NuScaleDCRaisPEm Resource

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Sent: Friday, June 09, 2017 2:26 PM
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Subject: Request for Additional Information No. 59, RAI 8853
Attachments: Request for Additional Information No. 59 (eRAI No. 8853).pdf

Attached please find NRC staff's request for additional information concerning review of the NuScale Design Certification Application.

Please submit your 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. 59 (eRAI No. 8853)

Issue Date: 06/08/2017
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 10.02 - Turbine Generator
Application Section: 10.2

QUESTIONS

10.02-1

10 CFR 52.47(a)(9) governs the technical content of a design certification application and requires that, for applications for light-water cooled nuclear power plants, an evaluation of the standard plant design against the Standard Review Plan (SRP) revision in effect 6 months before the docket date of the application. It also states that, where a difference exists, the evaluation shall discuss how the proposed alternative provides an acceptable method of complying with the Commission's regulations, or portions thereof, that underlie the corresponding SRP acceptance criteria.

FSAR Tier 2, Subsection 10.1.2.4, "Turbine Overspeed Protection," states that turbine overspeed protection is provided by two independent and diverse electronic overspeed protection features. In FSAR Tier 2, Section 10.2.2.3.3, the turbine governor is identified as the primary speed controller and the first line of defense against turbine overspeed is set to trip the turbine if it reaches 9 percent overspeed. The emergency trip system is identified as the second line of defense and it trips the turbine upon reaching 10 percent overspeed.

The turbine overspeed protection described in the FSAR differs significantly from the diverse design called for in SRP Section 10.2. The FSAR does not address the initiation of a reactor trip at 103 percent of rated speed by the normal speed-load control. Also, the NuScale proposed design does not provide the same level of diversity as that called for by SRP 10.2 (i.e., one mechanical and one electrical overspeed trip device) and, therefore, may be more subject to common cause failure.

Since the turbine overspeed protection system described in the FSAR appears to be an alternative design to the one described in SRP 10.2, sufficient information should be included in the FSAR to demonstrate that the level of protection provided by the NuScale turbine overspeed protection system is, at least, equivalent to that provided by the diverse design called for by SRP Section 10.2. As such, the staff requests that the following information and/or clarifications be provided:

1. Describe how the normal turbine control system will be used to prevent turbine overspeed, including information on functionality and protection provided by the system, and a discussion on how the system adheres to the guidance provided by items 2A and 2B of SRP Section 10.2.III regarding the 103 percent trip setpoint and meeting single failure criteria.
2. Describe how the system adheres to the guidance provided by items 2C and 2D of SRP Section 10.2.III and discuss the level of protection against common cause failures that is

provided by the proposed NuScale turbine overspeed control trip system and the extent to which the protection provided by the system is, at least, equivalent to that provided by the electrical/mechanical system assumed in the SRP.

10.02-2

10 CFR 52.47(c)(2) requires that a standard design certification of “a nuclear power reactor design that … uses simplified, inherent, passive, or other innovative means to accomplish its safety functions must provide an essentially complete nuclear power reactor design except for site-specific elements such as the service water intake structure and the ultimate heat sink, and must meet the requirements of 10 CFR 50.43(e).”

GDC 4 requires, in part, that SSCs important to safety be “appropriately protected against dynamic effects, including the effects of missiles …” According to SRP 10.2, the GDC 4 requirement, as it relates to the turbine generator system (TGS) for the protection of SSCs important to safety from the effects of turbine missiles, is met by providing the turbine with an overspeed protection system (with suitable redundancy and diversity) to minimize the probability of generation of the turbine missiles. SRP 10.2 further specifies that a mechanical overspeed trip device will actuate the control, stop, and intercept valves to close at approximately 111 percent of rated speed. The SRP also specifies that an independent and redundant backup electric overspeed trip device should actuate to close the control, stop, and intercept valves at approximately 112 percent of the turbine rated speed.

The staff finds that overspeed protection for the NuScale turbine generator, as described in NuScale FSAR Tier 2, Section10.2, is accomplished without the use of a mechanical overspeed trip device; instead a diverse electronic overspeed control system is used. A justification for this discrepancy is not provided.

The applicant is requested to:

1. Discuss how diversity for the turbine overspeed trip system is achieved based on the use of the two electrical overspeed (primary and emergency) trip systems. Include in the discussion information about physical and/or electrical separation of the two overspeed trip systems, and identify how the selected speed sensors, power supplies, hardware, software, etc. support turbine overspeed protection system diversity, redundancy and independence.

2. Explain how the design makes use of diversity and defense-in-depth to defend against a common cause failure (CCF) of the processors.

3. Provide a simplified functional diagram (including trip logic) of the turbine overspeed trip system that shows how overspeed of the turbine is detected and how the overspeed trip implemented.

4. Clarify whether any or all of the turbine overspeed protection systems share any common components (i.e. software, hydraulic circuits, power supplies, etc.) or

processors/inputs. If so, discuss if the components are fail-safe and provide an evaluation of the impact of failures of any such features/components.