NuScaleDCRaisPEm Resource

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Sent: Friday, August 25, 2017 2:33 PM
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Subject: Request for Additional Information No. 200, RAI 9021 (3.9.3)
Attachments: Request for Additional Information No. 200 (eRAI No. 9021).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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Request for Additional Information No. 200 (eRAI No. 9021)

Issue Date: 08/25/2017
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 03.09.03 - ASME Code Class 1, 2, and 3 Components
Application Section: 3.9

QUESTIONS

03.09.03-1

GDCs 1, 2, and 4 and 10 CFR 50.55a require that structures and components important to safety be constructed and tested to quality standards commensurate with the importance of the safety functions to be performed, and designed with appropriate margins to withstand effects of anticipated normal plant occurrences, natural phenomena such as earthquakes, and postulated accidents including LOCA. This requires to apply appropriate loads for design of ASME Class 1, 2, 3 piping, components and their supports.

The staff reviewed Tier 2 Section 3.9.3.1.1 and Table 3.9-2 for applicable loads for components, component supports and core support (CS) structures which include loads for pressure, deadweight, thermal expansion, seismic, system operating transients, wind, pipe break, thermal stratification, cycling and striping, friction, and transportation. As a result, clarify the following:

(1) why loads due to transportation (TR), load test (LT), Hydrostatic and sloshing, asymmetric cavity pressurization loads, containment vessel (CNV) integrated leak rate test pressure and hydrogen detonation are listed in Table 3.9-2 but not discussed in Section 3.9.3.1.1. Provide discussion in DCD Section 3.9.3.1.1 to explain how these loads are considered in the component design,

(2) whether Note 6 of Table 3.9-2 should also be included in Tables 3.9-3 through Table 3.9-14 to indicate there is no feedwater pipe break (FWPB) and main steam pipe break (MSPB) loads for service level D, and

(3) whether Section 3.9.3.1.1 should discuss loads due to Asymmetric Cavity pressurization which result from High Energy Line Breaks (HELBs) in the primary coolant system and concurring with the blowdown loads as described in TR-1016-51669.

03.09.03-2

10 CFR 50 Appendix S IV(a)(1)(iii) 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) ground motion through design, testing, or qualification methods. GDC 2 and 10 CFR 50, Appendix S, as they relate to safety-related structures and components being designed to withstand the effects of earthquakes combined with the effects of normal or accident conditions without loss of capability to perform their safety functions. Pursuant to GDC 2, mechanical components are designed to withstand the loads generated by natural phenomena as discussed Section 3.7.1.

For seismic loads, the applicant performed a detailed dynamic analysis of the nuclear power module (NPM) subsystem using a 3D NPM ANSYS model applying acceleration time histories resulting from composite reactor building (RXB) seismic analysis. The staff reviewed technical report TR-0916-51502, "NuScale Power Module Seismic Analysis." for the seismic loads and stresses. As a result, the applicant is requested to provide discussion and clarification for the following:

1. Considering a subsystem seismic analysis for NPM as stated above, based on RG 1.61, Table 6, Damping Values for Mechanical and Electrical Components, 3 percent damping should be used in lieu of 7 percent damping used in the TR, for pressure vessels (i.e., CNV and RPV).   Therefore, the applicant is requested to provide justification or test data for use of higher than 3 percent damping for CNV and RPV for the SSE event as given in Table 6 of RG 1.61.

2. Provide the damping values used for the reactor pool water inside and outside the CNV and the basis using these damping values in the SSE analysis.

3. Confirm whether there is or is not uplift of CNV and RPV modules during the SSE event considering the buoyancy force and the bearing support at the bottom of CNV and RPV.

4. Discuss whether and how the condition of an SSE event is not considered for the design of CNV and RPV during the refueling outage, when the vessel halves are separated.

5. Describe boundary conditions of the 3-D NPM analysis at the supporting skirt location where the prescribed acceleration time histories were applied. Also to how the motion transmitting from the pool bottom to the skirt and to the NPM when the contact was sliding during SSE.

03.09.03-3

As part of the staff's evaluation of the applicant's compliance with the requirements of GDCs 1, 2, 4, 14, and 15; 10 CFR 50.55a; and 10 CFR Part 50, Appendix S, this section focus on the acceptability of RSVs and ECCS valves which are ASME Class 1 components which are designed to with stand earthquake vibratory motion, thermal and mechanical cyclic transients as listed for service level normal and upset loadings. In DCD Tier 2 Section 3.9.3.2, the applicant stated that RSVs and ECCS valves are designed to withstand vertical and lateral loading due to seismic ground accelerations considering the appropriate damping values for pressure boundary valve bodies. The applicant is requested to (1) confirm whether and how these ASME Class 1 valves are qualified by analysis or test or both, using static analysis, or dynamic analysis, and (2) Discuss loads considered for calculation of fatigue cumulative factor (CUF) and effects of the environment assisted factor for these valves, and (3) What the damping values were used in the analysis.

03.09.03-4

Per requirements of GDCs 1, 2, 4, 14, and 15; 10 CFR 50.55a; this section evaluates the operating capability for components, valves and piping as they relate to ASME Class 1, Class 2, and Class 3 components. Per SRP 3.9.3 Appendix A.5.C, to ensure the operating capability of Helical Coil Steam Generator (HCSG), the applicant is requested to discuss whether and how does the HCSG, which is actually the helical coil piping system, meet the piping functional operability conditions as concluded by NUREG-1367.

1. Reversing dynamic loads are considered due to earthquakes, or relief-valve actuation and pressure wave loads.
2. Dynamic moments are calculated using an elastic response spectrum analysis with +/-15% peak broadening and with not more than 5% damping.
3. Steady-state (e.g., weight) stresses do not exceed 0.25Sy.
4. Do/t does not exceed 50 where Do is the pipe outer diameter and t is the thickness.
5. External pressure does not exceed internal pressure.

03.09.03-5

As part of the staff's evaluation of the applicant's compliance with the requirements of GDCs 1, 2, 4, 14, and 15; 10 CFR 50.55a; and 10 CFR Part 50, Appendix S, this section evaluates component supports the ASME Code Class 1, 2, and 3 component and core support structures.

In DCD Tier 2 Section 3.9.3.1.2, the applicant states that piping supports are designed in accordance with ASME BPVC Section III, Subsection NF. The core support structures are design to ASME BPVC Section III Subsection NG. The applicant also stated that the SG tubes supports are internal supports and, therefore, are also designed using Subsection NG. The applicant is requested to discuss the effects of the friction and wearing between the tubes and tag supports when the tubes are subject to the fluid induced vibration from the vertical cross flow for 60 years of plant life.

03.09.03-6

Per requirements of GDCs 1, 2, 4, 14, and 15; 10 CFR 50.55a; and 10 CFR Part 50, Appendix S, this section in part evaluates component supports for the ASME Code Class 1, 2, and 3 component and core support structures.

In DCD Tier 2 Section 3.12.6.6, the applicant states that there are no snubbers used at NuScale for ASME Code Class 1, 2 or 3 piping. In Section 3.10.1.2, the applicant states that requirements for active valves and dampers are addressed in a NuScale Equipment qualification record file. The structural integrity and operability of the active valve is qualified by a combination of analyses and tests. Identify what these dampers are and how they are used. Are these ventilation system dampers?