RAIO-0218-58733

February 19, 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. 352 (eRAI No. 9260) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 352 (eRAI No. 9260)," dated January 29, 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 Questions from NRC eRAI No. 9260:

- 12.02-27
- 12-02-28

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
Anthony Markley, NRC, OWFN-8G9A

Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9260

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9260

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

eRAI No.: 9260
Date of RAI Issue: 01/29/2018

NRC Question No.: 12.02-27

Regulatory Basis

10 CFR 52.47(a)(5) requires applicants to identify the kinds and quantities of radioactive materials expected to be produced in the operation and the means for controlling and limiting radiation exposures within the limits set forth in 10 CFR Part 20.

Appendix A to Part 50—General Design Criteria for Nuclear Power Plants, Criterion 61—"Fuel storage and handling and radioactivity control," requires systems which may contain radioactivity to be designed with suitable shielding for radiation protection and with appropriate containment, confinement, and filtering systems.

10 CFR 52.47(a)(22) requires applicants to provided information necessary to demonstrate how operating experience insights have been incorporated into the plant design.

10 CFR 20.1101(b) and 10 CFR 20.1003, and 10 CFR 20.1701 require the use of engineering controls to maintain exposures to radiation as far below the dose limits in 10 CFR Part 20 as is practical.

The DSRS Acceptance Criteria section of NuScale DSRS section 12.2, "Radiation Sources," states that the applications should contain the methods, models and assumptions used as the bases for all sources described in DCD Section 12.2.

Background
NuScale Design Control Document (DCD) Tier 2 Revision 0, Subsection 12.2.2.1, "Reactor Building Atmosphere" states that airborne radioactivity may be present in the RXB atmosphere due to reactor pool evaporation or primary coolant leakage. The airborne concentration is modeled as a buildup to an equilibrium concentration given the production and removal rate. The airborne concentration in the air space above the reactor pool is determined by using the peak reactor pool water source term. The input parameters are listed in Table 12.2-32, "Input Parameters for Determining Facility Airborne Concentrations." DCD Table 12.2-32 lists the Primary coolant source term as DCD Table 11.1-4, "Primary Coolant Design Basis Source Term".

Electric Power Research Institute (EPRI) technical report (TR) 3002000409 Revision 2, “EPRI Alpha Monitoring Guidelines for Operating Nuclear Power Stations,” (ADAMS Accession Number: ML14083A589,) provides information about the significance of alpha emitting radionuclides for radiation protection. The report states that transuranic (TRU) nuclides, such as americium, plutonium and curium are formed in irradiated uranium fuel by neutron activation and decay predominantly by alpha emission. Alpha contamination is most commonly associated with systems and components associated with fuel such as the reactor coolant system, spent fuel pool, and the associated radioactive waste systems. As noted in this report, the principal TRU nuclides of interest for radiation safety include curium-243/244, plutonium-238, plutonium-239/240, plutonium-241 (which decays to americium-241) and americium-241. These radionuclides are significant because of their presence in fluids in contact with reactor fuel, and alpha emitting radionuclides have a significantly lower Annual Limit on Intake (ALI) than beta-gamma emitting nuclides (see 10 CFR Part 20 Appendix B, Table 1.)

As noted in NUREG 1400, “Air Sampling in the Workplace,” (Accession Number: ML13051A671,) and operating experience (e.g., INPO-SER 3-93 Contamination Events Involving Alpha-Emitting Transuranic Elements - ADAMS Accession No. - ML12228A123 and Information Notice -1997-036 Unplanned Intakes by Workers of Transuranic Airborne Radioactive Materials and External Exposure Due to Inadequate Control of Work – ADAMS Accession No. ML031050563)), dry radioactive material is more likely to result in significant intakes from airborne TRU alpha-emitting radionuclides.

The radionuclide concentrations listed in DCD subsection 12.2 are the basis of the information used to establish plant source terms. NuScale DSRS 12.2 Acceptance Criteria, states that all of the sources of radiation exposure to workers and members of the public (from contained sources) should be identified, characterized, and considered in the design and operation of the facility. This section of the DSRS also states that unless described within other sections of the FSAR, source descriptions should include the methods, models, and assumptions used as the bases for all values provided in FSAR Section 12.2.

Key Issue 1:

As noted in the aforementioned references, alpha emitting radionuclides may be present in the RXB air through resuspension of contamination from dried surfaces, or from entrainment of material during evaporative processes. DCD Tier 2 Revision 0, Table 11.1-4, “Primary Coolant Design Basis Source Term,” lists the radionuclide concentrations in the reactor coolant system (RCS). However, DCD Table 11.1-4, does not list radiologically significant alpha-emitting radionuclides, so DCD Section 12.2 does not include the radiologically significant alpha emitting radionuclides

Question 1:

To facilitate staff understanding of the application information sufficient to make appropriate regulatory conclusions with respect to the alpha-emitting radionuclides that may be present, the

staff requests that the applicant:

- Justify/explain why section 12.2 of the NuScale DCD does not reflect the contribution of alpha-emitting radionuclides in the Design Bases Failed Fuel Fraction RCS fluids, in the description of the facility (RXB and RWB) airborne activity concentrations,
- As necessary, revise DCD Section 12.2, to include airborne alpha-emitting radionuclides in the airborne activity tables for the affected areas,
- Provide the methods, models and assumptions, used to develop the concentrations of the alpha-emitting airborne radionuclides,

OR

Provide the specific alternative approaches used and the associated justification.

NuScale Response:

The NuScale source terms in FSAR Section 12.2 are derived from the reactor core inventory, and the resultant primary and secondary coolant source terms provided in FSAR Section 11.1, and activated components. As stated in NuScale's Effluent Release (GALE Replacement) Methodology and Results technical report (TR-1116-52065) Section 2.2, consistent with 10 CFR 52.47(a)(5), NuScale developed a broad list of radionuclides in FSAR Section 11.1 by including a combined list of radionuclides from NUREG-0017/GALE code, ANSI/ANS 18.1-1999, and previous PWR design certification applicants. Neither the NRC-approved GALE code (NUREG-0017, Rev. 1) nor the ANSI 18.1-1999 standard, provided as NRC source term guidance documents, include alpha emitting radionuclides. Review of the KHNPP APR-1400 DCD Chapter 12 radwaste component and system source terms also shows no alpha emitting radionuclides. Because NuScale developed its coolant source terms in compliance with the NuScale DSRS Section 11.1, information related to alpha-emitting transuranics is not included. In addition, there is no regulatory guidance for performing such an analysis that would include values for variables such as the transuranic alpha emitting radionuclide fuel escape rate coefficient, deposition rate on wetted surfaces, and airborne fraction when the surface becomes dry.

10 CFR 52.47(a)(22) requires applicants to provide information necessary to demonstrate how operating experience insights have been incorporated into the design. Regulatory Guide 1.206 and NUREG-0800 define operating experience insights to be from generic letters and bulletins issued after the most recent revision of the applicable standard review plan and six months prior to the docket date of the application. None of the cited references are either generic letters or bulletins. Also, none of the cited references were issued after NuScale DSRS 12.2 or six months prior to the docket date of the NuScale Design Certification Application (DCA). Therefore, none of these cited references constitute operating experience under 10 CFR 52.47(a)(22), and are not required to be addressed.

However, the control of alpha-emitting radionuclides, for the radiation protection of workers, is an important aspect of the overall Radiation Protection Program, which will be developed as part of COL Item 12.5-1. NuScale has also included Regulatory Guide 8.25 as part of the criteria for the selection and placement of fixed continuous air monitors (CAM), as stated in FSAR Section 12.3.4.3. The NRC has issued NUREG-1400, "Air Sampling in the Workplace," to provide useful technical information on air sampling for following the recommendations of Regulatory Guide 8.25. As indicated by FSAR Table 1.9-2, Regulatory Guide 8.25 is the responsibility of the COL applicant. NRC Information Notice 97-036, "Unplanned Intakes by Worker of Transuranic Airborne Radioactive Materials and External Exposure due to Inadequate Control of Work," also demonstrates the importance of rigorous health physics practices at an operating facility, which will be developed under COL Item 12.5-1. COL Item 12.5-1 specifically states that the operational radiation control program will be developed to meet the goals of 10 CFR 20.1101.

The aforementioned discussion provides the basis for not including alpha-emitting radionuclides in DCD Section 12.2. The control of alpha-emitting radionuclides for the protection of workers is part of the COL Radiation Protection Program, identified in the DCD, in the same manner as previous NRC-approved DCAs, another DCA under NRC review, and the operating fleet of NRC-licensed nuclear power plants.

Impact on DCA:

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

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

eRAI No.: 9260
Date of RAI Issue: 01/29/2018

NRC Question No.: 12-02-28

The Regulatory basis and summary are in RAI-9260 question 30985

Key Issue 2:

DCD Tier 2 Revision 0, Section 12.4.1.6, “Refueling Activities, Including Dry Dock Outage Activities,” states that the major activities included in the dose assessment for refueling activities include disassembling the nuclear power module (NPM) and dry dock activities. While in the dry dock, components containing surfaces wetted by RCS during operation will dry. Likewise, the surfaces of the dry dock pool wetted with pool water will dry. While DCD Section 12.3.3.3, “Reactor Building Heating Ventilation and Air Conditioning System,” states that the dry dock area is provided with exhaust flow to entrain airborne contamination that may result from NPM components being exposed to air during maintenance activities, there is no description in DCD Section 12.2 or DCD Section 12.3-12.4 about the potential concentrations of radiologically significant alpha emitting airborne radionuclides, from dried surfaces. The air flow patterns, required air flow rates or other design features provided to control airborne radioactive material during work in the dry dock are not discussed.

Question 2:

To facilitate staff understanding of the application information sufficient to make appropriate regulatory conclusions with respect to potential airborne contamination by alpha emitting radionuclides during maintenance, the staff requests that the applicant:

- Justify/explain why section 12.2 of the NuScale DCD does not describe airborne radionuclide concentrations of radiologically significant alpha emitting radionuclides emanating from components in the dry dock area,
- Justify/explain why section 12.3-12.4 of the NuScale DCD does not describe the design features provided to prevent exposure of workers to radiologically significant alpha emitting radionuclides,
- As necessary, revise DCD Section 12.2, to include airborne alpha-emitting radionuclides in the airborne activity tables for the dry dock area,
- As necessary, revise DCD Section 12.2 to provide the methods, models and assumptions,

used to develop the concentrations of the alpha-emitting airborne radionuclides in the dry dock area,

- As necessary, revise DCD Section 12.3-12.4 describe the design features provided to minimize the exposure of workers to radiologically significant alpha emitting radionuclides emanating from components in the dry dock area,

OR

Provide the specific alternative approaches used and the associated justification.

NuScale Response:

In addition to the information provided by NuScale in response to RAI 12.2-27, NuScale recognizes the potential for airborne radionuclides in the dry dock area during refueling, which is why the design includes an elevated ventilation exhaust flow rate in the dry dock area. As noted in FSAR Section 12.3.3.3, the dry dock area is provided with exhaust flow to entrain airborne contamination. As stated in FSAR Table 9.4.2-5, the dry dock area is provided with an elevated air change rate of at least two air volume changes per hour. Additional control measures will be determined by plant operating personnel in accordance with the ALARA and radiation protection programs.

The potential for airborne radionuclides in the dry dock area is not different from a typical PWR transfer canal during a refueling outage, when wetted surfaces become dry after drain down. This radiological condition has been successfully addressed and managed by plant personnel in accordance with their radiation protection programs.

The discussion in the NuScale response to RAI 12.2-27 provides the basis for not including alpha-emitting radionuclides in DCD Section 12.2. The control of alpha-emitting radionuclides for the protection of workers is part of the COL Radiation Protection Program, identified in the DCD, in the same manner as previous NRC-approved DCAs, another DCA under NRC review, and the operating fleet of NRC-licensed nuclear power plants. The presence and transport of alpha emitting radionuclides in the NuScale design is generic to all NRC-licensed and certified nuclear power plant designs.

Impact on DCA:

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