NuScaleDCRaisPEm Resource

From:	Cranston, Gregory
Sent:	Monday, January 08, 2018 3:29 PM
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Subject:	Request for Additional Information No. 331 RAI No. 9283 (12.2)
Attachments:	Request for Additional Information No. 331 (eRAI No. 9283).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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Licensing Branch 1 (NuScale)
Division of New Reactor Licensing
Office of New Reactors
U.S. Nuclear Regulatory Commission
301-415-0546

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Request for Additional Information No. 331 (eRAI No. 9283)

Issue Date: 01/08/2018
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

QUESTIONS

12.02-23

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 of 10 CFR Part 20. 10 CFR Part 20 requires the use of engineering features to control and minimize the amount of radiation exposure to occupational workers and members of the public, from both internal and external sources. Appendix A to Part 50—General Design Criteria (GDC) 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. NuScale DSRS 12.2 DSRS Acceptance Criteria states that the applicant should describe the radiation fields in sufficient detail for evaluating the inputs to shielding codes, and determination of radiation doses.

Background

NuScale DCD, Tier 2 Revision 0, Subsection 12.2.1.8, "Reactor Pool Water," states that the neutron flux at the outside edge of the containment vessel was calculated to be approximately six orders of magnitude less than the average neutron flux in the core, and continues to quickly decrease in the reactor pool's borated water. DCD Tier 2, Revision 0, Table 4.3-12, "Typical Neutron Flux Levels (n/cm2-sec) in the Reactor Core and Reactor Pressure Vessel at Full Power," indicates that the core average neutron flux exceeds 1E14 (n/cm2-sec). There is no information on the flux and spectrum at the outside edge of the containment vessel in DCD Subsection 12.2. In addition, NuScale Technical Report TR-0116-20781-P Rev. 0, "Fluence Calculation Methodology and Results," does not appear to provide a calculation, or the associated results, that support the statement in DCD subsection 12.2.1.8. Based on assessment performed by the staff, given the limited information provided by the applicant, the dose rate outside of the containment vessel may be as high as approximately 21,000 Rem/h just due to neutrons. While this dose rate is only present underwater, utilities frequently use divers to perform underwater maintenance activities. Also, the neutron flux and spectral data is used by the staff to assess applicant estimates of activated material, including the production of isotopes (e.g., deuterium) that are precursors to radioactive species.

The neutron spectrum and flux information evaluated during the staff review under NuScale DSRS 12.2 are used as inputs to the evaluation performed by the staff for NuScale DSRS 12.3-12.4, related to the acceptability of the facility design, the establishment of radiation zones, the impact on systems, structures and components, and the activation of material. The inclusion of this type of information is consistent with NuScale DSRS 12.2 Acceptance Criteria, which states that the source descriptions should include all pertinent information required for input to shielding codes used in the design process, establishment of related facility design features, and determination of radiation dose rates, as well as the controlling radiation exposure to workers and members of the public, consistent with 10 CFR Part 20 and GDC 61. DSRS 12.2 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. These acceptance criteria are consistent with the relevant requirements of 10 CFR Part 50 and 10 CFR Part 52. Based on information made available to the staff during the RPAC Chapter 12 Audit, the staff was unable to identify the neutron flux and spectrum outside of the containment vessel near the reactor core.

Key Issue: It is unclear from the DCD document what the neutron flux and energy spectrum are external to the CV and how they were derived. The staff needs to know the neutron flux, energy spectrum and sufficient information about the methods, models and assumptions, used to justify the assumed values. The staff uses the stated neutron flux and energy to assess the impact on a variety of topics considered in the review, including; the generation of tritium from activation of Deuterium, and neutron capture in boron; the generation of radioactive argon; the generation of Deuterium from Hydrogen; and the activation of the containment structural materials. These radioisotopes contribute to the occupational radiation exposure of workers, and in some cases are related to the amount of effluent releases, which are important aspects of staff's review.

Key Issue: It is unclear what methods, models, and assumptions were used to derive the stated neutron flux and energy spectrum. The neutron flux and energy spectrum along with sufficient supporting information provide a basis for justifying the assumed values used in calculating the generation of tritium from activation of Deuterium, and neutron capture in boron; the generation of radioactive argon; the generation of Deuterium from Hydrogen; and the activation of the containment structural materials. These radioisotopes

contribute to the occupational radiation exposure of workers, and in some cases are related to the amount of effluent releases, which are important aspects of staff's review.

Question

To facilitate staff understanding of the application information sufficient to make appropriate regulatory conclusions, with respect to the kinds and quantities of radioactive materials and radiation fields within the facility, the staff requests that the applicant:

1. Explain/Justify the aforementioned statements made in DCD subsection 12.2.1.8 and DCD Table 4.3-12.
2. Identify and describe the methods, models and assumptions used to calculate the neutron spectrum and flux outside of the containment vessel near the elevation of the core.
3. As necessary, revise and update NuScale DCD, Tier 2, Revision 0, Section 12.2 to include information describing the neutron spectra and flux, at the area identified above, and the assumptions and input parameters used.

   OR

   Provide the specific alternative approaches used and the associated justification.