CCNPP3COLA PEmails

From: Clinton, Juanita D [juanita.d.clinton@unistarnuclear.com]
Sent: Thursday, February 02, 2012 10:30 AM
To: Quinn-Willingham, Laura; Kennedy, Silas
Subject: UN#12-009 RAI 316
Attachments: image001.png; UN12-009_RAI-316_20120130.pdf

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Subject: UN#12-009 RAI 316
Sent Date: 2/2/2012 10:30:29 AM
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From: Clinton, Juanita D

Created By: juanita.d.clinton@unistarnuclear.com

Recipients:
"Quinn-Willingham, Laura" <Laura.Quinn-Willingham@nrc.gov>
Tracking Status: None
"Kennedy, Silas" <Silas.Kennedy@nrc.gov>
Tracking Status: None

Post Office: VA3DIAXVS761.RED001.local

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Priority: Standard
Return Notification: No
Reply Requested: No
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10 CFR 50.4
10 CFR 52.79

January 30, 2012

UN#12-009

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: UniStar Nuclear Energy, NRC Docket No. 52-016
Response to Request for Additional Information for the
Calvert Cliffs Nuclear Power Plant, Unit 3,
RAI 316, Seismic System Analysis

References:
1) Surinder Arora (NRC) to Paul Infanger (UniStar Nuclear Energy), "FINAL RAI No. 316 SEB2 5988" email dated August 17, 2011

2) UniStar Nuclear Energy Letter UN#11-290, from Mark T. Finley to Document Control Desk, U.S. NRC, Updated RAI Closure Plan, dated November 30, 2011

The purpose of this letter is to respond to the request for additional information (RAI) identified in the NRC e-mail correspondence to UniStar Nuclear Energy, dated August 17, 2011 (Reference 1). This RAI addresses Seismic System Analysis, as discussed in Section 03.07.02 of the Final Safety Analysis Report (FSAR), as submitted in Part 2 of the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 Combined License Application (COLA), Revision 7.

Reference 2 indicated that a response to RAI No. 316, Question 03.07.02-67 would be provided to the NRC by January 31, 2012. The enclosure provides our response to RAI No. 316, Question 03.07.02-67.

Our response does not include any new regulatory commitments. This letter does not contain any sensitive or proprietary information.

If there are any questions regarding this transmittal, please contact me at (410) 369-1907, or Mr. Wayne A. Massie at (410) 369-1910.

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

Executed on January 30, 2012

Mark T. Finley

Enclosure: Response to NRC Request for Additional Information RAI No. 316, Question 03.07.02-67, Seismic System Analysis, Calvert Cliffs Nuclear Power Plant, Unit 3

cc: Surinder Arora, NRC Project Manager, U.S. EPR Projects Branch
Laura Quinn, NRC Environmental Project Manager, U.S. EPR COL Application
Getachew Tesfaye, NRC Project Manager, U.S. EPR DC Application (w/o enclosure)
Patricia Holahan, Acting Deputy Regional Administrator, NRC Region II (w/o enclosure)
Silas Kennedy, U.S. NRC Resident Inspector, CCNPP, Units 1 and 2
David Lew, Deputy Regional Administrator, NRC Region I (w/o enclosure)

MTF/AJF/mdf

bcc: Roger Andrieu, Senior Civil Engineer, Procurement & Engineering

UN#12-009

Enclosure

Response to NRC Request for Additional Information
RAI No. 316, Question 03.07.02-67, Seismic System Analysis
Calvert Cliffs Nuclear Power Plant, Unit 3

RAI No. 316

Question 03.07.02-67

The Defense Nuclear Facilities Safety Board (DNFSB) issued a letter on April 8th, 2011 requesting that the Department of Energy (DOE) address technical and software quality assurance issues related to potentially erroneous seismic analyses performed using the SASSI subtraction method. Versions of SASSI are used by CCNPP3 in the seismic analyses of the ESWB (Bechtel Computer Code SASSI 2000, Version 3.1) and the CBIS (RIZZO Computer Code SASSI Version 1.3a) both of which are modeled as embedded structures. Therefore, the subtraction issue may be of concern in the analyses of these structures if it was used in the SASSI modeling approach. It may also be a concern in any future analysis of the NI where embedment effects are considered.

To ensure the applicant has adequately met General Design Criteria (GDC) 1 and 2 to Part 50 and Appendix B to Part 50, the staff requests CCNPP3 to provide to following information:

a. Identify whether the SASSI Subtraction method is used in the seismic analyses

b. Describe how CCNPP3 addresses the technical and software quality assurance issues raised by DNFSB letter in the versions of SASSI which CCNPP3 uses for seismic analyses

c. If the SASSI Subtraction method is used by CCNPP3, provide an assessment to establish: 1) the seismic analyses performed in support of the CCNPP3 COL application do not contain any errors or anomalies as identified in DNFSB letter, 2) QA steps taken to ensure any future seismic analyses in support of the CCNPP3 COL application will be free from errors or anomalies as identified in DNFSB letter

Response

Response to Part a:

The Nuclear Island (NI), Nuclear Auxiliary Building (NAB), and Emergency Power Generating Building (EPGB) were originally modeled as surface-founded structures. As part of the site specific seismic reconciliation (UniStar Nuclear Energy Letter UN#11-290[1]), these structures will be analyzed as embedded structures using the MTR/SASSI Modified Subtraction Method.

The Essential Service Water Building (ESWB) was originally analyzed using Bechtel's SASSI2000 Subtraction Method. This structure will also be analyzed using the MTR/SASSI Modified Subtraction Method as part of the site specific seismic reconciliation.

The Common Basemat Intake Structure (CBIS) Soil-Structure Interaction (SSI) analysis was performed with RIZZO SASSI Version 1.3a using the Subtraction Method.

The seismic analysis of Turbine Island structures has not been performed yet; therefore, SASSI Subtraction Method has not been used. Furthermore, if Subtraction Method is used in any future SSI analyses of Turbine Island structures considering embedment effects, the structural

[1] UniStar Nuclear Energy Letter UN#11-290, from Mark T. Finley to Document Control Desk, U.S. NRC, Updated RAI Closure Plan, dated November 30, 2011

responses will be thoroughly examined for the concerns raised by the Defense Nuclear Facilities Safety Board (DNFSB) or the modified Subtraction Method will be used as appropriate.

Response to Part b:

For the NI, the EPGB, and the ESWB, the technical and software quality assurance issues raised by the DNFSB letter will be addressed as indicated in the response to U.S. EPR FSAR RAI 489, Supplement 2, Question 03.07.02-75[2]. The methodology described in the response provides test problems using MTR/SASSI to examine the accuracy of different impedance modeling schemes.

For the CBIS, the software quality assurance was addressed as per the RIZZO QA program requirements. The Subtraction Method results obtained with the use of the RIZZO SASSI Version 1.3a were compared with a benchmark problem using the Flexible Volume Method (FVM). The SASSI Version 1.3a Validation and Verification (V&V) performed under the RIZZO Quality Assurance Program supports the use of the Subtraction Method only for the particular case of the CBIS. It does not support the use of the Subtraction Method for soil properties, structure geometries, and seismic excitations which are different from those considered in the CBIS. The reason for this constraint in the range of applicability is that errors or anomalies were observed when the results obtained from the Subtraction Method were compared with general benchmark problems. This is consistent with the finding in the letter issued by the DNFSB.

The DNFSB letter cited in the question identifies significant technical and quality assurance issues associated with the use of SASSI Subtraction Method for SSI analysis of embedded structures. As mentioned in response to Part (a) of this question, Subtraction Method has not been used for the Turbine Island structures. The future seismic analyses of the Seismic Category II Turbine Island structures will be performed using either the Subtraction Method or the modified Subtraction Method using SASSI2010, with the structure modeled as embedded structure and the structural responses thoroughly examined to address concerns raised by the DNFSB.

Response to Part c:

To validate the applicability of the Subtraction Method used for the SSI analysis of the CBIS, a simplified model of the CBIS was analyzed using both the FVM and the Substructure Subtraction Method. The comparison indicated that, for the CCNPP3 site-specific conditions, and the structural geometry of the CBIS, the results obtained with the Subtraction Method are sound. Details of the comparison are provided in the following paragraph.

A quarter model of the CBIS is created by adding two symmetric planes along the X (NS) and Y (E-W) directions (Figure 1). The results of this analysis are compared with the same structure analyzed with the Subtraction Method at several locations. The "interaction nodes" considered in the Flexible Volume Method or "direct method" model are all nodes belonging to the excavated soil volume. On the other hand, the interaction nodes considered in the Substructure Subtraction Method model are those located at the outer perimeter boundary of the excavated

[2] D. Williford (AREVA) to G. Tesfaye (NRC), "Response to U.S. EPR Design Certification Application RAI No. 489 (5802), FSAR Ch. 3, Supplement 2," email dated October 21, 2011 (ADAMS ML11297A097).

soil volume. Soil profiles and seismic input are equivalent to the CCNPP3 site-specific conditions.

In-Structure Response Spectra (ISRS) in the Y direction are obtained at 13 control points. Two locations are selected at the Basemat (A and B), four locations on each floor at elevations 0.0 and 15.5 ft (A, B, C and D) and three locations on the floor at elevation 30.5 ft (B, C and D), as shown in Figure 2.

There are marginal differences in the transfer function comparison at the selected control points of the CBIS MWIS using the FVM and the Substructure Subtraction Method (SSM). In Figure 3, the effect of the difference transfer functions is evaluated by comparing the ISRS and maximum accelerations, which are the primary design parameters obtained from the SSI analysis (and subsequently used in the design of the CBIS).

The verification analysis shows very close agreement between both methodologies, and therefore the Subtraction Method can be applicable for the CCNPP3 CBIS. Moreover, similar analyses and comparisons will be performed for any future changes in the geometry of the CBIS or in its input parameters.

As discussed in response to parts (a) and (b) of this question, the Subtraction Method has not been used for seismic analysis of Turbine Island structures. The future seismic analyses of Turbine Island structures will be performed using the Subtraction Method or the modified Subtraction Method using SASSI2010. The analysis results, including the transfer functions, will be thoroughly reviewed to ensure the accuracy of the structural response. Therefore, the concerns presented in DNFSB letter will be addressed.

COLA Impact

There is no COLA impact as a result of this response.

Figure 1: Quarter Model of the CBIS at CCNPP3

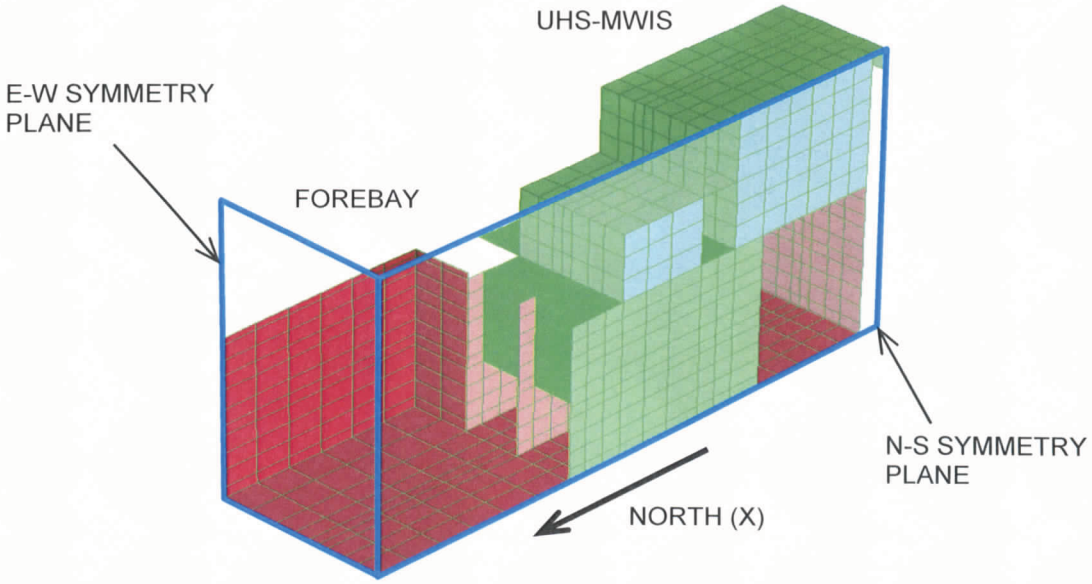

Figure 2: Location of Observation Points at Different Elevations

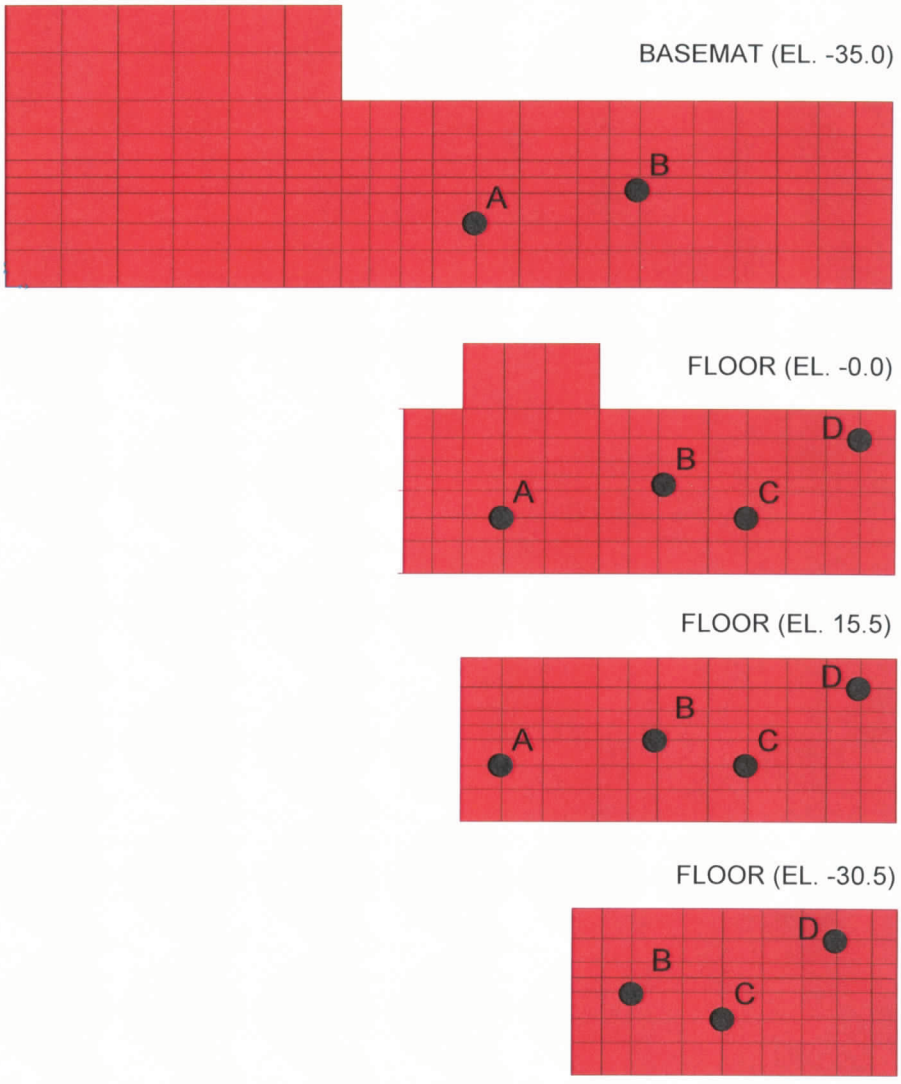

Figure 3: ISRS Comparison between the Flexible Volume Method (FVM) and the Substructure Subtraction Method (SSM) in the Y Direction