RAIO-0318-59069

March 09, 2018

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. 107 (eRAI No. 8984) on the NuScale Design Certification Application

REFERENCES:
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 107 (eRAI No. 8984)," dated July 25, 2017
2. NuScale Power, LLC Response to NRC Request for Additional Information No. 107 (eRAI No. 8984) on the NuScale Design Certification Application, dated September 7, 2017 (ML17250A838)

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. 8984:

- 05.03.01-2

The response to RAI Question 05.03.01-1 was previously provided in Reference 2. This completes all responses to eRAI 8984.

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 Carrie Fosaaen at 541-452-7126 or at cfosaaen@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 8984

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 8984

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

eRAI No.: 8984
Date of RAI Issue: 07/25/2017

NRC Question No.: 05.03.01-2

NuScale DCD Section 5.3.1.6 cites reactor vessel surveillance capsule lead factors ranging between 1.5 to 4.5. This range of lead factors is inconsistent with ASTM E-185-82, “Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactors Vessels,” which permits lead factors between 1 and 3. The use of ASTM E-185-82 for the development of a reactor vessel surveillance program is invoked by 10 CFR Part 50, Appendix H. In addition all lead factors used in DCD Table 5.3-5 are 4.3 implying that all capsules will be positioned to achieve the same high lead factor.

Nuclear power plant licensees have typically implemented a range of lead factors with the highest lead factor capsules being removed first to provide early access to measured irradiated material properties. Lower lead factor capsules then ensured capture of data based on a longer period of operational conditions. The incorporation of some surveillance capsules with lower lead factors ensures that data on reactor vessel embrittlement is being gathered from samples which represent the actual reactor vessel material conditions as closely as practicable.

The staff requests that the applicant justify the intent to design the location of surveillance capsules to achieve lead factors greater than 3 as cited in DCD Section 5.3.1.6 and revise the DCD accordingly. In addition the staff requests that the applicant address the suitability of a 100% high lead factor program.

NuScale Response:

Surveillance capsules have been repositioned to reduce the lead factors. A fluence analysis was performed and determined that the lead factors of all four capsules are now approximately 2.5, which is within the bands stated by ASTM E185-82. The FSAR has been revised to reflect this change.

Regarding having a range of lead factors, ASTM E185-82 recommends lead factors less than 3, but does not require a range of lead factors.

Impact on DCA:

FSAR Section 5.3 has been revised as described in the response above and as shown in the markup provided in this response.

time, the archive materials are maintained as full-thickness sections instead of being machined into specimens. Therefore, the archive materials for Reactor Pressure Vessel Surveillance Program are taken from the actual production forgings, and from weldments made from the same weld wire heat and flux lot combination used in the production weld.

Table 5.3-4 lists the specimen matrix for the Material Surveillance program requirements. As shown in the table, the number of specimens meets the ASTM E185-82 (Reference 5.3-6) minimum requirements.

The NuScale reactor vessel is designed for 60 years. Therefore, for the first 40 years of the 60-year design life, the capsule withdrawal schedule complies with Table 1 of ASTM E185-82, which is based on 32 effective full-power years (EFPY). Three capsules are sufficient to cover the initial 40-year operation per E185-82. ~~For the remaining 20-year design lifetime, a fourth capsule is included. This fourth capsule is consistent with the license renewal requirements of NUREG-1801, Revision 2, for the 20-year license renewal period after the initial 40-year license.~~ The capsule withdrawal schedule is provided in Table 5.3-5.

RAI 05.03.01-2

The capsules are inside capsule holders that are attached to the outside of the core barrel at mid-height of the core. The capsules are positioned to achieve a lead factor ~~between 1.5 and 4.5~~of approximately 2.5. The four capsules are positioned approximately 90 degrees apart around the circumference of the core support assembly. Figure 5.3-2 shows the core barrel horizontal cross-section and the location of the four capsule holders and capsule elevation on the core barrel.

RAI 05.03.02-2

The neutron flux and fluence calculations are ~~contained~~consistent with the guidance of RG 1.190 and are described in NuScale Technical Report TR-0116-20781, "Fluence Calculation Methodology and Results" (Reference 5.3-7).

The transition temperature upper shelf energy changes are calculated in accordance with RG 1.99, and are shown in Table 5.3-8, Table 5.3-9, and Table 5.3-10. Section 5.3.2 provides further information.

COL Item 5.3-3: A COL applicant that references the NuScale Power Plant design certification will describe the reactor vessel material surveillance program consistent with NUREG 0800, Section 5.3.1.

5.3.1.7 Reactor Vessel Fasteners

The RPV closure studs, nuts, and washers use SB-637 Alloy 718, instead of low alloy steels such a SA-540 Grade B23 or B24. The selection of Alloy 718 over traditional low alloy steels is to prevent general corrosion when the bolting is submerged during the plant startup and shutdown process. Because of its resistance to general corrosion, the concerns addressed by RG 1.65, Revision 1, position 2(b) do not apply to Alloy 718.