NuScaleDCRaisPEm Resource

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Sent: Wednesday, September 27, 2017 9:52 AM
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Subject: Request for Additional Information No. 240 RAI No. 8817 (14.3)
Attachments: Request for Additional Information No. 240 (eRAI No. 8817).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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Office of New Reactors
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301-415-0546

Hearing Identifier: NuScale_SMR_DC_RAI_Public
Email Number: 264

Mail Envelope Properties (2930e841927546c8909fe972c8a980dd)

Subject: Request for Additional Information No. 240 RAI No. 8817 (14.3)
Sent Date: 9/27/2017 9:52:14 AM
Received Date: 9/27/2017 9:52:15 AM
From: Cranston, Gregory

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Post Office: HQPWMSMRS07.nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	561	9/27/2017 9:52:15 AM
Request for Additional Information No. 240 (eRAI No. 8817).pdf		95667

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

Request for Additional Information No. 240 (eRAI No. 8817)

Issue Date: 09/27/2017
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 14.03 - Inspections, Tests, Analyses, and Acceptance Criteria
Application Section: 14.3

QUESTIONS

14.03-1

10 CFR Part 50, Appendix A, GDC 46 requires, in part, that the cooling water system shall be designed to permit appropriate pressure and functional testing to assure (1) the structural and leaktight integrity of its components, (2) the operability and the performance of the active components of the system, and (3) the operability of the system as a whole and, under conditions as close to design as practical, the performance of the full operational sequence that brings the system into operation for reactor shutdown and for loss-of-coolant accidents. For the NuScale design, the decay heat removal system (DHRS) functions as a cooling water system, as it is credited for certain transients as the system to transfer heat from structures, systems, and components important to safety, to an ultimate heat sink, and is therefore subject to both GDC 34 and 46.

In order to make a safety finding regarding the ability of the DHRS to meet GDC 46, staff needs to confirm that the proposed preoperational test program for the DHR function demonstrates the capability of all systems and components associated with the removal of decay heat (DSRS Section 5.4.7).

In the preoperational test program outlined in the FSAR, the acceptance criteria related to the DHRS contain no acceptance criteria related to the performance of the system: namely, to reduce temperature below 420F in 36 hours for any design basis transient. Test #63 (the module protection system test) contains a functional requirement to open the DHRS valves and includes provisions to go to “hot functional”, while test #104 (reactor trip from 100 percent power) is stated to verify the ability of the DHRS to cool the RCS to mode 3 following a reactor trip. Before the DHRS is relied upon to perform ESF functions (test #104), system performance should be verified via test, or a combination of testing and analysis. ITAAC 02.08.08, an ITAAC related to equipment qualification, appears to partially perform this function; however, the level of detail is insufficient to determine how system performance as a whole is verified via a combination of testing and analyses. This combination may inlcude qualification testing on system components, as-installed testing conducted as part of the pre-operational test program, or other testing in conjunction with analysis to demonstrate that the totality of the DHRS will perform its safety function prior to fuel loading, and how these tests and analyses combine to demonstrate system performance should be clearly described as part of the response.

Provide additional acceptance criteria for the DHRS such that the DHRS testing performed as part of the ITAAC and initial test program are deemed to demonstrate adequate system performance for all transients via the combination of testing and analysis. Further, provide additional clarity, either in the ITAAC or FSAR Table 14.3-1, how the “combination of type test and analysis” will demonstrate system performance meets or exceeds that assumed in the safety analysis, given that system performance characteristics will not be as challenging during testing as they would be under a more limiting transient (i.e., describe the analyses that will reconcile the difference between the test conditions and the limiting transient conditions).

14.03-2

10 CFR Part 50, Appendix A, GDC 46 requires, in part, that the cooling water system shall be designed to permit appropriate pressure and functional testing to assure (1) the structural and leaktight integrity of its components, (2) the operability and the performance of the active components of the system, and (3) the operability of the system as a whole and, under conditions as close to design as practical, the performance of the full operational sequence that brings the system into operation for reactor shutdown and for loss-of-coolant accidents. For the NuScale design, the decay heat removal system (DHRS) functions as a cooling water system, as it is credited for certain transients as the system to transfer heat from structures, systems, and components important to safety, to an ultimate heat sink, and is therefore subject to both GDC 34 and 46.

The DHRS piping layout and DHRS level sensor locations represent important design considerations in evaluating the performance of the DHRS. In reviewing the supporting calculations as part of an audit, staff found that both piping layout and slope were important in order to ensure that the natural circulation pathway remains uninterrupted and DHRS inventory is maintained. Additionally, considerations related to these design details revealed that the presence of additional non-condensable gases in the DHRS could adversely impact the heat transfer. Staff reviewed the FSAR and existing ITAAC and could not determine how these values were verified for the as-built design. Discrepancies in these values compared to the thermal-hydraulic analyses have the potential to invalidate the analyses and result in impaired system operation compared to that assumed in the licensing basis. Staff requests the applicant update the ITAAC or provide another appropriate verification mechanism to clarify that DHRS piping layout, slope, and level sensor location for considerations related to non-condensable gases such that the conditions laid out in the DHRS thermal-hydraulic analysis are verified in the as-built design.