## NuScaleDCRaisPEm Resource

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| **From:** | Cranston, Gregory |
| **Sent:** | Tuesday, December 19, 2017 12:31 PM |
| **To:** | RAI@nuscalepower.com |
| **Cc:** | NuScaleDCRaisPEm Resource; Lee, Samuel; Chowdhury, Prosanta; Mitchell, Matthew; Chereskin, Alexander; Markley, Anthony |
| **Subject:** | Request for Additional Information No. 305 RAI No. 9194 (9.3.4) |
| **Attachments:** | Request for Additional Information No. 305 (eRAI No. 9194).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.

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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**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
"Mitchell, Matthew" <Matthew.Mitchell@nrc.gov>
Tracking Status: None
"Chereskin, Alexander" <Alexander.Chereskin@nrc.gov>
Tracking Status: None
"Markley, Anthony" <Anthony.Markley@nrc.gov>
Tracking Status: None
"RAI@nuscalepower.com" <RAI@nuscalepower.com>
Tracking Status: None

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# Request for Additional Information No. 305 (eRAI No. 9194)

Issue Date: 12/19/2017
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 09.03.04 - Chemical and Volume Control System (PWR) (Including Boron Recovery System)
Application Section: 9.3.4

## QUESTIONS

### 09.03.04-8

**Regulatory Basis (applies to all questions in this RAI):**

Title 10 of the Code of Federal Regulations (10 CFR) Part 50, Appendix A, General Design Criteria (GDC) 14 "Reactor Coolant Pressure Boundary," requires assurance that the reactor coolant pressure boundary (RCPB) have an extremely low probability of abnormal leakage, rapidly propagating failure, and of gross rupture. 10 CFR Part 52.47 requires that a standard design certification submitted for approval under 10 CFR Part 52 shall "contain a level of design information sufficient to enable the Commission … to reach a final conclusion on all safety questions associated with the design." As described below, additional information is needed in the NuScale application for the staff to reach a safety finding.

DCD Tier 2, FSAR section 9.3.4, "Chemical and Volume Control System [CVCS]," addresses how the CVCS controls reactor coolant purity levels. The RCPB materials, and the impact of the reactor coolant chemistry on the materials, are discussed in FSAR section 5.2.3.2.1, "Reactor Coolant Chemistry."

Design Specific Review Standard (DSRS) 9.3.4, "Chemical and Volume Control System," Section II, "Acceptance Criteria," discusses compliance with GDC 14 in item 4 under the "Technical Rationale." The DSRS states that meeting the requirements of GDC 14 provides assurance that the probability of corrosion-induced failure of the RCPB will be minimized. FSAR Section 3.1.2.5, "Criterion 14 – Reactor Coolant Pressure Boundary," states that the NuScale design conforms to GDC 14 and cites FSAR Section 9.3 as a relevant section. FSAR Section 9.3.4.3, "Safety Evaluation," states that the CVCS is not required to assure the integrity of the RCPB due to compliance with NuScale Principal Design Criterion (PDC) 27, "Combined Reactivity Control Systems Capability," GDC 28, "Reactivity Limits," and GDC 29, "Protection Against Anticipated Operational Occurrences." However, compliance with PDC 27, GDC 28, and GDC 29 does not address the possibility of the corrosion-induced failure of the RCPB. NuScale PDC 27 ensures that the combined capabilities of the reactivity controls systems can reliably control reactivity changes under postulated accident conditions. GDC 28 ensures that reactivity controls systems have appropriate limits on the potential amount and rate of reactivity increase to ensure that postulated reactivity accidents do not damage the RCPB. GDC 29 ensures that protection and reactivity control systems have an extremely high probability to accomplish their safety functions during an anticipated operational occurrence. None of these design criteria address the prevention of corrosion-induced failure. Therefore, the staff requests the applicant provide the basis for ensuring compliance with GDC 14 with respect to the possibility of corrosion-induced failure of the RCPB.

### 09.03.04-9

The supplement dated August 3, 2017 (ADAMS Accession No.ML17215A977), stated that the NuScale Primary Water Chemistry Program would be "based on" the EPRI Primary Water Chemistry Guidelines (EPRI Guidelines). The staff requests additional information on the phrase "based on." Specifically, the applicant should provide a discussion to clarify whether a primary water chemistry program that is "based on" the EPRI guidelines meets the "Mandatory" and "Shall" elements of the EPRI Guidelines. In order to clarify the licensing basis for the Nuscale design, the staff requests the following information:

1. Confirm that the NuScale Primary Water Chemistry Program will follow the "Shall" and "Mandatory" elements as described in the EPRI Guidelines, and revise the FSAR to reflect this. If the "Shall" and "Mandatory" elements of the EPRI Guidelines will not be met, provide the technical basis for not following these parts of the EPRI Guidelines and how RCPB integrity will be ensured with respect to corrosion-induced failure.

2. The supplement did not add any detail on the diagnostic parameters as described in the EPRI Guidelines. State the parameters and associated limits to be monitored, or reference the appropriate tables from the EPRI Guidelines. In addition, update the relevant tables in the FSAR to reflect the information provided in this response.
3. The NuScale FSAR states that the Combined License (COL) Applicant will be responsible for developing a site-specific pH Control Program. Confirm that this program must follow the guidance provided in Table 3-1 of the EPRI Guidelines and provide a pH and lithium range for all operational modes, and add a COL Item that specifies the COL Applicant must develop a pH Control Program that follows the latest revision of the EPRI Guidelines, and fuel vendor recommendations. In addition, update the relevant section(s) of the FSAR to reflect the information provided in this response.

09.03.04-10

DCD Tier 2, FSAR Section 9.3.4 addresses the chemical volume and control system (CVCS) which controls reactor coolant purity levels. DCD Tier 2, FSAR section 5.2.3.2.1 addresses reactor coolant chemistry. In Figure 9.3.4-1, "Chemical and Volume Control System Diagram," it appears that there is piping that can connect the CVCSs for up to 6 NuScale Power Modules (NPMs) via the module heatup system.

What physical measures, or other controls, are in place to prevent impurities in the reactor coolant from one module from impacting the chemistry of the reactor coolant in a different module?

Additionally, if the CVCSs can be interconnected via other means not shown in Figure 9.3.4-1, describe the interconnections and address how impurities in one NPM may impact the reactor coolant chemistry in a different NPM.

Revise the DCD Tier 2 FSAR, as necessary, to reflect any ways the CVCSs may be interconnected and the controls in place to prevent impurities in the reactor coolant from one module from impacting the reactor coolant in a different module.

09.03.04-11

DCD Tier 2, FSAR Section 9.3.4.3, "Safety Evaluation," discusses the GDCs, their applicability to the NuScale design, and how the GDCs are met by the NuScale design.

In the discussion for GDC 14, the applicant stated that the CVCS provides the ability to correct the reactor coolant system (RCS) water chemistry from the EPRI Guidelines "…Action Level 3 thresholds to Action Level 2 thresholds within the 24 hour EPRI guidelines."

The statement in FSAR Section 9.3.4.3 seems inconsistent with the EPRI Guidelines. Therefore, NRC staff requests that the applicant verify:

1. That the CVCS has the capacity to reduce water chemistry values exceeding Action Level 2 limits to below the Action Level 2 threshold within 24 hours; and
2. That if a parameter exceeds an Action Level 3 value, that the licensee shall immediately initiate an orderly unit shutdown.

Revise the DCD Tier 2 FSAR, as necessary, to reflect the information provided in the response to the questions above.

09.03.04-12

In DCD Tier 2, FSAR Section 9.3.4.2.1, "Chemical Volume and Control System," the applicant discusses the CVCS ion exchangers and their operation. In order for the NRC staff to determine if the CVCS has adequate capacity to maintain primary water purity, the following information is requested.

Provide the capacity of the ion exchangers (i.e., will the resin last days/weeks/months) and the amount of flow each ion exchanger can handle relative to total RCS flow.

Revise the DCD Tier 2 FSAR as necessary to reflect the information provided in the response to the questions above.

09.03.04-13

In DCD Tier 2, FSAR section 9.3.4.2.1, “Chemical Volume and Control System,” the applicant discusses the water chemistry parameters that are required to be controlled as per the EPRI Guidelines. FSAR Table 9.3.2-1, “Primary Sampling System Normal and Post-Accident Sample Points,” lists the primary water chemistry parameters that will be monitored. However, the NRC staff notes that there are discrepancies between the primary water chemistry control parameters and the parameters that will be monitored. In order for the primary water chemistry parameters to be controlled within the acceptable limits these parameters will need to be monitored on the appropriate frequency. Therefore, the staff requests that the applicant either add the control parameters and testing frequency required by the EPRI Guidelines to FSAR Table 9.3.2-1, or address the discrepancy between FSAR section 9.3.4.2.1 and FSAR Table 9.3.2-1.