NuScaleDCRaisPEm Resource

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Sent:	Tuesday, December 12, 2017 3:29 PM
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Subject:	Request for Additional Information No. 295 RAI No. 9216 (6.2.6)
Attachments:	Request for Additional Information No. 295 (eRAI No. 9216).pdf

PLEASE DISREGARD DRAFT VERSION SENT EARLIER TODAY.

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 this question in this RAI is likely to require greater than 60 days.

If you have any questions, please contact me.

Thank you.

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301-415-0546

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Request for Additional Information No. 295 (eRAI No. 9216)

Issue Date: 12/12/2017
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 06.02.06 - Containment Leakage Testing
Application Section: Part 7

QUESTIONS

06.02.06-14

Regulatory basis is 10 CFR 50, Appendix J and 10 CFR 50.12(a)(1)

As stated in NuScale Exemption Request #7, “the potential vessel leakage pathways are testable containment penetrations, total CNV leakage can be quantified via 10 CFR 50, Appendix J, Type B and C tests, thus assuring that CNV leakage does not exceed allowable leakage rate values.”
The above statement makes the assumption that there can be no leakage through the containment other than through the penetrations. The CNV is constructed of stainless steel in the lower section, while the upper section is carbon steel, lined with stainless steel. The vessel would sit in a pool of borated water. What is stainless steel’s susceptibility to pitting in borate water? If the stainless steel cladding becomes pitted, what would happen to the underlying carbon steel vessel? Would this be susceptible to leakage over time?

06.02.06-15

Regulatory basis is 10 CFR 50, App. J and 10 CFR 50.12(a)(1)

NuScale’s technical report, TR-1116-51962, Sect. 4.1, Manufacturing Facility Testing and Inspection, states “the CNV is hydrostatically tested in the factory in accordance with ASME Subsection NB-6000.” ASME Subsection NB-6111, Scope of Pressure Testing, states “All pressure−retaining components, appurtenances, and completed systems shall be pressure tested. The preferred method shall be a hydrostatic test using water as the test medium. Bolts, studs, nuts, washers, and gaskets are exempted from the pressure test.” Explain how this structural integrity test confirms the leak tightness of the bolted flanges. Explain how this test could identify vessel leakage or weld leaks if bolted flanges are allowed to leak.

06.02.06-16

Regulatory basis is 10 CFR 50, Appendix J and 10 CFR 50.12(a)(1)

NuScale’s technical report TR-1116-51962, Table 5-2, Summary of Test and Inspection Elements, states that CNTS leakage test will be conducted in accordance with ASME Class 1, Section XI, IWB Exam Category B-P.

ASME Section XI requirements, IWB-2500-1 (B-P) Exam Category, requires a system leakage test of all pressure retaining components at the end of a refueling outage. This test is comparable to a GDC 52 and Appendix J Type A test. This is done with the reactor coolant boundary in a normal alignment for operation, and is conducted at normal operating pressure and temperature. This ensures the reactor coolant system integrity is ready for the next cycle. Will a comparable test be conducted for the containment vessel since it will be subject to ASME Class 1 in service inspection (ISI) requirements? If a comparable test is conducted for the CNV, identify what pressure will it be conducted, and explain why this supports the request for not testng at the design pressure and testing time for the Type A test.

06.02.06-17

Regulatory basis is 10 CFR 50, Appendix J and 10 CFR 50.12(a)(1)

NuScale FSAR section 6.2.6 states, in part, "…based on the high pressure and safety functions of the CNV, the Inservice Inspection Program requires the CNV to meet ASME class 1 requirements, similar to the RPV. The CNV design allows for visual inspection of the entire inner and outer surfaces."

NuScale FSAR section 6.2.1.6 states, in part, "   enhanced inspection requirements are provided for the CNV in excess of the Class MC requirements of ASME BPVC, Section XI, Subsection IWE. The CNV augmented inspections are based on Class 1 requirements of ASME BPVC, Section XI. The CNV inspection elements are provided in Table 6.2-3. An inspection element is a combination of a component and the inspection requirements."

Table 6.2-3, Containment Vessel Inspection Elements, does not address the containment shell inspection. Staff requests NuScale add the Examination Category and the Examination Method for the CNV shell to the table. If the CNV upper section, which is clad inside and outside, has different Categories or Examination Methods, address the distinction. Staff requests that FSAR Table 6.2-3, be revised to reflect the response and to include the CNV shell inspection. Indicate whether the inspection is inside or outside the CNV.
Staff requests that NuScale confirm that the CNV shell inspection will occur during each refueling outage. Include this frequency in the Notes column of FSAR Table 6.2-3.

Staff also requests that NuScale TR-1116-51962, Table 5-2, Summary of Test and Inspection Elements, be revised to include the CNV shell Examination Categories and Examination Methods.

NuScale Operating Procedure, OP-0000-10842, rev 0, NuScale Module Refueling Operations should also be updated to include the CNV shell inspection.

06.02.06-18

Regulatory basis is 10 CFR 50, Appendix J and 10 CFR 50.12(a)(1)

NuScale TR-1116-51962-NP, Rev 0, "NuScale Containment Leakage Integrity Assurance Technical Report", states in section 5, that CNV bolted flanges have their bolts inspected per ASME XI, Category B-G-1 or B-G-2, each time the bolting is removed. The TR, Appendix A, Table A.1, "Type B Containment Penetrations" lists the bolted containment penetrations. In addition to the CNV main flange, identify which of these flanges are opened at each refueling. If the flanges are not opened at each refueling, indicate the minimum frequency at which the flanges will be opened, and therefore the bolts inspected.

Staff also requests that NuScale TR-1116-51962, Table 5-2, Summary of Test and Inspection Elements, be revised to address the CNV main flange Examination Category and Examination Method.

06.02.06-19

Regulatory basis is 10 CFR 50, Appendix J and 10 CFR 50.12(a)(1)

NuScale calculation EC-A011-3036, rev 1, 28 Dec 2016, "CNV Ultimate Pressure Integrity Analysis" assumed a maximum allowable gap of 0.030" between the bolted flanges at the center of the outer O-ring. This is intended to represent the maximum gap before unacceptable NuScale FSAR section 6.2.6.2 states that all CNV bolted flanges have dual O-ring seals. flange leakage would occur. (This value is currently identified as ODI-15-0140).
Explain how this maximum flange gap will be verified, including but not limited to, the following items: Where will the CNV be during verification? Will this verification be automated? Will it require special tools? Will it be measured at each bolted flange? Will it be measured during each refueling? When will this maximum allowable gap value be finalized?

06.02.06-20

Regulatory basis is 10 CFR 50, Appendix J and 10 CFR 50.12(a)(1)

NuScale calculation EC-A011-3036, rev 1, 28 Dec 2016, “CNV Ultimate Pressure Integrity Analysis” section 3.1 lists several criteria, any of which would fail the CNV. One criterion is exceeding a flange gap of 0.030 in. at the outer O-ring of any bolted CNV opening. Calculation Table 5-2, Flange Gap vs. Pressure from 1000 psi to 1800 psi, shows that CNV31 flange gap for the pressurizer heater access port, is exceeded at less than the hydrotest pressure of 1250 psia. Explain how this is an acceptable hydrotest pressure.
Another CNV failure criterion is the loss of bolt preload occurring at any bolted CNV opening. As is shown in calculation Table 5-1, Stud Preload and Pressure to Lose Preload, all pressures exceed the 1240 psia ultimate pressure. These results illustrate the importance of correctly calculating and applying the bolt preloads. These current preload values are assumed, and require verification {ODI-14-0141}. When will these stud preload and pressure to lose preload values be finalized?

06.02.06-21

In Exemption Request 10 CFR 50 App A, GDC 52, Containment Leak Rate Testing, NuScale states “Type B and C testing, inspections, and administrative controls (e.g., configuration management and procedural requirements for system restoration) to assure leakage integrity associated with activity-based failure mechanisms (i.e., assures that CNV penetrations and CIVs remain within allowable leakage rate values after system and component modifications or maintenance)”
Staff notes that there is recent operating experience related to the opening and closing of reactor pressure vessels during refueling, which have involved leaking bolted flanges, overtorqued flange bolts, malfunction of specialized bolting equipment, deformed O-ring seals, and stud tensioner malfunctions. These failures have been self-evaluated as resulting from refueling equipment malfunction, inadequate operator training, human error, software, inadequate procedures, and misinterpretation of measurement data.
Because this exemption request relies upon heavily on administrative controls, staff requests NuScale address how they will ensure leakage integrity for a design which has no operating experience with these controls. Explain how NuScale procedures differ (i.e., are superior) from current plants such that these errors are reasonabily concluded to be eliminated; or provide an alterative means that will demonstrate that the adminstrive controls provide the necessary assurance.