RAIO-0518-59925

May 09, 2018

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. 445 (eRAI No. 9255) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 445 (eRAI No. 9255)," dated April 30, 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. 9255:

- 12.02-31

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,

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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9255

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9255

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

eRAI No.: 9255
Date of RAI Issue: 04/30/2018

NRC Question No.: 12.02-31

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 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) states that "the licensee shall use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA)." 10 CFR 20.1003 states that ALARA "means making every reasonable effort to maintain exposures to radiation as far below the dose limits in this part as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest." 10 CFR 20.1701 states that "the licensee shall use, to the extent practical, process or other engineering controls (e.g., containment, decontamination, or ventilation) to control the concentration of radioactive material in air." 10 CFR 20.1202(a) states that if the licensee is required to monitor under both 10 CFR 20.1502(a) and (b), the licensee shall demonstrate compliance with the dose limits by summing external and internal doses.

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 DCA Section 12.2.

Background

The radionuclide concentrations listed in DCA 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. Based on information made available to the staff during the RPAC Chapter 12 Audit, the staff was unable to identify where or how the airborne activity concentrations within the RWB were assessed.

DCA Tier 2 Revision 0, Section 12.2.2, "Airborne Radioactive Material Sources," describes the airborne radioactive material sources that form part of the basis for design of ventilation systems and personnel protective measures. DCA Section 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. DCA Table 12.2-33: "Reactor Building Airborne Concentrations," list the estimated airborne radionuclide concentrations for various portions of the Reactor Building (RXB). DCA Table 12.2-32: "Input Parameters for Determining Facility Airborne Concentrations," describes assumptions for calculating airborne activity within the RXB.

Alpha emitting radionuclides are radiologically significant because of their potential presence in fluids in contact with reactor fuel, and because 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.) Based on operating experience, even from plants with historically low levels of fuel defects, there is a reasonable expectation that alpha emitting radionuclides will be present in reactor coolant system fluids and the connected system components. The specific activity of the alpha emitting isotopes will increase with the amount of fuel defects present (such as operation at the Technical Specification RCS specific activity limit) and the duration of operation with even low levels of fuel defects. 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 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.

As noted in NUREG 1400, "Air Sampling in the Workplace," (ADAMS 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.

Key Issue

DCA Tier 2 Revision 0, Section 12.2.2, "Airborne Radioactive Material Sources," does not include a discussion about the sources of airborne radioactivity within the Radioactive Waste Building (RWB). DCA Table 12.2-32, does not contain a list of assumptions relevant to the determination of airborne activity concentrations in the RWB. The RWB has a number of components and active processes that contain significant quantities of radioactive material.

Question

To facilitate staff understanding of the application information in support of its reasonable assurance review regarding radiation exposures, the staff requests that the applicant:

· Revise and update Section 12.2.2 of the NuScale DCA to include a description of the airborne activity assessment for the RWB and revise and update Section 12.2.2 of the NuScale DCA to include the associated methods, models, and assumptions, used to develop the concentrations of the alpha-emitting radionuclide concentrations,

- As necessary, revise DCA Table 12.2-32 to include the relevant assumptions for calculating the airborne activity concentrations in the RWB,
- As necessary, revise the DCA to include a table describing the resultant estimated airborne activity concentrations,

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, as well as 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 radioactive waste component and system source terms also shows no alpha emitting radionuclides. Because NuScale developed its coolant source terms in compliance with

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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 surfaces become 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 the cited references in this RAI 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 potential for airborne radionuclides in the Radioactive Waste Building is not different from currently licensed operating nuclear power plants or designs that have been approved by the USNRC under 10 CFR part 52. A wide range of radiological conditions have been successfully addressed and managed by plant personnel in accordance with their radiation protection programs. The presence and transport of alpha emitting radionuclides in the NuScale design is generic to all NRC-licensed and certified nuclear power plant designs.

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.