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April 13, 2011
U7-C-NINA-NRC-110064

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
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South Texas Project
Units 3 and 4
Docket Nos. 52-012 and 52-013
Revised Response to Request for Additional Information

Attached is the Nuclear Innovation North America LLC (NINA) revised response to Request for Additional Information (RAI) question 03.09.02-21 related to Combined License Application (COLA) Part 2, Tier 2, Section 3.9.2.

Where there are COLA markups, they will be made at the first routine COLA update following NRC acceptance of the RAI response.

There are no commitments in this letter.

If you have any questions regarding these responses, please contact me at (361) 972-7136 or Bill Mookhoek at (361) 972-7274.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 4/13/11

Scott Head
Manager, Regulatory Affairs
South Texas Project Units 3 & 4

jep

Attachment: RAI 03.09.02-21, Revision 1

D091
NRO

STI 32854845

cc: w/o attachment except*
(paper copy)

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RAI 03.09.02-21, Revision 1

QUESTION:

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.

RESPONSE:

The original response to this RAI was provided in STPNOC Letter No. U7-C-STP-NRC-100236 dated October 25, 2010. In that response, it was stated that the ACSTIC code was not one of the major computer codes that needed to be included in COLA Part 2, Tier 2, Subsection 3.9.1.2. Following the review of this response, the NRC is requiring that the code be included in Subsection 3.9.1.2. This revised response incorporates this information as provided in the COLA markup below. All changes from the original response are indicated with bars in the margin.

The code was verified by comparisons with two analytical solutions and a comparison of predictions with test loop data. The analytical solutions involved a closed-open pipe resonator and a two-dimensional square of fluid. The two-dimensional square of fluid model is similar in complexity to the downcomer simulation in the STP-3 ACSTIC2 model. Both analyses were performed by first calculating acoustic mode frequencies by hand, exciting the ACSTIC2 models at these frequencies with a unit forcing function, and comparing the ACSTIC2 calculated mode shapes with theoretical values. Figures 10 and 12 of the reference (PVP-Vol. 63 - below) indicate that the ACSTIC2 and theoretical mode shapes are, for any given point, no more than 2% off and, on the average, no more than 0.5-1% different.

The test mentioned above was run with the intention of providing forcing functions for several pump frequencies and accomplished this objective for the first and second blade-passing frequencies. The comparisons also showed that the calculated waveforms in the test loop for each of these frequencies agreed within an average of 10% with the pressure transducer data collected at various locations around the test loop.

The verification analyses were published in PVP-Vol. 63 (ASME) as "A Method for Predicting Pump-Induced Acoustic Pressures in Fluid Handling Systems," R. E. Schwirian et al., pp. 167-184. This publication is identified as Reference 2 in WCAP-17287-P.

Also, verification was performed against plant data in 1983 and involved a comparison of ACSTIC predicted pressure gradient amplitudes with those inferred from guide tube and support column vibration measurements. The results were in reasonably good agreement, one case giving 0.180 psi/inch for the strain-inferred measurement compared to 0.190 psi/inch for the

ACSTIC calculation, a difference of 5.6%. This analysis is available for audit in a WEC proprietary report.

The ACSTIC code is controlled under WEC's quality assurance program.

The STP 3&4 COLA will be revised to include the ACSTIC computer code in the list of computer codes used for evaluation of reactor internals. COLA Part 2, Tier 2, Subsection 3.9.1.2 states that the computer codes are described in Appendix 3D, and Appendix 3D references Subsection 4.1.4.1 for the description of computer codes used for evaluating reactor internals. Therefore the revision to incorporate the ACSTIC computer into the COLA will be made to Appendix 3D and Subsection 4.1.4.1. Changes from Revision 5 of the COLA are highlighted with gray shading.

3D Computer Programs Used in the Design of Components, Equipment and Structures

The information in this appendix of the reference ABWR DCD, including all subsections, is incorporated by reference with ~~no departures or~~ the following supplements. A computer code that is used for analysis of reactor internal components is added to Section 3D.3.

3D.3 Reactor Pressure Vessel and Internals

The following computer programs are used in the analysis of the reactor pressure vessel, core support structures, and other safety class reactor internals: NASTR04V, SAP4G07, HEATER, FATIGUE, ANSYS, CLAPS, ASSIST, SEISM03, ~~AND~~ SASSI and ACSTIC. These programs are described in Subsection 4.1.4.

4.0 Reactor

4.1 Summary Description

The information in this section of the reference ABWR DCD, including all subsections and figures, is incorporated by reference with ~~no departures or~~ the following supplements. A computer code that is used for analysis of reactor internal components is added to Section 4.1.4.1.

4.1.4.1 Reactor Internal Components

Computer codes used for the analysis of the internal components are as follows:

(10) ACSTIC

4.1.4.1.10 ACSTIC

ACSTIC is a Westinghouse computer code which is used for predicting the amplitudes of pump-induced acoustic pressures in fluid-handling systems using a node-flow path discretization methodology and a harmonic analysis algorithm. The pump is represented as what has been referred to in the literature as a "volumetric forcing function." With this program, the fluid system is broken into nodes(pressure) and flow paths (mass flow), the latter connecting the former in multi-dimensional arrays or networks. The computer code is used to calculate pump-induced pressure pulsation loads on reactor internals.