NuScaleDCRaisPEm Resource

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Sent: Saturday, August 12, 2017 12:57 PM
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Subject: Request for Additional Information No. 171, RAI 9032 (7.01)
Attachments: Request for Additional Information No. 171 (eRAI No. 9032).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. 171 (eRAI No. 9032)

Issue Date: 08/12/2017
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 07.01.DSRS - Fundamental Design Principles
Application Section: DCD, Part 2 - Tier 2, Section 7.1.5, "Diversity and Defense-in-Depth"

QUESTIONS

07.01.DSRS-4

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Appendix A, General Design Criterion 22, "Protection System Independence," states that the protection system shall be designed to assure that the effects of natural phenomena, and of normal operating, maintenance, testing, and postulated accident conditions on redundant channels do not result in loss of the protection function, or shall be demonstrated to be acceptable on some other defined basis. Design techniques, such as functional diversity or diversity in component design and principles of operation, shall be used to the extent practical to prevent loss of the protection function.

NuScale Design Control Document, Part 2 – Tier 2, Section 7.1.5.2.2, “Results of Coping Analyses for Postulated Digital-Based Common Cause Failure Vulnerability,” describes the results of the coping analysis of the NuScale design. The applicant states the following within the ‘low reactor coolant system flow’ topic: "RCS [Reactor Coolant System] flow rate is a function of reactor power in the NuScale design, such that low RCS flow is only possible during startup conditions. The low-low RCS flow protective function is credited for actuating RTS [Reactor Trip System] and CVCS [chemical and volume control system] isolation in the event of a MHS malfunction that causes an RCS flow reversal. This event is not considered credible in combination with a digital-based CCF [common-cause failure] of the RCS flow sensor due to the very short, and limited operating window where the MHS [module heatup system] failure could occur."

The staff requests the applicant to provide the technical basis which led them to conclude that an MHS malfunction event in combination with a digital-based CCF of the RCS flow is not credible.

07.01.DSRS-5

Staff Requirements Memoranda (SRM) to SECY-93-087, “Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs,” staff position on diversity and defense-in-depth (D3) in item 18.II.Q., “Defense Against Common-Mode Failures in Digital Instrumentation and Control Systems,” Point 4 states in part, “*A set of displays and controls located in the main control room shall be provided for manual, system-level actuation of critical safety functions and monitoring of parameters that support the safety functions. The displays and controls shall be independent and diverse from the safety computer system*.”

The applicant provides their disposition of conformance to Point 4 of SRM to SECY-93-087 in NuScale Design Control Document (DCD), Part 2 – Tier 2, Section 7.1.5.3, “Diversity and Defense-in-Depth Assessment Regulatory Conformance.” DCD, Part 2 – Tier 2, Section 7.1.5.3 states in part that, “*The SDIS and manual controls are sufficiently diverse that any failure does not prevent the operator from obtaining or resolving conflicting information*.”

The safety display and indication system (SDIS) consists of two independent divisions of equipment, as shown in DCD, Part 2 – Tier 2, Figure 7.0-10, “Module Protection System Gateway Diagram.” The module protection system (MPS) interfaces with the SDIS is through a nonsafety-related module protection system (MPS) Gateway. DCD, Part 2 –Tier 2, Section 7.0.4.1.4, “Module Protection System Support System,” states that: "Each division of MPS has a nonsafety-related MPS gateway that consolidates the information received from the four separation groups, the two divisions of RTS, and the ESFAS. The MPS gateway also collects equipment

status feedback from the HWM for PAM-only mode, as well as reads the status of the three 24-hour timers. All of the information transmitted to the MPS gateway is consolidated by a single communication module that acts as a master on the MPS gateway backplane and then transmits the consolidated data through a qualified, isolated, one-way communication path to the MWS and the SDIS hubs as shown in Figure 7.0-10. There is one MPS gateway for each division."

The nonsafety-related MPS gateway for each MPS division consolidates information from four different sources, including information from each separation group and each division of the MPS. Hence, if there is a fault in MPS Division I, what is preventing the fault from propagating to MPS Gateways I and II and resulting in a failure of both SDIS I and SDIS II? The applicant is asked to demonstrate how SDIS I and II are sufficiently diverse such that any failure (including a fault in the MPS Gateways) does not prevent the operator from obtaining or resolving conflicting information.