RAIO-0717-55087

July 26, 2017

Docket No. 52-048

U.S. Nuclear Regulatory Commission
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SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 49 (eRAI No. 8843) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 49 (eRAI No. 8843)," dated June 02, 2017

The purpose of this letter is to provide the NuScale Power, LLC (NuScale) response to the referenced NRC Request for Additional Information (RAI).

The Enclosure to this letter contains NuScale's response to the following RAI Question from NRC eRAI No. 8843:

- 05.02.05-4

This letter and the enclosed response make no new regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions on this response, please contact Marty Bryan at 541-452-7172 or at mbryan@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 8843

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NuScale Response to NRC Request for Additional Information eRAI No. 8843

NuScale Power

Response to Request for Additional Information
Docket No. 52-048

eRAI No.: 8843
Date of RAI Issue: 06/02/2017

NRC Question No.: 05.02.05-4

10 CFR 52.47(a)(2) requires that a standard design certification applicant provide a description and analysis of the structures, systems, and components (SSCs) of the facility, with emphasis upon performance requirements, the bases, with technical justification therefor, upon which these requirements have been established, and the evaluations required to show that safety functions will be accomplished.

RG 1.45, Regulatory Position C.4.1 provides guidance on the content of technical specifications addressing reactor coolant pressure boundary (RCPB) leakage by stating:

> "Plant technical specifications should include the limiting conditions for identified, unidentified, RCPB, and intersystem leakage, and they should address the availability of various types of instruments to ensure adequate coverage during all phases of plant operation (not including cold shutdown and refueling modes of operation)."

FSAR Tier 2, Section 9.3.6.2.3 indicates that the leak-detection methods of containment vessel (CNV) pressure monitoring, containment evacuation system (CES) sample tank level change monitoring, and CES vacuum discharge radiation monitoring are used for leak-before-break (LBB) leakage monitoring. NuScale applies LBB for main steam and feedwater piping within the CNV, as described in FSAR Tier 2, Section 3.6.3.5.

Leak-detection methods are specified under plant technical specifications LCO 3.4.5, "RCS Operational Leakage," and LCO 3.4.7, "RCS Leakage Detection Instrumentation" for RCS leakage. While reviewing LCO 3.4.5 and LCO 3.4.7 for conformance with RG 1.45, Regulatory Position C.4.1, the staff could not confirm whether these two LCOs are also applicable for main steam and feedwater piping leakage.
The applicant is requested to:

a. Clarify whether LCOs 3.4.5 and 3.4.7 are applicable for main steam and feedwater piping or provide equivalent LCOs for main steam and feedwater piping LBB. The FSAR should be revised accordingly.
b. Otherwise, justify its position for not having LCOs for main steam and feedwater to support the LBB application.

NuScale Response:

Leak-Before-Break (LBB) leakage limits were not identified as a limit that is required to be included in facility Technical Specifications. The NRC staff acknowledged this explicitly in NUREG 2194, *Standard Technical Specifications, Westinghouse Advanced Passive 1000 (AP1000) Plants*, Rev. 0, Volume 2, Bases.

> The Applicable Safety Analysis section of the Bases for LCO 3.7.8, Main Steam Line Leakage, indicates that "the main steam line leakage limit is not required by the 10 CFR 50.36(c)(2)(ii) criteria...."

Regulatory Guide 1.45, Rev. 1 is applicable to the NuScale design as described and specified in FSAR section 1.9, Table 1.9-2. As titled and written, the Regulatory Guide is explicitly directed at monitoring and responding to reactor coolant system (RCS) leakage. This guide directs special attention to the RCS pressure boundary because of its key safety functions including providing one of the principal barriers to the release or radioactive materials from the reactor core. The application of LBB to the NuScale main steam and feedwater lines is not directed at monitoring and responding to RCS leakage.

RCS leakage detection instrumentation and limits have been included in the Technical Specifications based on Criteria 1 and 2 of 10 CFR 50.36(c)(2)(ii). Criterion 1 requires inclusion of a technical specification LCO for:

> Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the **reactor coolant pressure boundary**. [emphasis added]

As described in the FSAR, the lines subjected to LBB analysis are not a part of the reactor coolant pressure boundary.

Criterion 2 of 10 CFR 50.36(c)(2)(ii) requires inclusion of a technical specification LCO for:

> A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

The LBB limit on leakage from the main steam or feedwater lines does not meet this criteria because it is not a 'process variable, design feature, or operating restriction' that is an initial condition of the analyses. The LBB leakage limit is solely an indicator for the need to take further action to investigate the source of leakage and evaluate the potential consequences of that leakage.

The NuScale design operates with the containment vessel at a vacuum pressure below the vapor pressure corresponding to the bulk reactor pool temperature and leakage will be readily identified by changes in containment pressure. Plant procedures required by the RCS leakage limits established in accordance with commitments to Reg. Guide 1.45 will ensure that appropriate actions are taken to identify sources of leakage to the extent practicable, and to initiate actions appropriate for the conditions that exist.

Section 5.2 of the NuScale Final Safety Analysis Report has been updated to correct an error which indicated that the technical specifications included the LBB limits.

Impact on DCA:

FSAR Section 5.2 has been revised as described in the response above and as shown in the markup provided in this response.

Mechanical Engineers Boiler and Pressure Vessel Code and will establish implementation milestones. If applicable, a COL applicant that references the NuScale Power Plant design certification will identify the implementation milestone for the augmented inservice inspection program. The COL applicant will identify the applicable edition of the American Society of Mechanical Engineers Code utilized in the program plans consistent with the requirements of 10 CFR 50.55a

5.2.5 Reactor Coolant Pressure Boundary Leakage Detection

The RCS of each NPM does not employ traditional light water reactor components with designed leakage rates, such as through pump seals or valve stem shafts.

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For each NPM, distinguishing between RCS identified and unidentified leakage inside the containment is not practicable with the installed instrumentation. Leakage into containment may originate from sources other than from the RCPB (e.g., leakage from reactor component cooling water). Leakage is expected from the RCS to containment through mechanical boundaries such as the RRVs, RVVs, and RSVs. A partial vacuum condition is established in the CNV during NPM startup and maintained during reactor operation. As a result, reactor coolant leakage, whether from a known or unknown source, into containment quickly vaporizes and disperses within the containment atmosphere. Upon vaporization, there is no feasible means to monitor separately the flow rates of identified and unidentified leakage from inside the containment. Therefore, containment leakage is treated as unidentified until the source location is known and leakage quantified by other means. The RCS leakage rate into the containment is determined performing an RCS inventory balance and comparing it to the total flow rate into the CES. The operational unidentified leakage limit is provided in plant technical specifications.

~~The operational unidentified leakage limit is provided in plant technical specifications. This unidentified leakage limit ensures remedial actions are taken prior to exceeding the leak-before-break analysis limits. Leak-before-break is discussed in Section 3.6.~~

The RCPB leakage detection systems are sufficiently reliable, redundant, and sensitive to support the application of leak-before-break analyses addressed in Section 3.6.3.

5.2.5.1 Leakage Detection and Monitoring

The containment evacuation system (CES) maintains the containment below saturation pressure, which prevents water vapor from leaks or other sources from condensing into a liquid state and collecting at the bottom of the CNV; as such, monitoring containment water level for RCS leakage is not a reasonable option. Two primary methods of leakage monitoring are provided to detect leakage into containment; a change in containment pressure and condensate collected from the CES. The RCS leakage detection instrumentation requirements are specified in plant technical specifications.

Leakage Monitoring - CES Collected Condensate