NuScaleDCRaisPEm Resource

From: Cranston, Gregory
Sent: Wednesday, October 25, 2017 7:12 AM
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Subject: Request for Additional Information No. 271 RAI No. 9147 (6.2.6)
Attachments: Request for Additional Information No. 271 (eRAI No. 9147).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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301-415-0546

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Request for Additional Information No. 271 (eRAI No. 9147)

Issue Date: 10/25/2017
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: 6.2.6

QUESTIONS

06.02.06-4

Regulatory basis is 10 CFR 50, App. J and 10 CFR 50.12(a)(1)
In technical report TR-1116-51962, NuScale states “The NuScale CLIP(containment leakage integrity program) provides leakage integrity assurance equivalent to the containment leakage testing requirements of 10 CFR 50, Appendix J, “Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors.” One of the purposes of the leakage tests is to assure that leakage through the primary reactor containment and systems and components penetrating the primary containment shall not exceed allowable leakage rate values as specified in the technical specifications or associated bases. Identify and provide for audit the calculation(s) which demonstrate that the Type B leak test pressure applied to the main containment flange would be equivalent to applying an internal CNV pressure of P_a during a Type A test. As part of the response, provide a decription of the calculations and how the calculation demonstrates the requested information.

06.02.06-5

Regulatory basis is 10 CFR 50, App. 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 0.03” between the bolted flanges and the center of the O-rings. This is intended to represent a maximum gap before unacceptable flange leakage would occur. Provide the leakage rate at the accident pressure P_a for each CNV flange at the gap of 0.03” or their respective values for each of the bolted flanges.

For bolted flanges, the stud preload and the pressure to lose that preload could significantly affect the CNV leak rate. NuScale calculation EC-A011-3036, rev. 1, Table 5-1 provides the bolt preloads and the pressures to lose preload for several CNV flanges, including the main refueling flange. Identify and provide for audit the stud preload calculation for each of the bolted CNV flanges not included in the above calculation.

The above requested information is requested for all the bolted flanges, not just those of nominal pipe size (NPS) greater than 18”.

06.02.06-6

Appendix J to 10 CFR 50, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," states, in part:

The maximum allowable leakage rate, La (weight percent in 24 hours) is defined at accident pressure, Pa, as specified for preoperational tests in the technical specifications or associated bases, and as specified for periodic tests in the operating license or combined license. The combined leakage rate for all penetrations and valves subject to Types B and C tests shall be less than 0.60 La. NuScale's proposed technical specification for allowable leakage and containment operability is 0.20 % in 24 hrs. If leakage from Types B and C testing cannot exceed 0.60 La, or 0.12% in 24 hrs, describe how the Type A leakage is demonstrated to not exceed 0.08% in 24 hrs?

NuScale TR-1116-51962 states that the allowable pressure change in the CNV, which would meet the leakage criteria for the NuScale design, is approximately 0.06 psia. Explain the leakage criteria to which this pressure corresponds: the Technical specification. leakage value of 0.20 % in 24 hrs; the Type A equivalent allowable leakage of 0.12 % in 24 hrs; or other value.

The overall integrated leakage rate demonstrates containment Technical Specification operability. For that overall integrated leakage rate, which is obtained from a summation of leakage through all potential leakage paths, describe how the contribution from Type A testing is quantified to ensure and demonstrate containment operability.

06.02.06-7

In NuScale TR-1116-51962-NP, "NuScale Containment Leakage Integrity Assurance Technical Report", states that leakage rate test frequencies according to 10 CFR 50, Appendix J, will be established under Option A, Prescriptive Requirements. Since there would not be any performance history to the initially licensed NuScale plants, selecting Option B, Performance Based Requirements, would not be available.

RG 1.163 and NEI 94-01 describe the risk informed methods required to extend the leak rate test frequencies in order to select Option B. Among the minimum requirements, Type A, Type B and Type C tests must be performed on two successful, successive tests to demonstrate acceptable containment leakage performance.

The siting criteria in 10 CFR 52.47(a)(2)(iv) states, in part, "The applicant shall perform an evaluation and analysis of the postulated fission product release, using the expected demonstrable containment leak rate". Explain how Type A containment leakage is demonstrated to meet the siting criteria, or to successfully apply risk informed methods to extend leak rate testing frequencies, to those allowed under Option B.

ANSI/ANS 56.8, "Containment System Leakage Testing Requirements", 1994 is listed as a reference in NuScale TR-1116-51962. However, in the same TR, NuScale cites ANSI/ANS 56.8, 2002 version. Clarify to which version of 56.8 the NuScale design committed to comply.

06.02.06-8

In Service Inspection (ISI) and In-Service Testing (IST)

NuScale TR-1116-51962, "NuScale Containment Leakage Integrity Assurance Technical Report", commits to ISI per the requirements of ASME XI, IWB, of 100% visual inspection of the CNV, both inside and outside, once every 10 years. This is to be accomplished at each refueling by inspecting 20% of the CNV both inside and outside the CNV.

NuScale indicates in the TR, section 5.1.1 that there will be cladding, both inside and outside the CNV in the low alloy steel region. Clarify how this region be visually inspected? What percentage of the CNV surface area does this represent?

06.02.06-9

Confirm that 10 CFR 50 App J Type B test of the double O-ring seals on all the containment bolted closures are performed by local pressurization at containment peak accident pressure, Pa during each reactor shutdown for refueling.

FSAR Table 6.2-3, "Containment Vessel Inspection Elements" describes the ASME XI Examination Categories and Methods for the bolting for the CNV main flange and for bolting two inches or less in diameter. Clarify if these two categories comprise all the bolting for all the CNV flanges. Explain how compliance will be ensured. Will all the bolts be examined each time they are removed? Are the flange bolts inspected only when they are removed?

06.02.06-10

Provide the calculation which according to the TR-1116-51962 establishes that the acceptable CNV leakage rate La at 0.20 % at design pressure would be 18.05 SCFH. Or, 0.226 SCFM at 1000 psia.

Clarify whether NuScale means 18.05 CFH at 1000 psia and 0.226 CFM at 1000 psia, or 18.05 SCFH and 0.226 SCFM.

06.02.06-11

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)"
Because the exemption requests relies upon adminstrative controls, in order for the staff to make its safety finding additional information is needed, as requested below.

OP-0000-10842, "NuScale Module Refueling Operations Procedure", rev 0, 9 Mar 2015, and NuScale TR-1116-51962, "NuScale Containment Leakage Integrity Assurance Technical Report" describe the proposed refueling operation steps. For the following actions, indicate which are: being viewed remotely vs. directly; controlled directly, (i.e. not from a control station); accomplished remotely,(i.e. using special tools such as the containment flange tool;) performed or Inspected under water; 'instrumentation readings which are viewed directly; and, which actions are automated.

In Reactor Bay:
Disassembly of CNV
Visual inspection of CNV, including lower flange and flange bolts

In Dry Dock:
Inspect upper containment flange
Replace containment flange O-ring seals, when necessary
Inspect or replace containment flange nuts
Inspect ISI welds, forgings and surfaces
Perform App J Type B leak tests
(App J Type A is conducted during pressurized air assisted containment drain down)
Perform App. J Type C leak tests
Reassembly of upper module to lower module using CNV flange tool guides
CNV main flange stud preload tension applied

In Reactor Bay:
CNV main flange Type B tested

06.02.06-12

NuScale's Exemption Request for 10 CFR 50, App A, GDC 52 is based upon providing CNV design specifications and design capability for local leak rate testing to demonstrate that the CNV leakage will not exceed the Technical Specification allowable leakage rate values. This reasoning is being applied to a first of a kind (FOAK) containment vessel design, and relies heavily on refueling, inspection and test procedures which have yet to be shown as successful. The proposed Type B and Type C testing will be done under non-traditional, ie yet to be demonstrated as successful, conditions. This testing and inspection will be done at least partially remotely and under water. Describe the NuScale testing of this entire proposed refueling and inspection program, under the conditions which would be encountered in the NuScale design. Explain how the leakage test results demonstrate equivalency to containment leak rate testing which normally includes local leak rate testing, and App J Type A testing?

The operating experience of some BWRs illustrates that drywell leakage paths developed due to inadequate drywell closures is well known. The BWR drywell is similar to the NuScale design due to the limited volume and bolted flange designs. The operating experience demonstrated that leakage paths were not identified by the Type B testing of the drywell head flange, but only during the Type A tests. See NRC Bulletin 78-09: "BWR Drywell Leakage Paths Associated with Inadequate Drywell Closures", 14 June 1978.

Given that the NuScale design is a FOAK design, and will be refueled every twenty four months under more challenging conditions than current plants, explain how NuScale has demonstrated that the local leak rate testing accurately reflects containment allowable leakage rate for Technical Specification operability.

06.02.06-13

The NuScale FSAR section 6.2.6.2 states that all CNV bolted flanges have dual O-ring seals, with a testing port between the seals. Explain the success and/or failure criteria to determine if the O-rings may be re-used after unbolting. Explain the effect of minimal success of the O-rings on the leak rate. Identify and provide for audit the calculation and test(s) that demonstrate the extent of the varying acceptable levels of O-ring deformation on the leakage rate.