July 12, 2010

Mr. Scott Head, Manager
Regulatory Affairs
STP Nuclear Operating Company
P. O. Box 289
Wadsworth, TX 77483

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 350 RELATED TO SRP SECTIONS 03.08.01, 03.08.04, AND 03.08.05 FOR THE SOUTH TEXAS PROJECT COMBINED LICENSE APPLICATION

Dear Mr. Head:

By letter dated September 20, 2007, STP Nuclear Operating Company (STP) submitted for approval a combined license application pursuant to 10 CFR Part 52. The U. S. Nuclear Regulatory Commission (NRC) staff is performing a detailed review of this application to enable the staff to reach a conclusion on the safety of the proposed application.

The NRC staff has identified that additional information is needed to continue portions of the review. The staff's request for additional information (RAI) is contained in the enclosure to this letter.

To support the review schedule, you are requested to respond within **30** days of the date of this letter. If changes are needed to the safety analysis report, the staff requests that the RAI response include the proposed wording changes.

If you have any questions or comments concerning this matter, I can be reached at 301-415-8484 or by e-mail at Tom.Tai@nrc.gov or you may contact George Wunder at 301-415-1494 or George.Wunder@nrc.gov.

Sincerely,

/RA/

Tom M. Tai, Senior Project Manager
ABWR Projects Branch
Division of New Reactor Licensing
Office of New Reactors

Docket Nos. 52-012
52-013

eRAI Tracking No. 4832, 4833, and 4834

Enclosure:
Request for Additional Information

cc: William Mookhoek
John Price

If you have any questions or comments concerning this matter, I can be reached at 301-415-8484 or by e-mail at Tom.Tai@nrc.gov or you may contact George Wunder at 301-415-1494 or George.Wunder@nrc.gov.

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***Approval captured electronically in the electronic RAI system.**

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Request for Additional Information No. 4832 Revision 3

7/9/2010

South Texas Project Units 3 and 4
South Texas Project Nuclear Operating Co
Docket No. 52-012 and 52-013
SRP Section: 03.08.01 - Concrete Containment
Application Section: FSAR 3.8

QUESTIONS for Structural Engineering Branch 2 (ESBWR/ABWR Projects) (SEB2)

03.08.01-9
Follow-up to Question 03.08.01-6

In its response to Question 03.08.01-6, the applicant addressed some of the issues regarding the watertight doors. However, additional information is needed to completely address all of the issues pertaining to the design of the watertight doors. In order for the staff to complete its review, the applicant is requested to provide the following additional information:

1. In Section 2 of the response, the applicant provided a sketch that shows the location of the watertight door between the Control building and the Radwaste Building Access Corridor. However, the applicant did not include the sketch in the FSAR mark-up provided with the response. Therefore, the applicant is requested to include the sketch in the FSAR to clearly identify locations of all seismic category I watertight doors.

2. In Section 3(a) of the response, the applicant provided loadings and loading combinations for design of watertight doors considering flooding. The staff needs the following clarifications for the loads and load combinations provided in the response:

    a. Since ANSI/AISC N690 and ACI 349 do not specifically address flood loads, please explain how the flood loads and the loading combinations, including the load factors used in loading combinations involving flood load, were determined with reference to applicable industry codes and standards. Please include in FSAR Section 3H.6.4.3.3.4, “Extreme Environmental Flood (FL),” a description of the various components of flood load, e.g., hydrostatic load, hydrodynamic load, impact load from debris transported by flood water, etc., and the corresponding design values used.

    b. The applicant defined pressure load ‘P’ as hydrostatic or differential pressure, and used it in several loading combinations. Please explain why only pressure load ‘P’ need to be considered for design of watertight doors, and not the other components of FL, e.g., hydrodynamic load and load from debris transported by flood.

3. In Section 3(b) of the response, the applicant stated that the doors will be designed in accordance with AISC N690. Since it is not clear which version of ANSI/AISC N690 was used by the applicant, please confirm that the version of the specification used is the same as that referenced in SRP 3.8.4 and update FSAR accordingly, or provide justification for using a different version.

Enclosure

4. In response to the staff's question regarding design and analysis procedure used for the watertight doors, the applicant stated in Section 3(c) of the response that "the design of the door will be performed in accordance with the requirements of SRP Section 3.8.4." SRP 3.8.4 provides general guidance and acceptance criteria for analysis and design procedure of concrete and steel category I structure. Merely referencing the SRP does not provide any information about the analysis and design procedure used by the applicant. Therefore, the applicant is requested to include in the FSAR a description of the analysis and design procedure including how seismic loads are determined for the watertight doors.

5. In response to the staff's question regarding testing and in-service inspection of the watertight doors, the applicant stated in Section 3(f) of the response, and the FSAR mark-up included in the response, that the watertight doors will allow slight seepage during an external flooding in accordance with criteria for Type 2 closures in U.S. Army Corps of Engineers (COE) EP 1165-2-314. The applicant also stated that this criterion will be met under hydrostatic loading of 12 inches of water above the design basis flood level. The applicant further stated that the water retaining capability of the doors will be demonstrated by qualification tests that shall not allow leakage more than 1/10 gallon per linear foot of gasket when subjected to the specified head pressure plus a 25% margin for one hour. The applicant did not provide in the response any information regarding in-service inspections of the watertight doors. In order for the staff to assess adequacy of the watertight doors and their availability when needed, please provide the following additional information:

    a. The allowable leakage of 1/10 gallon per linear foot of gasket per hour may potentially allow ingress of significant amount of water over time. Please provide justification why this leakage is considered to meet criterion for Type 2 closure, which is defined to form essentially dry barriers or seals, and the basis for the underlying assumption that such leakage will not compromise functionality of any safety related commodity or any other design basis.
    b. Since hydrostatic pressure on the door may help in providing a seal for the door, please explain why testing these doors against the maximum water pressure only is adequate, and will envelope performance of the seals during lower hydrostatic pressure.
    c. Since the applicant did not include in its response any information about the in-service surveillance programs for the watertight doors, and corresponding FSAR update, please explain how availability of the normally open watertight doors during a flooding event is ensured considering that these doors will need to be closed upon indication of an imminent flood.

6. In Section 6 of the response, the applicant states that the access doors between the Reactor Building (RB) and Control building (CB) are not required to be watertight since both buildings are separately protected from design basis flood, and the gap between the two buildings will be sealed using the detail shown in Figure 03.08-04-15A, which is attached to the response to RAI 03.08.04-15 (see STPNOC letter U7-C-STP-NRC-090160 dated October 5, 2009). The above referenced Figure provides only a conceptual detail of a joint seal between the buried Reactor Service Water (RSW) tunnels, and the RSW Pump House and the Control Buildings. In its response to a subsequent follow-up question 03.08.04-25 for the above referenced joint seal, the applicant provided additional design criteria for the seals to accommodate differential movements across the seal, and explained that because of the low rate with which groundwater can flow through the seal if it were to fail in any particular location, the in-leakage of groundwater is a housekeeping issue and not a safety concern. Since the seals for the gaps between the RB and the CB are credited to prevent ingress of flood water into these buildings

and provide protection to safety related commodities against flooding, reference to the joint seals used for the RSW tunnels does not adequately address the issue of ingress of flood water and potential damage to safety related components. Therefore, the applicant is requested to include in the FSAR a description of the seal between the RB and the CB including information about seismic classification, performance demand, qualification, and in-service inspection of the seal to demonstrate that the seals will be capable of preventing flood water from entering these buildings under all postulated design basis loading conditions.

The staff needs the above information to conclude that the watertight doors are designed for appropriate loads and load combinations, pertinent design information per guidance provided in SRP 3.8.4 are included in the FSAR, and there is reasonable assurance that the normally open watertight doors will be available during a flooding event.

03.08.01-10
Follow-up to Question 03.08.01-7

In response to Question 03.08.01-7, Section (1), the applicant provided details of how the out-of-plane shear and moment demands for flood and seismic loads were determined. The staff notes that the applicant in its response did not consider loading due to floating debris for computing shear and moment demands for flood. Also, the applicant implicitly used the loading combination for flood load as shown in FSAR Section 3H.6.4.3.4.3. This loading combination is not included in ACI 349, "Code Requirements for Nuclear Safety Related Concrete Structures," as referenced in SRP 3.8.4. Further, computations of shear and moment demands due to flood loading for the RB and CB walls appear to be incorrect for the assumed boundary conditions for the wall sections. Therefore, in order for the staff to be able to conclude that the ABWR standard plant structures are capable of withstanding the site-specific flood load, the applicant is requested to provide the following additional information:

1. Please include the effect of debris in flood water in the evaluation of representative wall elements of the Reactor Building (RB) and the Control Building (CB) for design basis flood. The staff notes that in its response to Question 03.08.04-22, the applicant had considered loading due to debris in flood water by considering the unit weight of flood water to be 80 pounds per cubic foot (pcf). Please provide justification for assumed debris loading with reference to industry standards and codes, as applicable.
2. Please provide the basis for the loading combination used for flood loading with reference to applicable industry codes and standards.
3. Please review the computations for shear and moment demands due to flood for RB and CB wall sections included in the response, and correct them, as needed.

Request for Additional Information No. 4833 Revision 3

7/9/2010

South Texas Project Units 3 and 4
South Texas Project Nuclear Operating Co
Docket No. 52-012 and 52-013
SRP Section: 03.08.04 - Other Seismic Category I Structures
Application Section: FSAR 3.8

QUESTIONS for Structural Engineering Branch 2 (ESBWR/ABWR Projects) (SEB2)

03.08.04-28
Follow-up to Question 03.08.04-19

In its response to Question 03.08.04-19 (Letter No. U7-C-STP-NRC-100093 dated April 29, 2010), the applicant provided some information about the foundation waterproofing material. However, some of the information provided needs further clarification. In order for the staff to conclude that the foundation waterproofing used is adequate for providing waterproofing, and will not compromise sliding stability of structures, the applicant is requested to provide the following additional information:

1. The applicant stated in its response that a two-coat elastomeric spray-on membrane will be used for waterproofing, and the physical properties of the membrane have been specifically designed to cope with the rigorous requirements of below grade conditions. However, the applicant did not provide any information regarding the meaning of "rigorous requirements of below grade conditions," and how the physical properties of the membrane meet these requirements. The applicant is requested to describe the rigor of the requirements of the below grade conditions, and how the physical properties of the membrane meet these requirements. Please also include in the in the FSAR description and thickness of the material used for the waterproof membrane.

2. The applicant stated in the response that the waterproofing membrane will be 120 mils thick, and a qualification program, which will include testing, will be developed to demonstrate that the selected material will meet the waterproofing requirements. However, the applicant did not provide any information about what the waterproofing requirements are, and the criteria to be used for the testing. Therefore, the applicant is requested to describe these waterproofing requirements to be tested including how these requirements are established, and how they will be tested to demonstrate that the selected membrane is adequate to meet the waterproofing requirements considering long term behavior of the membrane. The applicant is also requested to update the FSAR as appropriate.

3. In response to the staff's question regarding the coefficient of friction for the waterproofing membrane, the applicant has proposed an ITAAC that states that "Type testing will be performed to determine the minimum coefficient of friction of the type of material used in the mudmat-waterproofing-mudmat interface beneath the basemats of the Category I structures." It is not clear from the description if the thickness of the specimen tested will be the same as that used for the membrane. The applicant is requested to clarify this and revise the ITAAC. Also, the acceptance criteria for the ITAAC states that "A report exists and documents that the waterproof system (mudmat-waterproofing-mudmat) has a coefficient of friction to support the

analysis against sliding." The applicant stated in the response that the minimum coefficient of friction needed for maintaining the minimum factor of safety against sliding for the Reactor Building (RB) and the Control Building (CB) is 0.47. In its response, the applicant also presented in Table RAI 03.08.04-19a the minimum coefficient of friction provided at the structural concrete fill and waterproofing membrane interface as 0.6. The applicant is requested to clarify which value of coefficient of friction will be used for the acceptance criteria of the ITAAC, and include in the FSAR the minimum coefficient of friction provided at the waterproofing membrane and structural concrete fill interface. Please also revise the ITAAC acceptance criteria accordingly.

4. The applicant stated in its response (Table RAI 03.08.04-19a) that the coefficient of friction provided at the interface of the bottom of the gravel layer and soil to be the smaller of 0.6 and shear capacity of the soil. Elsewhere in the response, the applicant stated that the soil capacity exceeds the value of 0.47 needed for maintaining minimum factor of safety against sliding of RB and CB. The applicant is requested to clarify the minimum coefficient of friction available at the bottom of gravel and soil interface based on site-specific soil properties and explain how it is determined.

03.08.04-29
Follow-up to Question 03.08.04-22

In its response to Question 03.08.04-22 (Letter No. U7-C-STP-NRC-100036 dated February 10, 2010), the applicant provided marked-up FSAR pages with information about loadings to be used for design of site-specific seismic Category I structures. To assist staff in understanding the information provided, the applicant is requested to provide the following additional information/clarifications:

1. FSAR mark-up for Section 3H.6.4.3.1.5 includes a statement "This thermal condition is applicable only for the basin basemat and basin walls below the 71 ft maximum water level with ACI 350-01 durability factors" for thermal conditions described in sub item (3) and sub item (6). Please clarify why the statement is applicable for only the above two thermal conditions, and not for all 6 thermal conditions.

2. FSAR mark-up for Section 3H.6.4.3.4.3 included in the response provides loading combinations to be used for site-specific seismic Category I structures. Please explain the following loading combinations:

    - $D + F + L + H + T_a + E'$ – Provide justification for using only lateral soil pressure H, and not H', which includes seismic effects.
    - $D + F + L_0 + H' + T_0 + R_0 + E'$ – Provide justification for using L_0, which is only 25% of design live load, and not L, the full design live load.

03.08.04-30
Follow-up to Question 03.08.04-23

In response to staff question requesting additional information (Letter U7-C-STP-NRC-100036, dated February 10, 2010) about how various steel and concrete elements of site-specific structures are designed, and the design results, the applicant provided some analysis and design information. The applicant also referred to the Supplement 2 response to Question 03.07.01-13 (Letter U7-C-STP-NRC-090230, dated 12/30/09) for pertinent design summary information. In order for the

staff to conclude that the design of site-specific structures meet the requirements of GDC 2 by meeting the guidance provided in SRP 3.8.4 and 3.8.5, or otherwise, the applicant is requested to provide the following additional information:

1. The applicant states in the response that a three dimensional finite element analysis (FEA) is used for structural analysis and design of the UHS/RSW Pump House. FSAR Section 3H.6.6.1 states that analysis for the seismic loads was performed using equivalent static loads and the induced forces due to X, Y, and Z seismic excitations were combined using the SRSS method of combination. However, the applicant did not describe how the equivalent static loads due to seismic excitation were determined and applied to the static FEA model from the results of soil structure interaction (SSI) analysis used for determination of seismic response. Therefore, the applicant is requested to provide details of how seismic response analysis results from dynamic SSI analysis were transferred to the static FEA model, including how the effects of accidental torsion were included in the analysis and design of UHS/RSW Pump house. Please also update FSAR with the information, as appropriate.

2. The applicant stated in its response that the modulus of subgrade reaction for static loading was calculated as the average of the local values at nine locations under the foundation. The applicant is requested to provide these nine values, and explain why it is considered appropriate to use the average value. Please also explain how the foundation subgrade modulus was used for calculating nodal springs for the FEA model, and how the effect due to coupling of soil springs was considered in the analysis.

3. For seismic loading, the applicant has outlined a hand-calculated procedure that utilizes published formulas and charts to estimate the foundation spring constants. According to this procedure, the equivalent modulus and Poisson's ratio of a layered soil system are first estimated using the cumulative strain energy method. The resulting values are then used in the equations for computation of the spring constants for a rigid foundation of an arbitrary shape embedded in a uniform half-space. The shear moduli used for individual layers are strain-compatible values, and include the mean, upper bound, and lower bound soil cases. The approximate procedure outlined above for developing the foundation spring constants does not take into account the pressure distribution under the base slab. Furthermore, this procedure does not account for the frequency dependence of these springs. As such, the applicant is requested to provide a justification for not considering the effects of pressure distribution and system frequency in developing the foundation dynamic springs including describing the impact on the calculated results.

4. The applicant's response does not provide details as to how the soil springs calculated under static and seismic loadings are inputted to the 3-D static FEA model to calculate the design stresses. Therefore, the applicant is requested to describe in detail how the static and seismic soil springs are inputted into the FEA model, and how the results are obtained for stress evaluations. Specifically, the applicant is requested to explain if the two sets of springs were used in a single model, and how the two sets were combined to a single set of springs. Otherwise, if the two sets of springs were applied to separate FEA models, describe how the load combinations were performed. The applicant is also requested to provide sufficient detail to assist staff in understanding how static and seismic soil springs are used in the FEA model and results combined for stress evaluations.

5. In the FSAR mark-up of Sections 3H.6.6.3.1 and 3H.6.6.3.2 provided with the response, the applicant identifies the method used by the applicant for combining forces and moments. In this method, for each reinforcing zone, the maximum force or moment is coupled with the

corresponding moment or force for design for the same load combination. It is not clear if this method of combining forces and moments for design will envelop the worst combination of forces and moments for all elements in a reinforcing zone. Therefore, the applicant is requested to describe the method of combining forces and moments used by the applicant with a typical example of a reinforcing zone, and demonstrate that this method of combination will yield the worst combination of forces and moments that should be considered for design.

6. The staff notes that in the FSAR mark-up of Section 3H.6.6.3.1 provided with the response, the reported values of soil springs for the RSW Pump House are significantly larger than those for the UHS basin. The applicant is requested to confirm these values, and explain the reason for the large difference.

7. The response did not include any information about the maximum static and dynamic bearing pressures under the foundations of UHS/RSW Pump House. The applicant is requested to provide the maximum static and dynamic bearing pressure under the foundations of UHS/RSW Pump House, compare these values with the maximum allowable static and dynamic bearing pressures, and include this information in the FSAR.

8. In its response to Question 03.07.01-19 (letter U7-C-STP-NRC-100129, dated June 7, 2010), the applicant provided analysis and design information for the seismic category I Diesel Generator Fuel Oil Storage Vault (DGFOSV) a which was not previously included in the FSAR. The information included in the response does not describe how structural analysis and design of the structure was performed. Also, reference is made to FSAR Section 3H.6.4 for design loads. FSAR Section 3H.6.4 has been updated several times in various responses, and it is not clear where this information can be found. Therefore, the applicant is requested to provide complete structural analysis and design information for the DGFOSV to ensure it meets acceptance criteria 1 through 7 of SRP 3.8.4 and 3.8.5. The staff needs this information to conclude that the DGFOSV is designed to withstand seismic loads and meet GDC 2. Include in the response an updated version of Appendix 3H where structural analysis and design information for all seismic category I structures can be found.

9. While reviewing this response, and other responses referenced in this response, the staff noted that the applicant has used different values of coefficient of friction for sliding stability evaluation; e.g., the value 0.3 was used for the RSW Pump House, 0.4 was used for UHS basin, 0.58 was used DGFOSV, and for the Reactor Building (RB) and the Control Building (CB), it was stated to be more than 0.47. It is not clear if these values are the required coefficient of friction, or the minimum coefficient of friction available. The applicant is requested to clearly specify the minimum coefficient of friction at various locations of the site, if they are different, and explain how these values were determined. Please also clarify this information in the FSAR.

10. The staff noted references to Diesel Generator Fuel Oil Tunnel (DGFOT) in several RAI responses. Please confirm that DGFOT is not a seismic category I structure, and if it is seismic category I, include the analysis and design information to show how the design of the DGFOT meets the acceptance criteria 1 through 7 in the SRP 3.8.4 and 3.8.5 in the FSAR.

03.08.04-31
Follow-up to Question 03.08.04-25

The staff reviewed the applicant's response to Question 03.08.04-25 (letter U7-C-STP-NRC-10018, dated May 13, 2010). In order for the staff to conclude that the interface between seismic category I buildings and tunnels will not result in any unacceptable interaction, the applicant is requested to provide the following additional information:

1. The applicant stated in its response that the separation gap between the Reactor Service Water (RSW) Piping Tunnels and the RSW Pump House and the Control Building (CB), as well as between the Diesel Generator Fuel Oil Storage Vaults (DGFOSV) and the Diesel Generator Fuel Oil Tunnels (DGFOT), will be at least 50% larger than the absolute sum of the calculated displacements due to seismic movements and long term settlement. The material used as flexible filler will be able to be compressed to approximately 1/3 of its thickness without subjecting the building to more than a negligible force. However, the applicant provided vendor test result where 7 psi compressive stress was observed when 5 inch joint was compressed to 50% movement. This does not provide any estimate of how much compressive stress may be developed when the material is compressed to 1/3 thickness of the material. Therefore, the applicant is requested to justify that no significant stress will be imparted to the building when the joint is compressed to 1/3 thickness.

2. The DGFOT is connected to the DGFOSV at one end. It is not clear from the response where the DGFOT is connected at the other end, and what are the anticipated movements at that connection. Please include this information in Table 3H.6-15.

3. Please provide an ITAAC with key parameters for as-built verification of the connections, or provide justification for not doing so.

03.08.04-32
Follow-up to Question 03.08.04-27

The applicant stated in its response (letter U7-C-STP-NRC-100036, dated February 10, 2010) to Question 03.08.04-27 regarding COL License Information Item 3.25 that the details of the Structural Integrity Test (SIT) and the instrumentation required for the test will be provided in the ASME Construction Specification. The applicant referred to RG 1.206, Section CIII.4.3, situation 4 for resolving the COL information item six months before performance of the test. According to RG 1.206, Section CIII.4.3, the applicant should justify why the item is not resolved before the issuance of license. However, the applicant did not provide any justification. Therefore, the applicant is requested to provide a detailed justification for why any part or all of the information pertaining to the COL information item cannot be provided at this time and clearly addressing all parts of COL license information item. Also, the applicant is requested to identify in Chapter 1 of the FSAR if the COL information item cannot be resolved completely before the COL is issued. The staff needs this information to conclude that deferral of the COL information item meets the guidance provided in RG 1.206.

03.08.04-33

In FSAR Section 3.8, page 3.8-1, the applicant references the departure STD DEP 1.8-1, "Tier 2* Codes, Standards, and Regulatory Guide Edition Changes." One of the changes included in this departure updates Tier 2 to refer to the 1997 edition of ACI 349 in place of the 1980 edition of the same building code for concrete structures. In the ABWR design certification (NUREG-1503, page 3-53), the staff had evaluated only the use of 1980 edition of ACI 349. Therefore, the applicant is requested to provide a detailed comparison of the differences between these two editions of the code as they apply to the ABWR standard design, and provide justifications for any differences in order for the staff to evaluate the acceptability of the 1997 edition of ACI 349.

FSAR Section 3H.6.4.1 references ANSI/AISC N690 specification for design, fabrication, and erection of site-specific seismic category I steel structures. The applicant did not specify in this section which version of the specification is used. It appears that the applicant uses the 1984 edition of the specification referenced in ABWR DCD Table 1.8-21, which the applicant incorporated by reference. However, according to SRP acceptance criteria 3.8.4.II.5, ANSI/AISC N690-1994 including Supplement 2 (2004) has been accepted by the staff for design, fabrication, and erection of safety-related steel structures. According to the guidance provided in RG 1.206, Section C.I.1.9.2, the applicant should use the current SRP for structures outside the scope of the ABWR DCD, or provide justification for not doing so. Therefore, the applicant is requested to provide a detailed comparison of the differences between the 1984 (or whatever edition is used by the applicant) and the 1994 editions of the specification as they apply to the site-specific seismic category I structures at STP site. Also, provide the justification(s) for any differences in order for the staff to evaluate the acceptability of the 1984 edition of the specification.

Furthermore, the staff observed that Table 1.8-21 in FSAR Tier 2, Section 1.8, references ASME Code, Section III, Division 2, Edition 2001 with 2003 addenda, and identifies certain limitations. The ABWR DCD specifies the use of ASME code version 1989. In the ABWR FSER, p. 3-49, the NRC has accepted the 1989 Edition of the ASME Code, Section III, Division 2. Therefore, the applicant is requested to provide a detailed comparison of the differences between these two editions of the code as they apply to the design and analysis of safety-related ABWR standard plant structures, and provide justification(s) for any differences in order for the staff to evaluate the acceptability of the ASME Code, Section III, Division 2 Edition 2001 with 2003 addenda. The applicant is also requested to explain how use of the Edition of the ASME Code proposed by the applicant meets the provisions of NCA-1140, "Use of Code Editions, Addenda, and Cases."

The staff needs the above information to conclude that the applicant used acceptable codes and standards for all seismic category I structures, and any deviations are appropriately addressed.

Request for Additional Information No. 4834 Revision 3

7/9/2010

South Texas Project Units 3 and 4
South Texas Project Nuclear Operating Co
Docket No. 52-012 and 52-013
SRP Section: 03.08.05 - Foundations
Application Section: FSAR 3.8

QUESTIONS for Structural Engineering Branch 2 (ESBWR/ABWR Projects) (SEB2)

03.08.05-4
Follow-up to Question 03.08.05-2

In its response to Question 03.08.05-2 (letter U7-C-STP-NRC-100108, dated May 13, 2010) regarding how differential settlements were considered for site-specific seismic category I structures, the applicant provided some information. However, in order for the staff to clearly understand the amount of differential settlement values accounted for in the design of site-specific seismic category I structures, and how these values reconcile with the estimated differential settlements at the site, the applicant is requested to provide the following additional information:

1. In Part (a) of its revised response to Question 03.08.05-2, the applicant referred to COLA Part 2, Tier 2, Section 2.5S.4.10 for conservatively calculated angular distortion/tilts. The applicant provided an explanation in its response to Question 03.08.05-3 about why the calculated angular distortions/tilts may be considered acceptable. In its justification of an acceptable tilt value of 1/500 for the seismic category I structures at STP, the applicant referenced several published materials that appear to be based on observations of cracking and structural damage of commercial structures. The applicant did not provide any justification for using this information for seismic category I structures. The information included in the response does not provide any estimate of the amount of additional stresses that may be imposed on these structures as a result of the tilt. Therefore, in order for the staff to conclude that the acceptable tilt of 1/500 for the seismic category I structures at STP will not adversely impact the calculated stresses in these structures in critical areas, the applicant is requested to provide a quantitative evaluation that explicitly considers the tilt for these structures.

2. In Part (b) of its revised response to Question 03.08.05-2 on Differential Settlement due to Flexibility of Structure/Basemat and Supporting Soil, the applicant stated that the effect of settlement due to the flexibility of the structure/basemat and supporting soil is accounted for through the use of finite element analysis (FEA) in conjunction with foundation soil springs. However, the foundation subgrade modulus may vary over a wide range across the foundation footprint. It is not clear from the response if the applicant considered in the analysis the horizontal variation of foundation subgrade modulus over the entire area of the foundation. Also, it is not clear from the response how the differential settlements accounted for in the design through the FEA modeling reconcile with the calculated differential settlements in Section 2.5S.10.4 of the FSAR and the values of maximum differential settlements that the structures are designed for. Therefore, in order for the staff to complete its review of how differential settlements are accounted for in the design of site-specific seismic category I structures, the applicant is requested to provide the following additional information:

- Describe how the variation of the subgrade modulus over the foundation footprint has been considered in the analysis, and
- List in the FSAR the values of maximum differential foundation settlements for which each seismic category I structure is designed.

03.08.05-5
Follow-up to Question 03.08.05-3

In its response to Question 03.08.05-3 (letter U7-C-STP-NRC-100083, dated April 14, 2010), the applicant stated that the ABWR DCD does not contain any criteria for settlement-related angular distortions/tilts. The applicant explained that its use of an acceptable tilt value of 1/500 for Category I structures is based on information from several published literature. However, the applicant did not provide any information about the amount of additional stress that may be imposed on the standard plant structures as a result of the acceptable tilt of 1/500. The applicant further stated that structural analysis and design of the structures account for the induced stresses due to structural and foundation flexibility. However, it is not clear from the response if the expected differential settlements for the standard plant structures at the STP site would be within the values of differential settlements that were accounted for in the analysis of ABWR standard plant structures. Therefore, to address COL information item 3.24, which requires that the physical properties of the site-specific subgrade medium be determined, and the settlement of foundations and structures, including seismic category I, be evaluated, the applicant is requested to:

1. Provide a quantitative evaluation of the proposed acceptance criteria for foundation tilt to demonstrate that the ABWR standard plant structures would not be adversely stressed as a result of the tilt.
2. Provide a quantitative evaluation to demonstrate that the maximum differential settlements for the ABWR standard plant structures at the STP site would be within the values accounted for in the design of these structures.

Please also update the FSAR to clearly state how this COL information item is addressed. The staff needs this information to conclude that the ABWR standard plant structures are adequate to accommodate site-specific differential settlements.