RAIO-0618-60307

June 05, 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. 479 (eRAI No. 9279) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 479 (eRAI No. 9279)," dated May 14, 2018

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. 9279:

- 12.03-58

The response to question 12.03-57 will be provided by August 31, 2018.

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 Steven Mirsky at 240-833-3001 or at smirsky@nuscalepower.com.

Sincerely,

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

Distribution: Gregory Cranston, NRC, OWFN-8G9A
Samuel Lee, NRC, OWFN-8G9A
Getachew Tesfaye, NRC, OWFN-8H12

Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9279

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9279

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

eRAI No.: 9279
Date of RAI Issue: 05/14/2018

NRC Question No.: 12.03-58

The Regulatory Basis and Background are in RAI-9279 Question 31027

Key Issue 2

DCD Tier 1 Section 3.11, "Reactor Building," states that the RXB includes radiation shielding barriers for normal operation and post-accident radiation shielding. It further states that DCD Tier 1 Table 3.11-2, "Reactor Building Inspections, Tests, Analyses, and Acceptance Criteria," contains the inspections, tests, and analyses for the RXB. DCD Tier 1 Table 3.11-1 item 4 Acceptance Criteria states that the thickness of RXB radiation shielding barriers is greater than or equal to the required thickness specified in DCD Tier 1 Table 3.11-1.

DCD Tier 1 Section 3.12, "Radioactive Waste Building," states that the RWB includes radiation shielding barriers for normal operation and post-accident radiation shielding. Also, the RWB includes radiation attenuating doors for normal operation and for post-accident radiation shielding. These doors have a radiation attenuation capability that meets or exceeds that of the wall within which they are installed. DCD Tier 1 Section 3.12 further states that DCD Tier 1 Table 3.12-2: "Radioactive Waste Building ITAAC" contains the inspections, tests, and analyses for the RWB. DCD Tier 1 Table 3.12-2 item 1 Acceptance Criteria states that the thickness of RWB radiation shielding barriers is greater than or equal to the required thickness specified in DCD Tier 1 Table 3.12-1, "Radioactive Waste Building Shield Wall Geometry."

DCD Tier 2 Section 12.3.2.2, "Design Considerations," states that DCD Tier 2 Table 12.3-6 and DCD Tier 2 Table 12.3-7, show the nominal shielding thicknesses for rooms in the RXB and the RWB, respectively. DCD Tier 2 Table 12.3-6, "Reactor Building Shield Wall Geometry," provides the nominal thickness of concrete for some of the walls in the RXB. DCD Tier 2 Table 12.3-7, "Radioactive Waste Building Shield Wall Geometry," provides the nominal thickness of concrete for some of the walls in the RWB.

Question 2

To facilitate staff understanding of the application information in support of its reasonable assurance review regarding the RXB and RWB shielding designs, the staff requests that the

applicant provide the following:

- Justify/explain the apparent differences between DCD Tier 1 Section 3.11 and DCD Tier 1 Section 3.12 minimum thickness, and DCD Tier 2 Section 12.3.2.2, nominal thickness,
- Describe/explain any differences between the thicknesses used in the shielding analysis packages for the RXB utilize and the shielding thicknesses described in DCD Tier 1 Section 3.11,
- Describe/explain any differences between the thicknesses used in the shielding analysis packages for the RWB and the shielding thicknesses described in DCD Tier 1 Section 3.12,
- As necessary, revise DCD Section 12.3.2, to provide a description of the RXB and RWB shielding requirements that are consistent with DCD Tier 1 Section 3.11 and DCD Tier 1 Section 3.12,
- As necessary, revise the tables in DCD Section 12.3-6 and DCD Section 12.3-7 to reflect the correct thicknesses and nomenclature for RWB radiation shielding,

OR

Provide the specific alternative approaches used and the associated justification.

NuScale Response:

The values of shielding material thicknesses provided in FSAR Tier 2, Tables 12.3-6 and 12.3-7 are the values assumed in the shielding analyses for developing the radiation zone maps for the Reactor Building and the Radioactive Waste Building, respectively.

Therefore, these shield thicknesses represent the minimum thicknesses, as listed in Tier 1, Section 3.11 and 3.12.

FSAR Tier 2, Section 12.3.2.2 has been revised to remove the word 'nominal' and state that the shielding thickness values listed in Tables 12.3-6 and 12.3-7 are those assumed in the shielding analyses.

Impact on DCA:

FSAR Section 12.3.2.2 has been revised as described in the response above and as shown in the markup provided in this response.

Design Criterion (GDC) 61, 10 CFR 50.34(f)(2)(vii), and 10 CFR 50.49. Dose is limited to protect plant personnel, members of the public, and susceptible equipment subject to environmental qualification requirements.

Shielding performance is in accordance with the following criteria:

- ALARA radiation protection principles of 10 CFR 20
- exposure limits of 10 CFR 20
- dose limits of 10 CFR 50, GDC 19

In addition, plant layout and shielding are used to limit equipment radiation doses to levels that are consistent with the assumptions used to demonstrate environmental qualification.

12.3.2.2 Design Considerations

Shielding is provided for radioactive systems and components to reduce radiation levels commensurate with area personnel access requirements and ALARA principles. The radiation zone maps described in Section 12.3.1 indicate the radiation levels for plant areas.

As described in Section 12.3.1, shielding design features include permanent shielding and separation of components that constitute substantial radiation sources, the use of shielded cubicles, labyrinths, and shielded entrances to minimize dose. Doors are designed to have a radiation attenuation capability that meets or exceeds that of the wall within which they are installed. The selection of shielding materials considers the ambient environment and potential degradation mechanisms. Temporary shielding is considered where it is impractical to provide permanent shielding for substantial radiation sources.

Consistent with RG 8.8, streaming of radiation into accessible areas through penetrations for pipes, ducts, and other shield discontinuities is reduced by using layouts that prevent alignment with the radiation source, placing penetrations above head height to reduce personnel exposures, and using shadow shields to attenuate radiation streaming.

Consistent with RG 8.8, shielding analysis employs accurate modeling techniques and conservative approaches in the determination of shielding thickness. Source terms, geometries, and field intensities are analyzed conservatively. In addition to normal and shutdown conditions, source terms include transient conditions such as resin transfers.

RAI 12.03-58

The material used for a significant portion of plant shielding is concrete. For most applications, concrete shielding is designed in accordance with ANSI/ANS 6.4-2006 (Reference 12.3-1). Table 12.3-6 and Table 12.3-7 show~~s~~ the ~~nominal~~ shielding thicknesses assumed in the shielding analyses~~for rooms~~ in plant buildings. In addition to concrete, other types of materials such as steel, water, tungsten, and polymer composites are considered for both permanent and temporary shielding. The use of lead is minimized.