

NuScaleDCRaisPEm Resource

From: Cranston, Gregory
Sent: Sunday, January 28, 2018 2:25 PM
To: RAI@nuscalepower.com
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Subject: Request for Additional Information No. 346 RAI No. 9291 (12.2)
Attachments: Request for Additional Information No. 346 (eRAI No. 9291).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. 346 (eRAI No. 9291)

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, 3.11

QUESTIONS

12.02-24

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, from both internal and external sources. 10 CFR 50.49(e)(4) requires applicants to identify the type of radiation and the total dose expected during normal operation over the installed life of the equipment. 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. GDC 4 requires applicants to ensure that structures, systems, and components important to safety are designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation. NuScale DSRS 12.2 DSRS and DSRS 3.11 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 dose to electrical equipment important to safety as described in 10 CFR 50.49, and GDC 4.

Background

NuScale DCD, Tier 2 Revision 0, Table 3C-6: “Normal Operating Environmental Conditions,” states that the 60 Years Integrated Gamma Dose (Rads), which the table indicates includes fission gammas, N-gammas, and coolant, for the area outside of the containment vessel and under the bioshield is 4.35E4 rads (0.087 rads/hour). DCD subsection 12.2.1.2 “Reactor Coolant System,” states that the primary coolant gamma spectra are provided in DCD Table 12.2-3 and DCD Table 12.2-4. However, there is no quantitative discussion of how these values are derived. For instance, DCD subsection 9.3.4 “Chemical and Volume Control System,” notes that reactor coolant system (RCS) gas removal operations are infrequent operations that only occur when non-condensable gas accumulation in the pressurizer impacts RCS pressure control. Based on this discussion, the staff expects fission product gases to accumulate in the pressurizer gas space. In addition, the Chemical and Volume Control System let down isolation valves and lines are located in the bioshield area. Based on operating experience at commercial Pressurized Water Reactors (PWR), dose rates from the valves alone could exceed the gamma values listed in Table 3C-6.

Also, NuScale DCD Table 3C-6 states that the 60 Years Integrated N Dose (Rads) for the area outside of the containment vessel and under the bioshield is 1.85E6 rads (3.7 rads/hour). There is no discussion in DCD subsection 3.11 nor DCD 12.2 about the gamma dose rate from activation of the containment vessel (CNV) steel, the stainless steel lining of the bioshield cover, the steel main steam and main feedwater lines etc. NuScale Technical Report TR-0116-20781-P Rev. 0 “Fluence Calculation Methodology and Results,” Table 5-1 “Best estimate of fluence expected to be experienced in various NuScale Power Module components and locations,” describes the neutron fluence to the reactor vessel and containment vessel, in the vicinity of the core, but does not provide any neutron fluence information above the reactor vessel flange area.

The gamma information evaluated during the staff review under NuScale DSRS 12.2, are used as inputs for the evaluation performed by the staff for NuScale DSRS 12.3-12.4 and DSRS 3.11, related to the acceptability of the shielding design, the establishment of radiation zones, the impact on systems, structures and components. This 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 to electrical equipment important to safety as described in 10 CFR 50.49, and GDC 4, as well as the controlling radiation exposure to workers and members of the public, consistent with 10 CFR 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.

The DCD does not provide sufficient bases for fully determining the gamma dose rates under the bio shield, nor does it clearly articulate how they were derived. The staff needs to ascertain the gamma dose rates resulting from operation of the plant and evaluate appropriate supporting information to assess the impact on a variety of review areas, including equipment qualification,

radiation streaming into adjacent areas, the amount of gamma radiation from neutron activation of materials, and operational radiation exposure for maintenance activities.

Key Issue: It is unclear what the gamma dose rates under the bio shield are, and how they were derived. The staff needs to know the gamma dose rates resulting from operation of the plant and sufficient information to justify the assumed values. The staff uses these values to assess the impact on a variety of topics considered in the review, including equipment qualification, radiation streaming into adjacent areas, the amount of gamma radiation from neutron activation of materials, and operational radiation exposure for maintenance activities.

Question

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

- Explain/Justify the methods, models and assumptions used to calculate the gamma dose rates during operation above the top of the pressurizer, inside the containment vessel above the reactor vessel, and under the bioshield wall (including gamma dose rates from neutron activation of materials, N-16, and all other sources).
- As necessary, revise and update the NuScale DCD, Tier 2, Revision 0, Section 12.2, to describe the gamma dose rate at the area identified above, and the assumptions and input parameters used.

OR

Provide the specific alternative approaches used and the associated justification.