

NuScaleDCRaisPEm Resource

From: Cranston, Gregory
Sent: Friday, August 25, 2017 2:41 PM
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Cc: NuScaleDCRaisPEm Resource; Lee, Samuel; Chowdhury, Prosanta; Samaddar, Sujit; Roche-Rivera, Robert; Vera Amadiz, Marieliz
Subject: RE: Request for Additional Information No. 201, RAI 8975 (3.8.4)
Attachments: Request for Additional Information No. 201 (eRAI No. 8975).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.

If you have any questions, please contact me.

Thank you.

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Licensing Branch 1 (NuScale)
Division of New Reactor Licensing
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301-415-0546

Hearing Identifier: NuScale_SMR_DC_RAI_Public
Email Number: 225

Mail Envelope Properties (7b9443bcfa734df99d2f2981e110edd7)

Subject: RE: Request for Additional Information No. 201, RAI 8975 (3.8.4)
Sent Date: 8/25/2017 2:40:40 PM
Received Date: 8/25/2017 2:40:44 PM
From: Cranston, Gregory

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Files	Size	Date & Time
MESSAGE	561	8/25/2017 2:40:44 PM
Request for Additional Information No. 201 (eRAI No. 8975).pdf		103333

Options

Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Request for Additional Information No. 201 (eRAI No. 8975)

Issue Date: 08/25/2017

Application Title: NuScale Standard Design Certification - 52-048

Operating Company: NuScale Power, LLC

Docket No. 52-048

Review Section: 03.08.04 - Other Seismic Category I Structures

Application Section: 3.8.4

QUESTIONS

03.08.04-25

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Section 3.8.4 provides review guidance pertaining to the design of seismic Category I structures, other than the containment. Consistent with DSRS Section 3.8.4, the staff reviews codes, standards, and specifications, loads and loading combinations, design and analysis procedures, and structural acceptance criteria.

FSAR Section 3.8.4.1.2 indicates that the steel portion of the CRB is classified and analyzed as a seismic Category II structure to ensure it will not fail and affect the seismic Category I portion of the CRB, or the seismic Category I RXB. However, it is not clear to the staff whether the codes, standards, and specifications, loads and loading combinations, design and analysis procedures, and structural acceptance criteria for seismic Category I portion of the CRB, also apply to the seismic Category II portion of this building. If yes, state in the FSAR. If not, provide the design criteria for the seismic Category II portion of the CRB.

03.08.04-26

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Section 3.8.4 provides review guidance pertaining to the design of seismic Category I structures, other than the containment.

FSAR Section 3.8.4.4 indicates that the SAP2000 results (element forces, moments, stress contours, joint displacements and mode shapes) from the various non-seismic loads are used in conjunction with the results of the seismic analysis described in Section 3.7.2 to perform the design assessments for the seismic Category I RXB and CRB. The staff requests the applicant to clarify how the mode shapes obtained from SAP2000 are used in the aforementioned process. Also describe which computer program was used to perform the design assessment, including reinforcement requirements, and whether the ACI code member approach for design assessment was used. If yes, state it in the FSAR. If not, describe why not.

03.08.04-27

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Section 3.8.4 provides review guidance pertaining to the design of seismic Category I structures, other than the containment. Consistent with DSRS Section 3.8.4.II.4.B the staff reviews the consideration of the effects of concrete cracking.

FSAR Sections 3.8.4.4.1 and 3.8.4.4.2 for the RXB and CRB respectively indicate that two SAP2000 analysis models were created to consider the conditions of cracked and uncracked concrete. Describe in the FSAR the level of cracking considered and the basis for the assumed level of cracking. Also, explain the

purpose of these models, including whether they are used for dynamic analysis, static analysis, or both, and how their respective results are used in design.

03.08.04-28

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Section 3.8.4 provides review guidance pertaining to the design of seismic Category I structures, other than the containment.

FSAR Sections 3.8.4.4.1 and 3.8.4.4.2 for the RXB and CRB respectively, indicate that there are rigid link elements at each node at the bottom of the foundation basemats for these structures. Describe in the FSAR, the connection between these rigid link elements and other elements/nodes as applicable. Describe the purpose of these elements.

03.08.04-29

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Section 3.8.4 provides review guidance pertaining to the design of seismic Category I structures, other than the containment.

FSAR Section 3.8.4.4.1 states that all applicable loads are converted to lumped joint masses for use in dynamic analyses. Clarify in the FSAR if this refers to dynamic analyses other than the SASSI2010 analyses and if so what type of dynamic analysis (time history or response spectrum analysis), and computer code name, and for what purpose. Clarify whether the aforementioned applicable loads refer to those identified in Table 3.8.4-7. Further, clarify whether the crane weight is included and how.

03.08.04-30

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Section 3.8.4 provides review guidance pertaining to the design of seismic Category I structures, other than the containment.

FSAR Section 3.8.4.4.1 states that "Table 3.8.4-7 lists masses included from various load cases and its corresponding multipliers for the RXB SAP2000 models for 1-g and dynamic analyses performed." Describe in the FSAR the purpose and results of the 1g analysis indicated above.

03.08.04-31

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Section 3.8.4 provides review guidance pertaining to the design of seismic Category I structures, other than the containment. Consistent with DSRS Section 3.8.4, the staff reviews loads and loading combinations.

Section 3B.2.7.3, "Nuclear Power Module Support Skirt" refers (under "Envelope Loads") to a vertical downward load based on DL + Vertical Seismic Load. Further, this section states that the "vertical displacement [of a NPM] is expected to be far less than 1 inch." Clarify in the FSAR whether the vertical

seismic load is obtained from the envelope of all the SASSI analysis cases or the detailed ANSYS seismic analysis cases of the NPM and provide the breakdown of the DL and vertical seismic load. Additionally provide the calculated vertical displacement and describe the analysis case(s) from which it is obtained.

03.08.04-32

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Section 3.8.4 provides review guidance pertaining to the design of seismic Category I structures, other than the containment.

Page 3B-30 (under "Nuclear Power Module Lug Restraint") indicates that the original design has been modified by increasing the diameter of the through bolts from 2" to 2.5." In contrast, page 3B-31 (related to Section 3B.2.7.4.1, "Shear Lug Evaluation") calculates the tensile D/C ratio based on a 2" diameter and concludes that the through bolts are acceptable (also note that Figures 3B-63 and 3B-64 also show 2" diameter through bolts). Clarify this discrepancy and correct the FSAR descriptions and figures as applicable.

03.08.04-33

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Section 3.8.4 provides review guidance pertaining to the design of seismic Category I structures, other than the containment.

FSAR Section 3.8.4 and 3.8.5 refer to several analysis cases/models used to establish static load demand, thermal effects, and stability of the RXB and CRB. To assist the staff in its review, provide a table in the FSAR that describes the seismic and static analysis cases (clarify whether the envelope of all or a partial envelope of the SSI and SSSI cases is used to establish the seismic demands), models used [e.g. clarify the use of standalone building model, multiple building model, partial model (e.g. local model for lug restraint analyses, standalone basemat model), cracked or uncracked concrete stiffness], computer programs used, purpose of the analysis, type of building response(s) (e.g., ISRS, member forces, displacements), and section in the FSAR and/or technical report(s) where these are explained and figures are given for each respective model.

03.08.04-34

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Section 3.8.4 provides review guidance pertaining to the design of seismic Category I structures, other than the containment.

In regards to the element based design check, the FSAR text in Appendix 3B refers to highlighted entries in the design check tables that show exceedances. Such entries are not highlighted in these tables. Revise the FSAR as necessary for consistency between the text and Table descriptions.

03.08.04-35

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Section 3.8.4 provides review guidance pertaining to the design of seismic Category I structures, other than the containment.

Provide in the FSAR, all the reduction factors used in the design equations shown in Appendix B.

03.08.04-36

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Section 3.8.4 provides review guidance pertaining to the design of seismic Category I structures, other than the containment.

Correct the FSAR Table numbers referenced in pages 3B-31 to 3B-37 to refer to the respective actual Tables that display the information described in pages 3B-31 to 3B-37. Further correct the reference to Section 3.8.5.4.2 in page 3B-32.