NuScaleDCRaisPEm Resource

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Sent: Saturday, August 05, 2017 9:26 AM
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Cc: NuScaleDCRaisPEm Resource; Lee, Samuel; Chowdhury, Prosanta; Samaddar, Sujit; Park, Sunwoo; Vera Amadiz, Marieliz; Chakravorty, Manas
Subject: RE: Request for Additional Information No. 134, RAI 8934 (3.7.2)
Attachments: Request for Additional Information No. 134 (eRAI No. 8934).pdf

Attached please find NRC staff's request for additional information concerning review of the NuScale Design Certification Application.

Please submit your technically correct and complete response within 60 days of the date of this RAI to the NRC Document Control Desk. The NRC Staff recognizes that NuScale has preliminarily identified that the response to one or more questions in this RAI is likely to require greater than 60 days. NuScale is expected to provide a schedule for the RAI response by email within 20 days.

If you have any questions, please contact me.

Thank you.

Gregory Cranston, Senior Project Manager
Licensing Branch 1 (NuScale)
Division of New Reactor Licensing
Office of New Reactors
U.S. Nuclear Regulatory Commission
301-415-0546

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Request for Additional Information No. 134 (eRAI No. 8934)

Issue Date: 08/05/2017
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 03.07.02 - Seismic System Analysis
Application Section: 3.7.2

QUESTIONS

03.07.02-13

10 CFR 50 Appendix S requires that the safety functions of structures, systems, and components (SSCs) must be assured during and after the vibratory ground motion associated with the Safe Shutdown Earthquake (SSE) through design, testing, or qualification methods.

a. On Page 3.7-28 of the FSAR, in the second paragraph, the applicant states, "The bottom nodes of the foundation are represented by COMBIN14 spring elements." The applicant is requested to describe how the spring constant for COMBIN14 elements was evaluated. Also, please clarify if the spring constant (10^{10} lbs/inch) used for the SAP2000 model described on Page 3.7-23 of the FSAR is used for the ANSYS model.

b. On Page 3.7-28 of the FSAR, in the second paragraph from the bottom, the applicant states, "Fixed base boundary conditions are utilized for the ANSYS model." However, on Page 3.7-28, in the second paragraph, the foundation bottom nodes are represented by spring elements. The applicant is requested to explain how fixed-base boundary conditions are realized by using spring elements.

c. Figure 3.7.2-34 in the FSAR shows a plan view of the wall segments used for fluid-structure interaction (FSI) analysis, and walls separating the refueling pool, spent fuel pool, and dry dock are indicated. However, ANSYS finite elements presented in Figure 3.7.2-33 do not show a wall segment separating the refueling pool and spent fuel pool and a segment separating the refueling pool and dry dock. The applicant is requested to clarify the discrepancy.

d. On Page 3.7-28 of the FSAR, in the second paragraph from the bottom, the applicant states, "The input to the ANSYS analysis is the CSDRS-compatible Capitola time history." In Section 8.0 of NuScale Technical Report, TR-0916-51502-P (NuScale Power Module Seismic Analysis), Rev 0, the applicant indicates that the time history input to NPM seismic analysis was obtained from RXB SASSI2010 analysis based on the CSDRS-compatible Capitola time history and Soil Type 7. The applicant is requested to justify the adequacy of the NPM seismic analysis based on a single CSDRS-based time-history and a single soil type while the seismic design of the RXB is based on analyses involving multiple time histories and soil types as discussed in FSAR Section 3.7.2.4.

03.07.02-14

10 CFR 50 Appendix S requires that the safety functions of structures, systems, and components (SSCs) must be assured during and after the vibratory ground motion associated with the Safe Shutdown Earthquake (SSE) through design, testing, or qualification methods.

a. On Page 3.7-28 of the FSAR, in the first paragraph, the applicant describes modeling of "contact" between the bottom nodes of the Containment Vessel (CNV) and pool foundation surface. The

applicant is requested to clarify whether friction is considered between the contacting surfaces and provide the coefficient of friction, if considered.

b. In Figure 3.7.2-32 in the FSAR, backfill soil elements are included in the ANSYS analysis model. The applicant is requested to describe the boundary conditions on the exterior sides of the backfill soil elements and describe whether they are modeled as a stress-free surface?

c. Figure 3.7.2-35 in the FSAR indicates perfect matching between accelerations for X1 and X3 wall sections; whereas, Figure 3.7.2-37 indicates slight difference between pressures for X1 and X3. The applicant is requested to explain the difference in pressure between X1 and X3 while their accelerations are shown to match perfectly.

d. Figures 3.7.2-37 and 3.7.2-38 in the FSAR indicate a non-zero pressure at the top of the curve, which appears to indicate that the top end point of the curve does not correspond to the free water surface of the pool top. The applicant is requested to clarify and explain why the curves do not cover the elevations all the way up to the free water surface.

03.07.02-15

10 CFR 50 Appendix S requires that the safety functions of structures, systems, and components (SSCs) must be assured during and after the vibratory ground motion associated with the Safe Shutdown Earthquake (SSE) through design, testing, or qualification methods.

a. On Page 3.7-30 of the FSAR, Eq. 3.7-14 represents the conversion of ANSYS FSI-based hydrodynamic pressure to SASSI2010 equivalent static pressure. In this process, ANSYS used the CSDRS-compatible Capitola time history input on a fixed-base model and SASSI2010 used the CSDRS-compatible Capitola time history input for Soil Types 7, 8, and 11, respectively. The applicant is requested to explain why FSI correction factors for the case of CSDRS-HF-compatible time history input for Soil Type 9 (hard rock) are not considered. Since the boundary conditions for an ANSYS fixed-base model and a SASSI model with Soil Type 9 (hard rock) are similar, it appears that FSI-correction factors developed for Soil Type 9 may be more representative.

b. On Page 3.7-31 of the FSAR, the fourth paragraph, “The pressure at the bottom of the pool due to …”, describes an approach the applicant took in taking into account the FSI effects on vertical water pressure estimation. The applicant is requested to provide a technical basis for the approach taken.