters 6,10, and 13," 05/21/2010 (ML100630184)

6. Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design, 7/1994, and Supplement 1, 5/1997, (NUREG 1503) (ML100430016 and ML080710134)

7. Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition, (NUREG 0800)

8. Regulatory Guide 1.206, - "Combined License Applications for Nuclear Power Plants," June 2007

9. NRO-REG-100, "Acceptance Review Process for Design Certification and Combined License Applications, DRAFT 01, For Use and Comment," 01/07/08 (ML073340829)

10. Staff Requirements - Periodic Briefing on New Reactor Issues, 1:00 P.M., Wednesday, April 30, 2008, Commissioners' Conference Room, One White Flint North, Rockville, Maryland (Open to Public Attendance), 05/08/2008, (ML081290255)

11. Letter to Chairman Jaczko, NRC, “Closure of Design Acceptance Criteria for New Reactors,” 08/09/2010, (ML102000425)

12. 10 CFR Section 50.63(c)(2), Loss of All Alternating Current Power - Alternate AC Source

11. Letter to Chairman Jaczko, NRC, “Closure of Design Acceptance Criteria for New Reactors,” 08/09/2010, (ML102000425)

12. 10 CFR Section 50.63(c)(2), Loss of All Alternating Current Power - Alternate AC Source

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