NuScaleDCRaisPEm Resource

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Sent:	Monday, January 08, 2018 9:34 AM
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Subject:	Request for Additional Information No. 326 RAI No. 9266 (12.2)
Attachments:	Request for Additional Information No. 326 (eRAI No. 9266).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. 326 (eRAI No. 9266)

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, 11.1

QUESTIONS

12.02-12

Regulatory Basis

10 CFR 52.47(a)(5) requires applicants to identify the kinds and quantities of radioactive materials expected to be produced during 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 20 as is practical. The requirements of 10 CFR 20.1204, "Determination of Internal Exposure"; 10 CFR 20.1701, "Use of Process or Other Engineering Controls"; and 10 CFR 20.1702, "Use of Other Controls," specify the use of design features such as the use of ventilation for controlling the intake of radioactive materials. NuScale DSRS section 12.2, "Radiation Source," regarding the identification of isotopes and the methods, models and assumptions used to determine dose rates. The Acceptance Criteria provided in NuScale DSRS section 12.3, "Radiation Protection Design Feature," provides guidance to the staff for evaluating the potential for airborne radioactivity areas within the facility.

Background

NuScale Design Control Document (DCD) Tier 2 Revision 0, Subsection 12.2.2.1, "Reactor Building Atmosphere," states that airborne radioactivity may be present in the RXB atmosphere due to reactor pool evaporation or primary coolant leakage. The airborne concentration is modeled as a buildup to an equilibrium concentration given the production and removal rate. The airborne concentration in the air space above the reactor pool is determined by using the peak reactor pool water source term. The input parameters are listed in Table 12.2-32 "Input Parameters for Determining Facility Airborne Concentrations." DCD Table 12.2-32 lists the pool evaporation rate at 1705 lbm/hour.

Based on information made available to the staff during the RPAC Chapter 12 Audit, the staff determined that the stated evaporation rate was based on assumed air flow rates over the pool surface, and an assumed temperature of the ultimate heat sink (UHS) water. The staff determined that the NuScale Technical Specifications 3.5.3, "Ultimate Heat Sink," bulk average temperature limit of 140 ºF was significantly greater than the temperature assumed for determining the evaporation rate. As the pool temperature increases, the pool evaporation rate increases. The assumed pool temperature is not listed in DCD Table 12.2-32.

As stated, the assumed evaporation rate is based on an assumed air flow rate over the pool surface, however, this value is not listed in DCD Table 12.2-32. Also, based on information made available to the staff during the RPAC Chapter 12 Audit, the staff was not able to ascertain the bases of the assumed air flow rate above the UHS pool. It is not clear to the staff what conditions (e.g., ventilation supply and exhaust flow rates etc.) are assumed in order to meet the stated flow conditions.

Based on information made available to the staff during the RPAC Chapter 12 Audit, the staff also noted that the atmospheric conditions (e.g., temperature and humidity) inside of the RXB were inputs to the methodology used by the applicant to determine the evaporation rates. The staff reviewed DCD Section 9.4, "Air Conditioning, Heating, Cooling, and Ventilation Systems," and DCD Section 9.4.2, "Reactor Building and Spent Fuel Pool Area Ventilation System," and was unable to find any reference to the conditions used to establish the assumed evaporation rate.

Key Issue 1:
The DCD does not contain the information necessary for the staff to perform their evaluation of airborne activity as stated above.

Question 1:

To facilitate staff understanding of the application information sufficient to make appropriate regulatory conclusions with respect to radiation exposures, the staff requests that the applicant:

- Revise, as necessary, DCD Table 12.2-32 to include all of the parameters needed to calculate the RXB airborne tritium, and other radionuclide concentrations,
- As necessary revise DCD Sections 9.4.2 and DCD Section 12.2.1.8 to describe the bases for the assumed pool air flow rate,
- As necessary revise DCD Sections 9.4.2 to describe the design features provided for maintaining the required air flow rate over the pool,
- As necessary, revise DCD 12.2.1.8 to describe how this value is to be assessed,

OR

Provide the specific alternative approaches used and the associated justification.

12.02-13

The Regulatory Basis and Background are in RAI-9266 Question 30992

Key Issue 2:

Because the methodology used by the applicant to calculate the evaporation rate from the UHS pool water appears to use non-bounding values, it may underestimate the total evaporation of tritium and other radionuclides from the UHS pool water. Since airborne concentrations in the RXB are directly dependent on the UHS pool evaporation rate, the airborne activity concentrations in the RXB may be underestimated. The concentrations described in Chapter 12.2 for the RXB are for the purpose of radiation protection, and should be based on appropriately conservative assumptions (e.g., UHS bulk average temperature at 140 ºF). Other related parameters should be based on assumed bounding values, and the basis for those assumptions should be clearly stated.

Question 2:

To facilitate staff understanding of the application information sufficient to make appropriate regulatory conclusions with respect to radiation exposures, the staff requests that the applicant:

- Establish bounding values to be used for determining radiation protection airborne concentrations in the RXB resulting from UHS pool evaporation.
- Using the bounding values, calculate the evaporation rate, and the subsequent RXB airborne activity concentration calculations,
- As necessary, revise DCD Section 12.2.1.8 to include a description of the revised methodology, that reflect the assumptions related to the evaporation rate from the pool,
- As necessary, revise DCD Section 12.2.2, “Airborne Radioactive Material Sources,” to include a description of the revised methodology, that reflect the assumptions related to the evaporation rate from the pool,
- As necessary, revise DCD Section 12.2.2 to clearly state the bounding assumptions for maintaining RXB airborne concentration limits within the limits of 10 CFR Part 20,
- As necessary, revise DCD Table 12.2-10, DCD Table 12.2-32 and DCD Table 12.2-33 to reflect the changes in UHS pool and RXB airborne tritium and other radionuclide concentrations establishing the bounding conditions for pool evaporation,
- As necessary, revise DCD Section 9.4.2 to clearly identify that the ventilation flow rate, the RXB air temperature and the RXB are key inputs to the RXB airborne activity concentrations,

OR

Provide the specific alternative approaches used and the associated justification.