NuScaleDCRaisPEm Resource

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Sent: Tuesday, April 25, 2017 1:10 PM
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Cc: NuScaleDCRaisPEm Resource; Lee, Samuel; Chowdhury, Prosanta; Burkhart, Lawrence; Lavera, Ronald; Markley, Anthony
Subject: Request for Additional Information No. 11 (eRAI No. 8759) Section 12.02 (RPAC)
Attachments: Request for Additional Information No. 11 (eRAI No. 8759).pdf

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

Please submit your 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. 11 (eRAI No. 8759)

Issue Date: 04/25/2017
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: DCD Chap 3.11, 11, 12, Tech Reports

QUESTIONS

12.02-1

10 CFR 52.47(a)(5) requires applicants to identify the kinds and quantities of radioactive materials expected to be produced during operations and the means for controlling and limiting radiation exposures. 10 CFR Part 20 requires the use of engineering features to control and minimize the amount of radiation exposure to members of the public and 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. General Design Criterion (GDC) 4 of Appendix A to 10 CFR Part 50 requires applicants to ensure that structures, systems, and components (SSC) important to safety are designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation.

Design Specific Review Standard (DSRS) section 12.2 Acceptance Criteria states in part, that the shielding and ventilation design fission product source terms will be acceptable if developed using the bases of 0.25-percent (%) fuel cladding defects (aka design basis failed fuel fraction value) for pressurized-water reactors (PWRs) or the reactor coolant system (RCS) isotopic concentrations, including fission products and significant corrosion and activation products, equivalent to operation for a full fuel cycle at the technical specification (TS) limits for halogens (I-131 dose equivalent) and noble gases (Xe-133 dose equivalent). DSRS Chapter 11, Sections 11.1, 11.2, and 11.3; NUREG-0800 "Standard Review Plan" (SRP) Chapter 3, Section 3.11; and Branch Technical Positions (BTPs) 11-5 and 11-6 also provide guidance on fuel leakage (failed fuel fraction) assumptions.

NuScale Design Control Document (DCD), Tier 2, Revision 0, Chapter 11, Table 11.1-2: "Parameters Used to Calculate Coolant Source Terms," shows that the design basis failed fuel fraction value is 0.028% (which is proposed as the basis for determining plant radiation shielding, zoning, ventilation design, equipment qualification (EQ) dose calculations, etc). NuScale Technical Report TR-1116-52065 Revision 0 "Effluent Release (GALE Replacement) Methodology and Results," describes the derivation of the 0.028% value. In essence, the method determined the **average** fuel failure fraction over a multiple year period (0.0028%), and then multiplied that value by a factor of 10, to arrive at the proposed 0.028% failed fuel fraction value to be used for shielding and ventilation system design, etc. The value of 0.028%, is less than one tenth of the TSs section 3.4.8 RCS Specific Activity Limit of 0.2 micro Ci/gram Dose Equivalent Iodine (DEI).

NuScale used data from "Benchmarking of GALE-09 Release Predictions Using Site Specific Data from 2005 to 2010," PNNL-22076, dated November 2012, to determine a realistic fission product source term to be used for the evaluation of normal effluent releases. This report examined the reported average fuel failure fraction from 2005 to 2010. DCD subsection 11.1 states "(t)he design basis source term assumes a conservative value of equivalent fuel defects an order-of-magnitude greater than the realistic coolant source term. This results in a design basis failed fuel fraction that is ten times greater than the realistic failed fuel fraction." In the view of the staff, an empirical survey of operational experience regarding failed fuel experiences at operating reactor facilities does not constitute a safety case for the proposed NuScale failed fuel fraction of 0.028%. Further, the use of an average failed fuel experience, without a corresponding Technical Specification limit for DEI and Dose Equivalent Xenon, does not comport with established licensing practices used by the staff for evaluating the acceptability of the proposed design bases for shielding and ventilation systems. The value proposed by NuScale is not a bounding design bases value, since it is about a factor of 5 less than the amount of fuel cladding defects that occurred at one plant in 2009, which had been designed for normal system operation with clad defects in fuel rods generating 1% of rated core thermal power. The NuScale proposed value is comparatively less than that used by other plant designs, including passive designs, and is less than the historically used 0.25% failed fuel fraction, is not bounding with respect to operational data within the stated time frame, and is not conservative. Based on the information provided, this lower failed fuel fraction would not meet the acceptance criteria in NuScale DSRS Chapter 11, Sections 11.1, 11.2, 11.3, and Chapter 12, Section 12.2; NUREG-0800 Chapter 3, Section 3.11; and BTPs 11-5 and 11-6. (Note: for shielding and ventilation system design, the value is about a factor of 10 less than that used by the NRC to license plants under 10 CFR Parts 50 and 52, and about a factor of 10 less than the value currently specified in NuScale DCD TS Part 4, Volume 1, Section 3.4.8.)

Based upon the docketed information, the NRC staff is unable to determine whether the NuScale design is adequate to protect members of the public and occupational workers from exposure to radiation and protection of SSCs important to

safety. The staff requests the applicant to provide additional information (e,g., requisite analyses and safety margin evaluations) that clearly demonstrates, through the implementation of the shielding and ventilation system acceptance criteria stated in DSRS 12.2 and DSRS 11.1, that the NuScale design provides reasonable assurance that the public and occupational workers will be protected from exposure to radiation. Explain why the proposed assumed failed fuel fraction is appropriately conservative for the purposes of evaluating personnel doses, radiation protection design features, radwaste handling system capacities, and equipment qualification analyses. Explain why adopting a technical specification limit that bounds the newly proposed failed fuel fraction is not warranted as discussed in the DSRS acceptance criteria stated above.