December 15, 2017

Docket No. 52-048

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 273 (eRAI No. 9187) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 273 (eRAI No. 9187)," dated November 03, 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. 9187:

- 03.06.02-16

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,

Jennie Wike
Manager, Licensing
NuScale Power, LLC

Distribution: Gregory Cranston, NRC, OWFN-8G9A
Samuel Lee, NRC, OWFN-8G9A
Marieliz Vera, NRC, OWFN-8G9A

Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9187

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NuScale Response to NRC Request for Additional Information eRAI No. 9187

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

eRAI No.: 9187
Date of RAI Issue: 11/03/2017

NRC Question No.: 03.06.02-16

10 CFR 52.47(a)(4) states that analysis and evaluation of emergency core cooling system (ECCS) cooling performance and the need for high- point vents following postulated loss-of-coolant accidents shall be performed in accordance with the requirements of §§ 50.46 and 50.46a. 10 CFR 50.46(a)(1)(i) states that Appendix K, Part II Required Documentation, sets forth the documentation requirements for each evaluation model. Furthermore, 10 CFR Part 50 Appendix K, I.C.1 - *Break Characteristics and Flow,* requires that a spectrum of possible pipe breaks be considered in the analyses of loss-of-coolant accidents (LOCAs). Based on its review of the Final Safety Analysis Report (FSAR) Section 15.6.5.1, the NRC staff identified that the reactor vent valves (RVV), reactor recirculation valves (RRV), and control rod drive mechanism housings were not identified as being considered in the spectrum of possible break locations. The applicant was requested in RAI No. 8785, Question 15.06.05-1 to provide sufficient evidence to justify that a sufficient break spectrum has been considered such that the limiting break size has been identified and that it meets the applicable acceptance criteria.

In a letter dated July 19, 2017, the applicant provided its response stating that NuScale's ASME Design Specification for the RPV specifies that for the ECCS valve nozzle locations, the safe ends, the safe-end-to-nozzle welds, and the valve-to-safe-end welds are part of the RPV and analyzed as such. Therefore, the RVVs and RRVs are not required to be analyzed as a LOCA break location. Rather than analyzing a break at the connection between the RVV's and RRV's and the RPV, NuScale considers an inadvertent operation of an ECCS valve is analyzed as a design basis event in FSAR Section 15.6.6.

Based on its review of the information provided in the above applicant's RAI response, the NRC staff determined that additional information as described below is needed to justify that the RVVs and RRVs are not required to be considered in the break spectrum of possible break locations to determine the limiting break and that it meets the applicable acceptance criteria to permit exclusion as a potential break location.

a. The NRC staff found that the NuScale's design specification for the scope of RPV vessel for the ECCS valve nozzle locations as described above is not consistent with the definition and scope of vessel and pipe as described by the ASME Companion Guide. Companion Guide to the ASME Boiler and Pressure Vessel Code states that Paragraph U-1(a)(2) of ASME Section VIII-1 scope addresses pressure vessels that are defined as containers for the containment of pressure, internal or external and if the primary function of the pressure container is to transfer fluid from one point in the system to another, then the component should be considered as piping. In addition, Paragraph 21.3.1.2 of the Companion Guide states that the vessel boundary ends at the face of the welding and connection for the first circumferential joint for welded connections to piping, other pressure vessels, and mechanical equipment.

In applying the definition and scope of vessel and pipe as described by the ASME Companion Guide, the NRC staff considers the RPV vessel boundary ends at the safe end-to nozzle welds and the safe ends, the valve-to-safe end welds are not part of the RPV vessel. Therefore, the valve-to-safe end weld is considered as a pipe weld rather than a vessel weld. Moreover, the NRC staff noted that FSAR Section 3.6.2.1.2 describes some containment isolation valves (CIVs) for certain piping systems which have similar geometric configurations such that those CIVs are welded directly to safe-ends that are welded to the respective nozzles on the containment vessel head. For those welds between the valve and the safe end, the applicant considers them as potential break locations and applies certain specific design and examination criteria to preclude the need for breaks to be postulated. Accordingly, the NRC staff does not agree with NuScale's position that for the RVVs and RRVs, the valve-to-safe end weld is a vessel weld and need not be considered a break location. The applicant is requested to justify its position as described above.

b. There is precedent for not postulating breaks in certain locations where additional design and operational criteria provide assurance that this approach is acceptable. General Design Criterion (GDC) 4 in Title 10 of the Code of Federal Regulations (10 CFR), Part 50, Appendix A, explicitly allows exclusion of certain pipe ruptures when "the probability of fluid system piping rupture is extremely low" - the basis used for "leak-before-break" as described in SRP Section 3.6.3. The specific staff's guidelines included in SRP 3.6.3, "Leak-Before-Break Procedures" are deterministic fracture- mechanics-based approach. The concept is to demonstrate that leakage will be detected in a timely manner to ensure that the probability of gross failure (in this case, catastrophic failure of welded connection) is extremely low. The NRC staff would accept application of the leak-break to the weld provided the leak-before-break criteria are met for the weld attaching the valve to the safe end.

   In addition, Section 2A(ii) of BTP 3-4 states that breaks need not be postulated in those portions of piping from containment wall to and including the inboard or outboard isolation valves (the "break exclusion zone"), provided they meet certain specific design and examination criteria (e.g., stress and fatigue limits, welding, and full volumetric examination of welds). Even though these existing break exclusion guidelines are for fluid system piping in the containment penetration area of current generation large light-water reactors and, therefore, are not directly applicable to the NuScale design configuration, the concept of demonstrating that employing certain specific design criteria and augmented in-service-examination to ensure the probability of gross rupture is extremely low should be the same.

The NRC staff would accept the weld as a beak exclusion area provided the break exclusion criteria are met for the weld attaching the valve to the safe end.

Therefore, in order for the NRC staff to conclude that postulating break at the RRV or RVV welds is not needed, the applicant needs to provide information to demonstrate that the probability of a postulated break at this location is extremely low. That could be done by meeting either the break exclusion criteria or the leak-before-break criteria for the weld attaching the valve to the safe end.

Note: This supplemental RAI only addresses the aspect related to RRV and RVV breaks. The other aspect related to CRDM housing failure identified in RAI No. 8785, Question 15.06.05-1 is still under NRC staff's review and will be addressed separately, as necessary.

NuScale Response:

In subquestion "a," it is requested that NuScale provide justification to support the position that, for the RVVs and RRVs, the connection to the RPV need not be considered a break. The question references a NuScale response to RAI No. 8785, Question 15.06.05-1, submitted by letter dated July 19, 2017; however, it does not reference another relevant NuScale response to RAI No. 8776, Question 15.06.05-5, dated October 18, 2017. In this RAI 8776 response, additional justification was provided to support NuScale's position that high energy line breaks do not need to be postulated at the RVV and RRV connections to the RPV. NuScale requests that the NRC consider the response to RAI No. 8776, Question 15.06.05-5, in addressing subquestion "a."

In subquestion "b," it is requested that NuScale show that the welds between the RVVs and RRVs and the RPV nozzles satisfy either leak-before-break (LBB) criteria per guidelines contained in SRP 3.6.3, "Leak-Before-Break Evaluation Procedures," or the break exclusion criteria per the guidelines in Section B.A(ii) of BTP 3-4, in order to justify that breaks do not need to be postulated at those locations.

Since the issuance of this RAI, NuScale has changed the configuration of the RVVs and RRVs from a welded connection to a bolted connection. Consequently, neither SRP 3.6.3 or BTP 3-4 are applicable as they do not provide guidelines for excluding breaks at flanged connections.

Impact on DCA:

There are no impacts to the DCA as a result of this response.