

NuScaleDCRaisPEm Resource

From: Cranston, Gregory
Sent: Sunday, January 28, 2018 3:50 PM
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Subject: Request for Additional Information No. 352 RAI No. 9260 (12.2)
Attachments: Request for Additional Information No. 352 (eRAI No. 9260).pdf

Attached please find NRC staff's request for additional information concerning review of the NuScale Design Certification Application.

Please submit your technically correct and complete response within 60 days of the date of this RAI to the NRC Document Control Desk. .

If you have any questions, please contact me.

Thank you.

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Request for Additional Information No. 352 (eRAI No. 9260)

Issue Date: 01/28/2018

Application Title: NuScale Standard Design Certification - 52-048

Operating Company: NuScale Power, LLC

Docket No. 52-048

Review Section: 12.02 - Radiation Sources

Application Section: 12.2, 12.3, 11.1

QUESTIONS

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 provide 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.

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.