NuScaleDCRaisPEm Resource

From:	Chowdhury, Prosanta
Sent:	Monday, April 02, 2018 1:44 PM
To:	Request for Additional Information
Cc:	Lee, Samuel; Cranston, Gregory; Markley, Anthony; Dudek, Michael; Lavera, Ronald; NuScaleDCRaisPEm Resource
Subject:	Request for Additional Information No. 405 eRAI No. 9277 (12.03-12.04)
Attachments:	Request for Additional Information No. 405 (eRAI No. 9277).pdf

Attached please find NRC staff's request for additional information (RAI) 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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Division of New Reactor Licensing
Office of New Reactors
U.S. Nuclear Regulatory Commission
301-415-1647

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Request for Additional Information 405 (eRAI 9277)

Issue Date: 04/02/2018
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 12.03-12.04 - Radiation Protection Design Features
Application Section: 12.3, 14.2, 9.4.2, Tier 1 3.3

QUESTIONS

12.03-48

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.
Appendix A to Part 50—General Design Criteria 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.

10 CFR 52.47(a)(22) requires applicants to provided information necessary to demonstrate how operating experience insights have been incorporated into the plant design.

10 CFR 20.1204 requires that summation of and protection from radiation exposure consider both external and internal sources of radiation.

10 CFR 20.1101(b) states that "the licensee shall use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA)." 10 CFR 20.1003 states that ALARA "means making every reasonable effort to maintain exposures to radiation as far below the dose limits in this part as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest." 10 CFR 20.1406(b) states, in part, that "applicants for standard design certifications . . . shall describe in the application how facility design will minimize, to the extent practicable, contamination of the facility and the environment." 10 CFR 20.1701 states that "the licensee shall use, to the extent practical, process or other engineering controls (e.g., containment, decontamination, or ventilation) to control the concentration of radioactive material in air."

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.

The acceptance criteria of NuScale DSRS Section 12.3-12.4, "Radiation Protection Design Features," state that the applicant is to describe how facility design and procedures for

operation will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste.

Background

DCD Revision 0 Tier 2 Subsection 12.3.1.1.7, "Ventilation," states that the duct air velocity is kept at sufficiently high velocities to keep particulates suspended. DCD Subsection 12.3.3.2, "Design Features to Minimize Personnel Exposure from Heating Ventilation and Air Conditioning Equipment," states that ventilation ducts are designed to minimize the buildup of radioactive contamination within the ducts, and the duct air velocity is kept at sufficiently high velocities to keep particulates suspended. DCD Subsection 12.3.3, "Ventilation," states that the plant heating, ventilating, and air-conditioning (HVAC) systems are designed to provide a controlled environment for personnel and equipment during normal operation. In areas subject to airborne activity, the ventilation systems are designed to collect, process, and exhaust airborne radioactive material, including directing airflow to processed exhausts. DCD Subsection 12.3.3.2, "Design Features to Minimize Personnel Exposure from Heating Ventilation and Air Conditioning Equipment," states that the building ventilation systems are designed to maintain an air flow inside the building from areas of low airborne potential to areas of higher airborne potential.

DCD Tier 2 Subsection 9.4.2.2.1. "Component Description," states that ducting interior and exterior surfaces have relatively smooth finishes to reduce localized collection of radioactive contamination. The lengths of ducting runs are minimized, as are abrupt changes in direction.

Key Issue

Neither DCD Chapter 9 nor DCD Chapter 12 provided any additional specific information regarding physical parameters of the HVAC systems in the Reactor Building (RXB) or Radioactive Waste Building (RWB). DCD Section 9.4 states that ductwork, supports, and accessories meet the design and construction requirements of the industry standards listed below. The design and construction requirements of these industry standards, address the functional requirements needed to maintain airborne radioactive materials suspended in the ducts air, and to maintain local air flow rates that are needed to sweep air from areas of lower contamination to higher contamination:

- Sheet Metal and Air Conditioning Contractors' National Association "HVAC Systems - Testing, Adjusting and Balancing," SMACNA 1780, Third Edition, 2002, Chantilly, Virginia.
- Sheet Metal and Air Conditioning Contractors' National Association "Rectangular Industrial Duct Construction Standards," SMACNA 1922, Second Edition, 2004, Chantilly, Virginia.
- Sheet Metal and Air Conditioning Contractors' National Association "Round Industrial Duct Construction Standards," SMACNA 1520, Second Edition,1999, Chantilly, Virginia.
- Sheet Metal and Air Conditioning Contractors' National Association, "HVAC Duct Construction Standards - Metal and Flexible," SMACNA 1966, Third Edition, 2005, Chantilly, Virginia.

Also, there is no discussion about the design features (e.g., flow balancing dampers) provided to support establishing the required flowrates, and the application does not contain any information, such as minimum and maximum ventilation flow rates or minimum or maximum

allowable differential building pressure, required to maintain flow conditions within the criteria specified in the referenced standards.

Question

To facilitate staff understanding of the application information in support of its reasonable assurance review regarding the radiation protection design features of the HVAC systems in the RXB and RWB, the staff requests that the applicant:

- Justify/explain the controlling parameter, including the associated methods, models and assumptions, needed to maintain radiological conditions within the RWB and RXB,
- As necessary, revise DCD Section 12.3 to include the relevant assumptions and design parameters discussed above,

OR

Provide the specific alternative approaches used and the associated justification.

12.03-49

The Regulatory Basis and Background are in Question 12.03-48 above.

Key Issue

DCD Section 9.4.2.4 "Inspection and Testing," states that a system air balance test and adjustment to design conditions is conducted in the course of the plant preoperational test program using the SMACNA documents referenced in the application. Neither DCD Tier 2 Revision 0 Table 14.2-96, "Reactor Building Ventilation System (RBVS) Capability (Test #96)," nor DCD Table 14.2-20, "Reactor Building HVAC System Test # 20," includes any test parameters or criteria related to the radiation protection design functions (e.g., sufficient flow rate to prevent settling in ducts, sufficient air flow rate to ensure sweeping radioactive material from areas of low contamination to areas of higher contamination) for the RXB HVAC system, as described in the SMACNA documents referenced in the application.

Question

To facilitate staff understanding of the application information in support of its reasonable assurance review regarding the radiation protection design features (i.e., design flow rates) of the HVAC systems in the RXB, the staff requests that the applicant:

- Justify/explain the methods for testing the radiation protection design features of the RXB HVAC systems that supports the functional requirements stated in the DCD,
- As necessary, revise DCD Section 14.2 to include the relevant testing discussed above,

OR

Provide the specific alternative approaches used and the associated justification.

12.03-50

The Regulatory Basis and Background are in Question 12.03-48 above.

Key Issue

DCD Tier 2 Revision 0 Table 14.2, does not contain adequate tests of the radiation protection design functions described above, of the HVAC system in the RWB.DCD Tier 2 Revision 0 Table 14.2, does not contain testing of the RWB ventilation system that includes testing parameters or criteria related to ensuring the functionality of the radiation protection design features of the RWB Ventilation system. There do not appear to be tests that verify functional requirements are met, such as, testing that the RWBS maintains the design environment for SSCs in the RWB (e.g., air flow from areas of low contamination to high contamination,) checking that sufficient flow rates exist in the ducting to prevent settling of radioactive material in the duct, testing that negative pressure with respect to adjacent areas inside of the facility is maintained, verifying that adequate ventilation of areas that may contain explosive/flammable gases, etc.).

Question

To facilitate staff understanding of the application information in support of its reasonable assurance review regarding the radiation protection design features (i.e., design flow rates) of the HVAC systems in the RWB, the staff requests that the applicant:

- Justify/explain the methods for testing the radiation protection design features of the HVAC systems that supports the functional requirements stated in the DCD,
- As necessary, revise DCD Section 14.2 to include the relevant testing of the RWB HVAC system discussed above,

  OR

Provide the specific alternative approaches used and the associated justification.

12.03-51

The Regulatory Basis and Background are in Question 12.03-48 above.

Key Issue

Neither DCD Tier 2 Revision 0 Table 14.2-96, "Reactor Building Ventilation System (RBVS) Capability (Test #96)," nor DCD Table 14.2-20, "Reactor Building HVAC System Test # 20," includes any test parameters or criteria related to the radiation protection design functions described (e.g., variable speed controller operation for normal HVAC operation, and variable speed controllers following a high radiation signal, and operation of the SFP and dry dock ventilation dampers) as described in the following.

DCD Tier 2 Revision 0 Subsection 9.4.2.2.1, "Component Description," states that the cooling and heating of the ventilation air serving the RXB is provided by four air handling units (AHU) with variable speed supply air fans. DCD Subsection 9.4.2.2.2.2, "Off-normal Operation," states that on a high radiation alarm in spent fuel pool (SFP) area, the isolation damper of the RXB general exhaust from the dry dock area and SFP area is closed and supply fans reduce capacity to accommodate the reduction in exhaust. This change in supply air flow ensures that air in other areas of the RXB continues to flow from areas of low contamination to areas of potentially higher contamination, and exhaust from the RWB and annex building (ANB) continues to flow into the RBVS exhaust.

Question

To facilitate staff understanding of the application information in support of its reasonable assurance review regarding the radiation protection design features of the HVAC systems in the RXB (e.g., the ability of the variable speed controllers to maintain the required differential pressures for normal HVAC operation, and variable speed controllers following a high radiation signal, and operation of the SFP and dry dock ventilation dampers), the staff requests that the applicant:

- Justify/explain the methods for testing the radiation protection design features of the HVAC systems that supports the functional requirements stated in the DCD Subsection 9.4.2.2,
- As necessary, revise DCD Section 14.2 to include the relevant testing of the RXB HVAC system discussed above,

  OR

Provide the specific alternative approaches used and the associated justification.