NuScaleDCRaisPEm Resource

From: Cranston, Gregory
Sent: Friday, December 22, 2017 12:11 AM
To: RAI@nuscalepower.com
Cc: NuScaleDCRaisPEm Resource; Lee, Samuel; Chowdhury, Prosanta; Burkhart, Lawrence; Lavera, Ronald; Markley, Anthony
Subject: RE: Request for Additional Information No. 308 RAI No. 9261 (12.02)
Attachments: Request for Additional Information No. 308 (eRAI No. 9261).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. The NRC Staff recognizes that NuScale has preliminarily identified that the response to this question in this RAI is likely to require greater than 60 days.

The NRC Staff recognizes that NuScale has preliminarily identified that the response to the question in this RAI is likely to require greater than 60 days. NuScale is expected to provide a schedule for the RAI response by email within 14 days.

If you have any questions, please contact me.

Thank you.

Gregory Cranston, Senior Project Manager
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. 308 (eRAI No. 9261)

Issue Date: 12/22/2017
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: 3.11, 12.2

QUESTIONS

12.02-3

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.

10 CFR 50.49 and 10 CFR Part 50, Appendix A, Criterion 4 require that certain components important to safety be designed to withstand environmental conditions, including the effects of radiation, associated with design basis events, including normal operation, anticipated operational occurrences, and design basis accidents. The Acceptance Criteria of DSRS section 3.11 "Environmental Qualification of Mechanical and Electrical Equipment," states that the radiation environment should be based on the integrated effects of the normally expected radiation environment over the equipment's installed life, plus the effects associated with the design-basis event during or following which the equipment is required to remain functional.

10 CFR 20.1101(b) and 10 CFR 20.1003, require the use of engineering controls to maintain exposures to radiation as far below the dose limits in 10 CFR Part 20as is practical. NuScale DSRS section 12.2 "Radiation Source," regarding the identification of isotopes and the methods, models and assumptions used to determine dose rates. NuScale DSRS section 12.3 "Radiation Protection Design Feature," states in the specific acceptance criteria that areas inside the plant structures should be subdivided into radiation zones, with maximum design dose rate zones and the criteria used in selecting maximum dose rates identified.

Background

DCD Tier 2 Revision 0 DCD Table 3C-1: "Environmental Qualification Zones - Reactor Building," DCD Table 3C-8: "Accident EQ Radiation Dose," and DCD Table 3C-6: "Normal Operating Environmental Conditions," describe the integrated dose in and around the NuScale module containment vessel (CNV) due to normal operations and radiation exposure following an accident. DCD Section 12.2.1.13 "Post-Accident Sources," states the post-accident source remains within the containment vessel except for assumed leakage into the bioshield envelope, which is above the surface of the pool water and below the bioshield. It further states that there are four volumes that are evaluated for the post-accident source term. Table 12.2-31 lists the integrated post-accident source energy deposition versus time for both photons and electrons for these four volumes. Table 12.2-28: "Post-Accident Source Term Input Assumptions," list some of the assumptions used in the analysis. DCD Table 12.2-31: "Post-Accident Integrated Energy Deposition and Integrated Dose," list some time integrated doses for periods following the accident. However, DCD Section 12.2 does not contain a table describing the airborne concentrations in the CNV or above the surface of the pool water and below the bioshield.

Key Issue 1:
Based on the review of material made available to the staff during the RPAC Chapter 12 Audit, the staff determined that the environmental qualification calculations performed to establish the post-accident total integrated dose (TID) between the top of the containment vessel (CNV) and the interior of the bioshield structure only considered accumulated dose due to gases released from the CNV following the accident. The methodology used by the applicant did not consider the additional contribution to TID due to gamma photons emanating from the gases in the CNV and the liquid in the CVN and reactor, which penetrate the CNV. Based on analysis by the staff, the additional TID associated with just the gases in the top of the CNV could be over a 1000 Rad/hr.

Key Issue 2: Based on the review of material made available to the staff during the RPAC Chapter 12 Audit, the staff determined that the methodology used by the applicant to calculate the dose rate from gamma emissions used the total photon energy emission rate from individual isotopes, rather than the individual photon emission rate. Based on an analysis by the staff, this may underestimate doses from photons by over 20%.

Question

- Revise the calculations used to determine the post-accident dose rates to account for sources of radiation other than just the gas cloud above the surface of the pool water and below the bioshield,

- As necessary revise DCD Section 12.2.1.13 and DCD Table 12.2-28 to state the assumptions regarding radiation transport to and through the areas listed in Table 12.2-31,
- As necessary, revise the DCD radiation zone maps in DCD Section 12.3 to reflect the changes to the post-accident dose rates to areas affected by the shine from areas above the surface of the pool water and below the bioshield,
- As necessary, revise the thicknesses of shielding described in the DCD to reflect the increase in the photon strength resulting from the changes to the calculation method,
- As necessary, revise the EQ dose estimates and categories described in DCD Table 3C-1: “Environmental Qualification Zones - Reactor Building,” DCD Table 3C-8: “Accident EQ Radiation Dose,” and DCD Table 3C-6: “Normal Operating Environmental Conditions,” affected by the changes in photon strength caused the changes to the table in DCD section 12.2,

OR

Provide the specific alternative approaches used and the associated justification.