PMSTPCOL PEmails

From: Tai, Tom
Sent: Tuesday, February 22, 2011 11:29 AM
To: Price, John E
Cc: STPCOL
Subject: RAI 5542 (2).doc
Attachments: RAI 5542 (2).doc

John,

Attached for your information is a draft RAI with the three Chapter 3.8.4 questions we discussed last Wednesday (shear averaging, soil bearing pressure calculation method, and ACI 349 impact on existing design).

Since we'll have a 2 pm telephone conference tomorrow (/223), please let me know if you need any clarification.

Regards

Tom Tai
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Hearing Identifier: SouthTexas34Public_EX
Email Number: 2644

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Recipients:
"STPCOL" <STP.COL@nrc.gov>
Tracking Status: None
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Request for Additional Information No. 5542 Revision 4

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 3.8.4

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

03.08.04-***

10 CFR 50, Appendix A, GDC 2, requires that structures important to safety shall be designed to withstand the effects of natural phenomena with appropriate combination of the effects of normal and accident conditions. To meet this requirement, all seismic category I structures must be designed for required strength at all locations in the structure. During the October 2010 audit the applicant presented the procedures to verify the concrete sections of the UHS/PH structural members resulting from the code-required load combinations. The internal forces (i.e. shear, moment, axial force, torsion, etc.) used to determine the required strength of the structural members (i.e. walls, slabs, beam, columns, etc.) of the UHS/PH building are generated by the applicant with the help of SAP2000 models simulating the building's static and dynamic behavior. These element forces are subsequently processed by the applicant with a number of in-house developed programs for design of concrete sections. It was noted that concrete slabs and walls were designed for out-of-plane shear by averaging the element shear forces across cut lines that extended along the entire width of the walls and slabs. The staff considers that averaging of out of plane shear along the entire cut line of a slab or wall could lead to unconservative estimate of shear stress in slabs. The subject was discussed with the applicant during the audit. Although the applicant explained the procedure by referencing to ACI 349-97, Section 11.12, "Special provisions for slabs and footings," it did not provide the staff with a sufficient interpretation of the provision of the ACI code, which appears to be intended for shear strength of slabs and footings in the vicinity of columns, concentrated loads, or reactions, to close this issue. ACI 349, Section 13.5.1, states that a slab system shall be designed by any procedure satisfying conditions of equilibrium and geometric compatibility, if shown that the design strength at every section is at least equal to the required strength. Averaging of out-of-plane shear across the entire width of a slab may not show that the design strength at every section is at least equal to the required strength. Therefore, in order for the staff to conclude that the site-specific structures are adequately designed for out-of-plane shear, the staff requests STP to provide detailed justification using industry accepted standards, recognized publications, experimental results, etc., or by any other means, to demonstrate that use of average shear force across the entire width of slab, instead of the shear force demand at every section obtained from analysis may be considered acceptable, and update the FSAR as appropriate.

03.08.04-***

10 CFR 50, Appendix A, GDC 2, requires that structures important to safety shall be designed to withstand the effects of natural phenomena with appropriate combination of

the effects of normal and accident conditions. To meet this requirement, bearing pressure under the basemat of seismic category I structures under all design loading combinations must be within the allowable bearing capacity for a site. During the October 2010 audit, the applicant presented the procedures used to determine the dynamic soil pressures beneath the UHS/PH foundation mat, resulting from SSE loadings. In this procedure, the applicant applied vertical and lateral loads to the structure to compute equivalent eccentricity of the vertical load. The applicant then considered a reduced bearing area of the basemat accounting for the computed eccentricity of the vertical load over which the vertical load is concentric. The soil bearing pressures are calculated as uniformly distributed pressure under the reduced foundation area. The applicant then calculated a factor of safety (FOS) as the quotient between the total ultimate soil bearing capacity and the calculated bearing pressure.

The staff noted that the applicant's methodology of calculating soil bearing pressure (based on equivalent foundation and uniformly distributed soil pressures) under the foundations was not consistent with the analysis and design of the structures including basemat (based on SAP2000 models with soil spring elements), and may significantly underestimate the expected foundation toe pressures for loading combinations having large overturning moment. Therefore, the staff requests the applicant to provide additional information describing how the procedure used by the applicant for verifying soil bearing pressures, reconcile with the analysis and design (i.e., internal element forces, displacement, total building tilt, soil settlement, overturning and sliding safety factors, etc.) of the structures for all design load combinations, including those where foundation uplift may be present.

03.08.04-***

Follow-up Question to Question 03.08.04-33(Question 18287)

The staff reviewed the applicant's response to question 03.08.04-33 regarding acceptability of using newer versions of ACI 349 and ASME Section III, Division 2, than those used in the ABWR DCD. It was noted that the applicant identified several areas in the newer versions of both codes where the newer codes are either more restrictive or may result in more robust design. However, the applicant did not demonstrate how the design information included in the ABWR DCD that is being incorporated by reference is affected by the provisions of the newer codes in these cases. When taking a departure, the applicant must evaluate that departure against other information in the FSAR (including the DCD incorporated by reference), to determine whether the departure is acceptable in light of the rest of the FSAR and whether the departure is consistent with the rest of the FSAR, and make any appropriate changes as a result of this evaluation. The applicant is requested to evaluate any potential adverse impact of the provisions of the newer codes that are more restrictive, or result in a more robust design, on the ABWR DCD structural design information.