September 10, 2010

Dr. Said Abdel-Khalik, Chairman
Advisory Committee on Reactor Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: RESPONSE TO ADVISORY COMMITTEE ON REACTOR SAFEGUARDS INTERIM LETTER: SAFETY EVALUATION WITH OPEN ITEMS RELATED TO THE SOUTH TEXAS PROJECT COMBINED LICENSE APPLICATION REFERENCING THE CERTIFIED ADVANCE BOILING-WATER REACTOR DESIGN

Dear Dr. Abdel-Khalik:

I am writing in response to the letter from the Advisory Committee on Reactor Safeguards (ACRS), dated August 9, 2010. The letter addressed the U.S. Nuclear Regulatory Commission staff's safety evaluation (SE) with open items (OIs) related to the combined license application (COLA) for South Texas Project Nuclear Operating Company (STPNOC), STP Units 3 and 4. The ACRS discussed the SE during its 574th meeting on July 14–16, 2010. The ACRS Advanced Boiling-Water Reactor Subcommittee had previously held meetings to discuss technical aspects of the combined license and the staff's SE with OIs between February and June 2010.

ACRS's letter included two recommendations:

Conclusion: The STPNOC COLA and the staff's SE report with OIs for the chapters we reviewed are acceptable subject to satisfactory closure of OIs and resolution of our remaining questions and comments.

Staff Response: The staff appreciates the Committee's efforts.

Recommendation: A process for the identification and resolution of Title 10 of the *Code of Federal Regulations*, Part 21 notifications issued between the design certification rulemaking and COLA submittals should be developed and applied to all design centers and COLAs.

Staff Response: The staff agrees with the recommendation of the Committee. The enclosure describes the staff's plans to develop a generic process in this area.

We thank the ACRS for their time and their valuable input, and we look forward to working with the Committee in the future.

Sincerely,

/RA/

R. W. Borchardt
Executive Director
for Operations

Enclosure:
As stated

cc: Chairman Jaczko
Commissioner Svinicki
Commissioner Apostolakis
Commissioner Magwood
Commissioner Ostendorff
SECY

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STAFF RESPONSE TO ACRS RECOMMENDATIONS
SOUTH TEXAS PROJECT COMBINED LICENSE APPLICATION

ACRS Comment:

> In 2008, STPNOC [South Texas Project Nuclear Operating Company] 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 [combined license application]. Application of the methodologies in these LTRs to STP Units 3 and 4 was reviewed by the staff and documented in the applicable SE [safety evaluation] sections. Since staff decisions pertaining to the RCOLA [referenced COLA] will apply to all subsequent COLAs, we intend to review the staff's evaluation of these LTRs for generic applicability.

Staff Response:

The staff agrees with this comment. The LTRs submitted in support of the STP COLA, whether prepared by Toshiba or another entity, will not receive separate SEs from the staff; neither will they be on any docket except the dockets for STP Units 3 and 4. The applicability of the LTRs submitted in support of the STP COLA is limited to STP Units 3 and 4 exclusively. We understand, however, the Committee's interest in these LTRs and are in the process of scheduling a separate presentation on them.

ACRS Comment:

> The COLA references the fuel design prescribed in the certified design. STPNOC plans to submit an amendment to the COL [combined license] 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.

Staff Response:

The staff agrees with this comment. The staff has already forwarded several of these LTRs to the ACRS and will provide the remaining LTRs as the staff receives them. At the meeting with the ACRS scheduled for October 4, 2010, the staff intends to provide the Committee with more detailed technical information on these LTRs to inform your future review decisions.

ACRS Comment:

> 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 [Title 10 of the *Code of Federal Regulations*],

> 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.

Staff Response:

The staff agrees with this comment. The staff will address these concerns in a separate response to the August 9, 2010, letter.

ACRS Comment:

In conclusion and recommendation (Item 2) you stated:

> 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.

Staff Response:

The staff agrees with the ACRS comment regarding the applicability of 10 CFR Part 21 notifications to design certification rulemakings that are being referenced by COL applicants. The staff will develop guidance and any necessary clarifications to ensure that 10 CFR Part 21 notifications are appropriately addressed as part of the licensing process for new reactors. The staff will provide an update to the ACRS after development of such guidance is completed.

ACRS Comment:

> 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.

Staff Response:

The staff agrees with the comment regarding a need to develop a process to ensure that all applicable Part 21 reports are addressed by all design centers and COLAs. However, we disagree that additional evaluation is needed for STP. In responding to the other concern raised by the Committee specific to the STP COL, the staff and the applicant independently reviewed 10 CFR Part 21 notifications issued subsequent to the Advanced Boiling-Water Reactor (ABWR) design certification. The staff searched the reactor operating experience system for 10 CFR Part 21 notifications issued from the time the ABWR was certified in 1997. The staff's search discovered two issues that required additional action. The applicant searched all 10 CFR Part 21 notifications issued since 1995 and also identified two issues that required additional action. The applicant's search and the staff's search found one common issue related to Stability Long-Term Solution Option III, which was germane to the ABWR design review and was presented at the ACRS meeting. The second issue identified by the staff as requiring additional action by the STP applicant related to a 10 CFR Part 21 notice prepared in response to a deficiency in a General Electric analysis for operating a boiling-water reactor with one main steamline isolated. STP has not proposed to operate in that configuration and would not have characterized it as a relevant Part 21 report. However, the staff recognized a weakness in the technical specifications and proposed action to address this through a request for additional information (RAI). In resolving the issue, STP plans to modify the final safety analysis report (FSAR) and technical specification bases to clarify that an analysis of the potential effects of flow-induced vibration must be performed before operation with an isolated main steamline and that continued plant operation must remain within the bounds of the analysis. This is currently a Confirmatory Item.

The second issue identified by the applicant occurred before 1997; therefore, the staff did not identify it because it was designated as a licensee event (Licensee Event Report: Reference 05000000-9600-000, Part 21, log 96470). The deficiency related to a General Electric computer program GESTAR II to model fuel configuration used in predicting Safety Limit Minimum Critical Power Ratio. It predicted the value may be non-conservative for some specific fuel design and configuration. However, the NRC staff panel later judged this potential situation to have generic implications, but to be of minor safety significance. Furthermore, the staff did not propose any corrective action.

ACRS Comment:

> 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.

Staff Response:

The staff agrees with your comment. The staff will work with the applicant to incorporate design-based solutions, as recommended by the Committee.

ACRS Comment:

> 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 SE 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.

Staff Response:

The staff agrees with this comment. We agree that the use of mixed units can have undesirable consequences. The staff routinely works with applicants to use common units throughout the application. However, where applicants choose to retain mixed units, the staff acknowledges that it is a complicating factor.

ACRS Comment:

> 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.

Staff Response:

The staff agrees with this comment. In response, we made this an open item (OI) in our SE and issued an RAI requesting the applicant describe how it intends to address this issue. The applicant has subsequently responded, and the resolution of this issue will be described to ACRS when the staff presents its final SE Chapter 8.

ACRS Comment:

> 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.

Staff Response:

The staff agrees with this comment. The applicant has noted this comment and will consider carefully its power configuration for the switchyard breakers.

ACRS Comment:

> 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 [probabilistic risk assessment] 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.

Staff Response:

The staff agrees that the DRAP list in Chapter 19 of the ABWR design certification may not be complete. The staff believes that Commitment 17.4-1 in STP FSAR Section 17.4S ("Reliability Assurance Program"), which will appear in Revision 4 of the FSAR, should sufficiently address this issue. Under Commitment 17.4-1, STP will update the DRAP list using the methodology described in FSAR Section 17.4S.1.4 by September 2011, before STP enters the detailed design and construction phases. This methodology augments the PRA techniques used in the referenced ABWR design control document (DCD) by using (1) an expert panel, (2) the deterministic technique described in FSAR Section 17.4S.1.4, and (3) industry operating experience. Use of these tools (i.e., the expert panel, the deterministic technique, industry operating experience, and STP's PRA, which is based on the ABWR DCD PRA) should ensure that the DRAP list is adequately populated. It is also important to note that, in accordance with the DRAP process, the DRAP list is a "living" list in that the licensee updates it, as needed,

throughout the detailed design and construction phases as changes are made to the plant-specific design and PRA.

To ensure that the DRAP list is acceptable, the staff has planned specific activities. We intend to perform an audit in the fall of 2010 to ensure that the DRAP list is being developed in accordance with the methodology described in Section 17.4S.1.4 of the FSAR. We also plan to conduct an inspection in late 2011 to verify that the applicant has met Commitment 17.4-1.

ACRS Comment:

> 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 (Cv 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 Cv energy values, were not documented by the staff. We plan to pursue this issue at a later meeting.

Staff Response:

The staff agrees with this comment. The staff is currently finalizing the SE sections related to the turbine generator. The staff's final SE with no OIs, which it will present to the Committee at a future meeting, will address the resolution of the concerns raised.

ACRS Comment:

> 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.

Staff Response:

The staff agrees with this comment. The applicant will be submitting the turbine maintenance program to meet a requirement in the DCD. The SE details the scope of the staff's review. Following its review, the staff will be happy to respond to any questions from ACRS.

ACRS Comment:

> 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 [Inspections, Tests, Analyses, and Acceptance Criteria]. 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.

Staff Response:

The staff agrees with this comment. The staff continues to devote significant time to the review of this Tier 2 departure from the DCD. Section VIII.B.5.b of Appendix A, "Design Certification Rule for the U.S. Advanced Boiling Water Reactor," to 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," gives specific criteria that must be met before an applicant can take such a departure without NRC approval. The staff's review efforts are focused on ensuring that the applicant has demonstrated adequately that these criteria have been met. The staff is still reviewing an OI associated with this issue. The resolution of this issue will be addressed in the staff's final SE with no OIs and will be presented to the Committee at a future meeting.

ACRS Comment:

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.

Staff Response:

The staff agrees with this comment. The fuel that is being licensed from the DCD is not available to the applicant for downstream effects testing at this time. To justify the issuance of a license, the staff is requiring the applicant to submit a test plan with acceptance criteria to demonstrate satisfactory fuel performance following a loss-of-coolant accident when the effects of downstream debris are considered. This test plan will be required, however, not for the amendment requesting the initial fuel load, but rather for the issuance of the COL. The criteria in the test plan will be incorporated in a license condition that will be imposed on the COL at issuance.

We understand that sump strainer performance is only one aspect of the larger long-term cooling questions associated with the ABWR design. For this reason, we are scheduling a meeting with the Committee, separate from the STP COL meetings, to address ABWR performance.