September 16, 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. 363 RELATED TO SRP SECTION 3.9.2 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. 5058

Enclosure:
Request for Additional Information

cc: William Mookhoek
John Price
Loree Elton

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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NAME	YWong	JDHerrity	TTai	GWunder
DATE	08/30/10	09/01/10	09/09/10	9/15/10

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

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Request for Additional Information No. 5058 Revision 3
9/15/2010
South Texas Project Units 3 and 4
South Texas Project Nuclear Operating Co
Docket No. 52-012 and 52-013
SRP Section: 03.09.02 - Dynamic Testing and Analysis of Systems Structures and Components
Application Section: 3.9.2

QUESTIONS for Engineering Mechanics Branch 2 (ESBWR/ABWR Projects) (EMB2)

03.09.02-16

In the Calculation Note CN-SEE-II-10-15, Revision 0, "STP 3 Flow Induced Vibration Analysis," the estimation of the cross-flow loading functions is based on the Reynolds number range of the flow across each component of the reactor internals. When the maximum Reynolds number of the component is in the supercritical range ($2x10^5$ – $4x10^6$), the periodic cross-flow excitation functions are based on the flow conditions at $2x10^5$. However, the Reynolds number for some of the analyzed components is close to the lower limit of the transcritical range, which exhibits periodic flow excitation. Since the boundaries between different cross-flow regimes are not well defined and involve high degree of uncertainties, these components may be exposed to transcritical flow conditions at the maximum cross-flow velocity and are therefore subjected to periodic fluid forces. The applicant is requested to consider periodic cross-flow forcing functions at the maximum flow velocity for the reactor internal components which have Reynolds numbers close to the lowest boundary of the transcritical regime.

03.09.02-17

Table 4.6.5-1 in page 68 of the Calculation Note CN-SEE-II-10-15, Revision 0, "STP 3 Flow Induced Vibration Analysis" provides the estimated cross-flow velocities approaching various components of the reactor internals. Several of the values given in the table appear to contradict those used in estimating the forcing functions. Similar discrepancies seem to exist in Tables 4.6.5-2 and 4.6.5-3. The applicant is requested to:

(a) clarify these discrepancies and revise the calculation note(b) confirm that the correct flow velocities are used in the revised note to estimate the forcing functions of various components(c) review all other input data used in estimating the forcing functions and ensure that these are correctly listed in the calculation note(d) address any changes that will be implemented to improve the quality control procedure of the calculation notes

03.09.02-18

In the Calculation Note CN-SEE-II-10-15, Revision 0, "STP 3 Flow Induced Vibration Analysis," the steam separator turbulent buffeting loads (page 74) should be estimated from Mulcahy's procedure and not from the turbulent buffeting equation suggested by Au-Yang (i.e. from Section 4.3.1 not 4.3.2). However, the calculation note seems to incorrectly use Au-Yang's procedure. The applicant is requested to clarify the procedure used to estimate the steam separator turbulent buffeting loads and, if necessary, revise the calculation note. Although the procedure of estimating the turbulent buffeting loads for all other components seems appropriate, the applicant is advised to review this procedure for all components to ensure that the appropriate procedure is used for each component.

Enclosure

03.09.02-19

The forcing functions of the reactor internal pump guide rail are discussed in Section 5.13 of the Calculation Note CN-SEE-II-10-15, Revision 0, "STP 3 Flow Induced Vibration Analysis." Since the guide rail has a non-circular cross-section, it may experience galloping vibration. The applicant is requested to address the liability of this component to flow-induced galloping vibration.

03.09.02-20

The approach flow velocities used to estimate the forcing functions in Calculation Note CN-SEE-II-10-15, Revision 0, "STP 3 Flow Induced Vibration Analysis" are mean values based on the total flow rate and the flow area at the relevant component. Since CFD analysis is being performed, especially for the lower plenum, the applicant is requested to confirm that the CFD velocity values will be used, in calculating the loading functions, if they are larger than the estimated mean velocity values.

03.09.02-21

In WCAP-17287-P, Revision 0, "South Texas Project 3, ABWR Pump-Induced Pulsation Analysis", the ACSTIC2 computer code is used to compute the forcing functions generated by the pump acoustic pulsation. The validation process of this computer code is not addressed. The applicant is requested to explain how this code was validated on a system reflecting the degree of complexity of the STP reactor. The applicant is also requested to verify whether this computer code should be listed in Section 3.9.1.2 of the FSAR.

03.09.02-22

In WCAP-17287-P, Revision 0, "South Texas Project 3, ABWR Pump-Induced Pulsation Analysis," a uniform hysteretic damping value is assumed. The applicant is requested to elaborate on how this coefficient was determined and how the acoustic attenuation is estimated for various components, such as vessel bottom head, core plate and top guide.

03.09.02-23

In WCAP-17287-P, Revision 0, "South Texas Project 3, ABWR Pump-Induced Pulsation Analysis," the applicant uses the measurements from K-6 reactor to determine the level of the pump-induced acoustic forcing functions for STP reactor. These measurements (given in Fig. 3-1) show a higher pulsation level at location P7 than at location P6. It is stated in the report that "*Theoretically, the pressure amplitude at P7 for pump-induced pulsation should be lower than P6.*" The applicant is requested to address whether the computer model predicts a similar trend or not, and to explain any differences which may exist between the measured and computed pressure pulsation.

03.09.02-24

In Toshiba Document Number 7B11-D001-3809-01, Revision 0, "CFD Analysis Report for Lower Plenum," the flow within the lower plenum is simulated by means of CFD. The applicant is requested to address the sensitivity analysis performed to ensure that the grid size of the model is sufficiently small such that further grid refinement would not affect the CFD results.

03.09.02-25

In Toshiba Document Number 7B11-D001-3809-01, Revision 0, "CFD Analysis Report for Lower Plenum," the flow within the lower plenum is simulated by means of CFD. The applicant is requested to address the sensitivity analysis performed to ensure that the CFD results are not strongly dependent on the assumed turbulence level and scale at the pump outlets.

03.09.02-26

In Toshiba Document Number 7B11-D001-3809-01, Revision 0, "CFD Analysis Report for Lower Plenum," the flow within the lower plenum is simulated by means of CFD. The applicant is requested to address the procedure used to validate the CFD model on a system reflecting the degree of complexity of the STP lower plenum.

03.09.02-27

In Toshiba Document Number 7B11-D001-3809-02, Revision 0, "Forcing Function Analysis Report for Lower Plenum," the forcing functions on the lower plenum components were determined for different elevations. The applicant is requested to elaborate on the methodology which will be used to correlate the forcing functions at different elevations.

03.09.02-28

In the CFD analysis reported in Toshiba Document Number 7B11-D001-3809-01, Revision 0, the ICGT and ICMH were not included in the numerical model. The forcing functions on these components were determined from the flow velocities computed at their locations, as described in Toshiba Document Number 7B11-D001-3809-02, Revision 0. The applicant is requested to elaborate on the effect of blockage on the computed flow velocities, which may result if the ICGT and ICMH were included in the CFD numerical model.

03.09.02-29

In Toshiba Document Number 7B11-D001-3809-02, Revision 0, "Forcing Function Analysis Report for Lower Plenum," the forcing functions on the lower plenum components were determined for different elevations. The applicant is requested to elaborate on how the worst case, which results in the highest dynamic stresses, will be determined. In other words, does the applicant plan to analyze all CRGTs to determine the one with the highest dynamic stresses, or a different approach will be pursued? This RAI applies equally to the analysis of all components of the CRDH, ICGT, ICMH.

03.09.02-30

The acceptance criteria to avoid excessive flow-induced vibration of cylindrical structures in cross-flows are presented in Section 4.3 of document XGEN-2010-03, Revision 0, "FIV Evaluation of Option 1 Components for STP Unit 3." The second criterion to limit the stress amplitudes from vortex shedding loads is the ratio of f_1 to f_s. The applicant is requested to elaborate on the physical meaning of this criterion, especially in view of its contradiction with the analysis given in the rest of the report.

03.09.02-31

In Section 6.4 of document XGEN-2010-03, Revision 0, “FIV Evaluation of Option 1 Components for STP Unit 3,” it is concluded that the orificed fuel support can be excluded from the FIV test plan. This conclusion is based on extensive operating experience with this design. The applicant is requested to confirm that:

(a) there are no design differences between the orificed fuel support planned for STP Unit 3 and those in currently operating plants

(b) the flow conditions of the orificed fuel supports in currently operating plants envelope those of STP Unit 3.

03.09.02-32

Per Regulatory Guide 1.20, Subsection C.2.1(1), the applicant is expected to describe and justify all bias errors and random uncertainties for reactor internals, including components which may be affected by the flow-excited acoustic resonances and flow-induced vibrations. Please address uncertainties in all calculations (performed by Westinghouse, XGEN and Toshiba) or in the comprehensive vibration assessment program, including plan and approach to validate analytical results.

03.09.02-33

In Section 3.2 of SES 10-161, Rev. 0, “RG 1.20 Assessment for Natural Frequencies & Mode Shapes for CP DP lines & RIP DP lines," the report states that the translation degrees of freedom (DOFs) perpendicular to the pipes are assumed to be fixed. However there is a gap between the pipe and support for the CP DP line and for the RIP DP line. Please provide more details to justify the assumption in fixing the translational DOFs perpendicular to the pipe. If the CP DP lines and RIP DP lines are installed in a preloaded condition for preventing FIV motions as described by the applicant during the audit of August 23 - 25, 2010, please provide details of the preload conditions and installation procedure.

03.09.02-34

The assumption in Section 3.2 of “RG 1.20 Assessment of Natural Frequencies & Mode Shapes for FW and LPCF spargers” (SES 10-162, Rev. 0) states that the boundary conditions of the pin and the stop are modeled such that there is no vertical and radial movement. Please provide more details to justify these boundary conditions.

03.09.02-35

In section 3.2 of calculation SES 10-164, Rev. 0, “Assessment of Natural Frequencies & Mode Shapes for Guide Rods,” the boundary conditions described in the second assumption do not consider a gap between the bracket hole and the guide rod although there is a gap at the top and at the bottom. Please justify this boundary condition.

03.09.02-36

Section 3.2 of SES 10-165, Rev. 0, “Assessment of Natural Frequencies & Mode Shapes of Shroud Head and Steam Separators” states that some nodes of the shroud head are fixed horizontally to prevent rigid body motion. Please explain the basis and selection of these nodes.

03.09.02-37

Appendix 1 of SES 10-165, Rev. 0, “Assessment of Natural Frequencies & Mode Shapes of Shroud Head and Steam Separators” states that the fluid contains less water at the top of the separator than in the bottom. In the analysis the fluid density is conservatively assumed the same along the whole separator. Please explain and justify the conservatism of this assumption.

03.09.02-38

The shroud head structure in Calculation SES-10-165, Revision 0, is a complex model, and there is no K-6 data to compare and validate. Please advise if there is any measurement plan and what parameters are being considered.

03.09.02-39

The introduction section of XGEN-2010-03, Revision 0 states that these are reactor internal structures other than the steam dryer that can either be excluded from the FIV plan based on experience and scoping evaluation or detailed stress analyses, or they can be included in the test plan. The results concluded that none of these components need to be included in the FIV stress analysis and test program. Please advise if there is any plan to validate this conclusion.

03.09.02-40

Section 5.3 of 7B11-D001-3809-03, Revision 0, “Modal Analysis of CR Guide Tube and CRD Housing” states that the two lateral translational DOFs are fixed at the top of the guide tube at core plate level. However, the report does not specify the gap size at the top end. Please provide the gap size and justification for fixing the two translational DOFs.

03.09.02-41

In Table 5.1 of Calculation 7B11-D001-3809-05, Revision 0, “Modal Analysis of HPCF Sparger and Coupling”, the water weights at 160 degree Celsius and at 289 degree Celsius are significantly different. Please explain the difference.

03.09.02-42

In Section 5.4 of Calculation 7B11-D001-3809-06, Revision 0, “Modal Analysis of Shroud,” it states that the lowest frequency of the shroud has been compared with that of seismic analysis. Please provide the comparison data.

03.09.02-43

Please explain in more detail the reason for ignoring the mode shapes of the 7th and 8th modes of the control rod guide tube and control rod drive housing in Calculation 7B11-D001-3809-03, Revision 0.