NuScaleDCRaisPEm Resource

From:	Cranston, Gregory
Sent:	Monday, January 08, 2018 11:35 AM
To:	RAI@nuscalepower.com
Cc:	NuScaleDCRaisPEm Resource; Lee, Samuel; Chowdhury, Prosanta; Burkhart, Lawrence; Lavera, Ronald; Markley, Anthony
Subject:	Request for Additional Information No. 328 RAI No. 9269 (12.2)
Attachments:	Request for Additional Information No. 328 (eRAI No. 9269).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 one or more questions 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

Hearing Identifier: NuScale_SMR_DC_RAI_Public
Email Number: 355

Mail Envelope Properties (CY4PR09MB12876D1AEBD8F3749F22E51D90130)

Subject: Request for Additional Information No. 328 RAI No. 9269 (12.2)
Sent Date: 1/8/2018 11:34:46 AM
Received Date: 1/8/2018 11:34:50 AM
From: Cranston, Gregory

Created By: Gregory.Cranston@nrc.gov

Recipients:
"NuScaleDCRaisPEm Resource" <NuScaleDCRaisPEm.Resource@nrc.gov>
Tracking Status: None
"Lee, Samuel" <Samuel.Lee@nrc.gov>
Tracking Status: None
"Chowdhury, Prosanta" <Prosanta.Chowdhury@nrc.gov>
Tracking Status: None
"Burkhart, Lawrence" <Lawrence.Burkhart@nrc.gov>
Tracking Status: None
"Lavera, Ronald" <Ronald.LaVera@nrc.gov>
Tracking Status: None
"Markley, Anthony" <Anthony.Markley@nrc.gov>
Tracking Status: None
"RAI@nuscalepower.com" <RAI@nuscalepower.com>
Tracking Status: None

Post Office: CY4PR09MB1287.namprd09.prod.outlook.com

Files	**Size**	**Date & Time**
MESSAGE	818	1/8/2018 11:34:50 AM
Request for Additional Information No. 328 (eRAI No. 9269).pdf	127763	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Request for Additional Information No. 328 (eRAI No. 9269)

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

12.02-15

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 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 20 as is practical.

10 CFR Part 50 Appendix A, criterion 4 requires applicants to identify the environmental conditions, including radiation, associated with normal operation.

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.

The DSRS Acceptance Criteria 12.3-12.4, “Radiation Protection Design Features,” states that the areas inside the plant structures, as well as in the general plant yard, should be subdivided into radiation zones, with maximum design dose rate zones and the criteria used in selecting maximum dose rates identified.

Background

NuScale DCD Tier 2, Revision 0 Figure 12.3-2a, ”Radioactive Waste Building Radiation Zone Map - 71' Elevation,” shows that the “Class A/B/C HICS Storage Area,” (Room 030-034 per DCD Figure 1.2-28, ”Radioactive Waste Building 71'-0" Elevation”,) as a Radiation Zone VII. Based on DCD Tier 2 Revision 0 Table 12.3-1,”Normal Operation Radiation Zone Designations,” areas designated as radiation zone VII may have dose rates ≥ 500 Rad/hr, with no upper limit specified.

Because Section 12.2 of the DCD did not contain a description of the radioactive material contained within the “Class A/B/C HICS Storage Area,” in RAI-8860 Question 12.02-2, the staff asked the applicant to provide the radionuclide contents in the room, the methods, models and assumptions used to develop the assumed radionuclide contents, the dimensions and configurations of the packages stored within the room, and to state whether drum dryer facility drums are allowed to be stored in the area.

The applicant’s response to RAI-8860 Question 12.02-2, dated July 10 2017, provided a revised “Table 12.2-18: Solid Radioactive Waste System Component Source Term Inputs,” “Table 12.2-19: Solid Radioactive Waste System Component Source Terms - Radionuclide
Content,” “Table 12.2-20: Solid Radioactive Waste System Component Source Terms – Source Strengths,” and a change to paragraph 12.2.1.7 “Solid Radioactive Waste System.” The essence of these proposed changes was to say that for the purpose of the shielding analysis, the determination of the contained sources assumed that five 5.83 feet high by 4.92 feet diameter High Integrity Containers (HIC) loaded with resin at the activity listed in Table 12.2-19 column “SRST Ci” that has been decay for 2 years, were stored in a single layer.

In the discussion provided with the response, the applicant stated that this was a conservative analysis because it assumed all 12 modules were operating at the design basis failed fuel fraction for 2 years. While the amount of resin represented 1 year of resin generation, the applicant stated that a year was sufficient time to arrange for off-site disposal of additional HICs. The RAI response discussion noted that the HICs were assumed to be located in the middle of the room in a single layer. The discussion further noted operational plant programs are provided to control the amount of radioactive material in the Class A/B/C HIC Storage Area to limit the radiation levels in the surrounding areas to be compliant with the designated radiation zones.

Key Issue 1

Based on the relative sizes of the Reactor Building (RXB) and the Radioactive Waste Building (RWB) depicted on Figure 1.2-4: Layout of a Multi-Unit NuScale Power Plant, the size of the RXB as described in DCD Tier 2, section 3.8.4.1.1, “Reactor Building,”

and DCD Tier 2 Figure 12.3-2a, “Radioactive Waste Building Radiation Zone Map - 71' Elevation” and Figure 12.3-2b, “Radioactive Waste Building Radiation Zone Map - 100' Elevation,” the staff estimated that over 36 HICs could be stored in the room in a single layer, and that sufficient height was available to stack the HICs 3 high. Based on staff estimates, space is available to store over 100 HICs in the room. Since the DCD does not contain any prohibitions on the total number of HICs that could be stored in this room nor against stacking HICs, it is unclear why the assumption of 5 HICs located in the center of the room is conservative. Furthermore, because there are no such restrictions, up to 18 HICs (in a 6 by 3 array) may be stored against the wall that is adjacent to a claimed radiation zone 1 room. This could represent a non-conservative assumption for the source term used for the shielding analysis of the adjacent Zone 1 room. Since there are 2 spent resin storage tanks (SRST), each with a capacity of 2138 ft^3, the contents of a single SRST can generate more than 18 HICs. Stacking HICs is a concern because there is sufficient vertical clearance to stack HICs in the room, the staff has reviewed recent applications that relied upon stacking of HICs, and stacking HICs changes the dose rate profile in adjacent areas located to the sides and above the room.

Question 1

To facilitate staff understanding of the application information sufficient to make appropriate regulatory conclusions, with respect to the descriptions of the sources of radiation present in the facility, the staff requests that the applicant:

- Explain/Justify the assertion that the stated contents and locations of HICs in the HIC storage room, represents a conservative assessment of the radiation source term in the room.
- Is stacking HICs allowed?
- If stacking HICs is allowed, then state under what conditions the COL licensee may stack HICs and any limitations (e.g., avoiding alignment with known penetrations to lower dose rate areas, structural weight or seismic restrictions etc.) associated with stacking HICs.
- As necessary, revise DCD Section 12.2 to include this information in the DCD,

  OR

  Provide the specific alternative approaches used and the associated justification.

12.02-16

The Regulatory Basis and Background are in RAI-9259 Question 30997

Key Issue 2

In order for the staff to understand the methods, models and assumptions used as the bases for amount of radioactive material contained in a HIC, the staff needs to understand the specific activity of isotopes in the fluid stream from the reactor coolant system, the fluid stream flow rate, the duration of flow, the isotope specific purification removal factors, and the volume of resin in each purification demineralizer. These values are then used to specify the specific activity of each source of resin, and the volume of each source of resin added to the SRST, which in turn determines the amount of radioactive material contained in a HIC. DCD Tier 2 paragraph 11.4.2.5.1 states that the resins from the CVCS and Pool Cleanup System (PCUS) demineralizers are discharged to the SRSTs, which are then transferred to HICs. DCD Table 9.3.4-1: “Chemical and Volume Control System/Module Heatup System Major Equipment with Design Data and Parameters,” states that the required resin volume for the CVCS demineralizers is 8.8 ft^3. DCD Table 12.2-6: “Chemical and Volume Control System Component Source Term Inputs and Assumptions,” provides dimensions of the CVCS Mixed Bed corresponding to 19 ft^3 but does not specify the volume of the contained resin. The staff noted during their review of information available through the ongoing RPAC Chapters 11 & 12 audits, that there are differences between the demineralizer volumes specified in the DCD and those identified in the NuScale calculations. In addition, the staff has been unable find a description of how much resin is contained in the PCUS demineralizer. As a result, the staff has been unable to determine based on information in the DCD, what portion of the radioactive material stated to be present in the SRST/HIC originates from the PCUS demineralizer. Because the specific activity of the PCUS resin is lower than the CVCS mixed bed resin, higher estimates of the amount of resin from the PCUS demineralizer may result in lower specific activity in the HICs, and non-conservative dose rate estimates. As noted above, the input radionuclide concentrations in the resins are dependent on the functional location, flowrate of the influent stream, and the volume of the contained resin. How the respective volumes are mixed determines the activity in the HICs. Understanding the kinds and quantities of radioactive material contained in components is necessary for the staff to evaluate the effectiveness of shielding, accuracy of the radiation zones stated within the DCD, and the estimates of airborne activity within the facility, and therefore is necessary to for the staff to evaluate the ability of the design to comply with the requirements of 10 CFR Part 20.

Question 2

To facilitate staff understanding of the application information sufficient to make appropriate regulatory conclusions, with respect to the descriptions of the sources of radiation present in the facility, the staff requests that the applicant:

- Explain/Justify the methods, models and assumptions used for establishing the radioactive material content of the SRST and subsequently the HICs,
- As necessary revised DCD Section 12.2, to include the description of the bases used for establishing the radioactive material content of the SRST and subsequently the HICs,

  OR

  Provide the specific alternative approaches used and the associated justification.

12.02-17

The Regulatory Basis and Background are in RAI-9259 Question 30997

Key Issue 3

The gamma source strengths listed in Table 12.2-20 are used as inputs to the radiation shielding and radiation zone calculations. As part of the RPAC NuScale audit, the staff reviewed the calculations used to determine the radionuclide content of the demineralizer beds, and subsequently the SRST. The staff identified errors that result in non-conservative underestimations of resin radioactivity, and thus the gamma source strength. Some examples of errors noted by the staff include: the amount of Ba-137m contained in the SRST is under estimated by three orders of magnitude; the amount of Ba-137m contained in the CVCS Mixed bed and other CVCS system demineralizers, is zero after 2 days of decay, but since Ba-137m is in secular equilibrium with Cs-137, and Ba-137m has a 2.552 minute half-life, after 20 minutes, the amount of Ba-137m should be within about 6 percent of the amount of Cs-137. Since the principle gamma considered for shielding from the decay of Cs-137 actually originates from the subsequent decay of Ba-137m, the errors could result in higher than estimated dose rates, and the need for additional shielding or the changing of radiation zone designations.

Question 3

To facilitate staff understanding of the application information sufficient to make appropriate regulatory conclusions, with respect to the descriptions of the sources of radiation present in the facility and the resultant radiation zone designations, the staff requests that the applicant:

- Correct the calculations used to determine the activity in the SRST, the HICs and other contained sources described by those same calculations.
- As necessary, revise the DCD tables in section 12.2 that describe the radioactive content of the relevant tanks and demineralizers
- As necessary, revise the DCD tables in section 12.2 that describe the relevant photon source strengths.
- As necessary, revise the DCD Section 12.3 radiation zone maps affected by the changes in source strengths.

OR

Provide the specific alternative approaches used and the associated justification.

12.02-18

The Regulatory Basis and Background are in RAI-9259 Question 30997

Key Issue 4

In their response, the applicant stated that Operational plant programs are provided to control the amount of radioactive material in the Class A/B/C HIC Storage Area to limit the radiation levels in the surrounding areas to be compliant with the designated radiation zones. The operational radiation protection program and the operational ALARA program are defined in Nuclear Energy Institute (NEI), “Generic FSAR Template Guidance for Radiation Protection Program Description,” NEI 07-03A, Revision 0, and the associated NRC SER (ADAMS Accession No. ML091490684), and NEI, “Generic FSAR Template Guidance for Ensuring that Occupational Radiation Exposures Are as Low as Is Reasonably Achievable (ALARA),” NEI 07-08A, Revision 0, and the associated NRC SER (ADAMS Accession No. ML093220178). Neither of these documents specify that the plant limit the accumulation of radioactive material in order to maintain the radiation zones specified in the DCD. Therefore, the staff is unsure of the basis of the assertion by the applicant to that effect.

Question 4

To facilitate staff understanding of the application information sufficient to make appropriate regulatory conclusions, with respect to the descriptions of the program controls needed to maintain the facility within its design basis, the staff requests that the applicant:

- Explain/Justify the operational controls to be used to maintain the facility within its design basis,
- As necessary, revise DCD Section 12.3 (e.g., COL Item) to include the operational program controls required by the COL Licensee, needed to assure that the operation of the facility remains within the design basis for situations where more than 5 HICs of radioactive material are stored within the facility.

OR

Provide the specific alternative approaches used and the associated justification.