

NuScaleDCRaisPEm Resource

From: Cranston, Gregory
Sent: Monday, September 10, 2018 3:35 PM
To: Request for Additional Information
Cc: Lee, Samuel; Khan, Maryam; Vera Amadiz, Marieliz; Chowdhury, Prosanta; NuScaleDCRaisPEm Resource; Samaddar, Sujit
Subject: Request for Additional Information No. 503 eRAI No. 9596 (3.5.3) R1
Attachments: Request for Additional Information No. 503 (eRAI no. 9596).pdf

Resent to correct Subject line attachment is correct. PW remains the same.

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.

Hearing Identifier: NuScale_SMR_DC_RAI_Public
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Request for Additional Information No. 503 (eRAI no. 9596)

Issue Date: 09/07/2018

Application Title: NuScale Standard Design Certification - 52-048

Operating Company: NuScale Power, LLC

Docket No. 52-048

Review Section: 03.05.03 - Barrier Design Procedures

Application Section: 3.5.3

QUESTIONS

03.05.03-4

General Design Criterion 4, "Environmental and Dynamic Effects Design Bases," of Appendix A, "General Design Criteria for Nuclear Power Plants," to Title 10 of the *Code of Federal Regulations*, Part 50, "Domestic Licensing of Production and Utilization Facilities" (10 CFR Part 50) (Ref. 1), requires, in part, that structures, systems, and components important to safety be appropriately protected against the effects of missiles that might result from equipment failures. Failures that could occur in the large steam turbines of the main turbine-generator sets have the potential to produce large high-energy missiles.

Regulatory Guide (RG) 1.115 Revision 2 describes methods that are acceptable to the staff for implementing NRC regulations to protect essential SSCs against both high-trajectory and low-trajectory turbine missiles resulting from the failure of main turbine-generator sets. Plants can protect essential SSCs against turbine-generated missiles by four different approaches, one of which is barriers constructed to protect all essential SSCs. Although the Design Certification Application describes a probabilistic approach to address the protection of essential SSCs from turbine-generated missiles, the applicant subsequently proposed an approach that relies on using barrier alone to protect essential SSCs from turbine-generated missiles. The staff's guidance for using barriers to protect essential SSCs is provided in Sections C.2.d and C.3 of RG 1.115.

The applicant in response to eRAI No. 9058 (ML 17355A168) committed to provide changes to Tier 1 and Tier 2 of the Nuscale Final Safety Analysis Report to support safeguarding essential SSCs from Turbine missile using barriers. The applicant in its letter: "NuScale Power, LLC Submittal of Changes to Tier 1 and Tier 2 of the NuScale Final Safety Analysis Report to Support Safeguarding Essential SSC for Turbine Missiles Using Barriers", dated June 25, 2018, (ML18176A394) submitted changes to FSAR for the staff's review. The applicant in its submittal stated that the results of their analysis showed that essential SSCs are protected by barriers alone and that the reactor building and the control building provide adequate protection against turbine-generated missiles for essential SSCs contained therein. In Enclosure 2 of the submittal, the applicant stated that "the exterior walls and roof of the reactor building (RXB) and control building (CRB) are heavily reinforced concrete structures. These structures are sufficient to prevent turbine missile perforation and back-face scabbing assuming minimal credit being taken to reduce the velocity of the missile as it penetrates the turbine generator casing."

The applicant in its submittal did not provide sufficient information in order for the staff to review the barriers design credited for providing adequate protection against turbine-generated missiles for essential SSCs contained therein. The staff requests the following additional information to complete their review of the applicant's approach of using barrier alone to protect essential SSCs from turbine missiles.

1. In order to demonstrate that the damage potential to concrete and steel barriers from the turbine-generated missiles is bounded by the design basis tornado and hurricane missiles, the applicant is requested to provide parameters (i.e. mass, velocity, impact area, shape and hardness of missile) for the spectrum of both high-trajectory and low-trajectory turbine-generated missiles and compare them with the parameters provided for the design basis tornado and hurricane missiles in FSAR Table 3.5-1. Note that since the NuScale turbine does not credit an independent turbine overspeed protection system, nor rotor material and processing, fracture toughness, preservice and inservice inspection and testing for minimizing turbine missiles, the spectrum of turbine missiles may not be based on current operating experience of nuclear turbines that do credit these items such the material properties, inspection, and overspeed protection in minimizing turbine missiles. Therefore, since the quality of the turbine rotor is not credited nor overspeed protection, the spectrum of turbine missiles would include up to half of the last stage of the rotor with the blades attached. Also, since there is no longer an independent and redundant turbine overspeed protection, the speed of the missile should be based on the design speed of 3600 rpm up to destructive overspeed.
2. The applicant in Tier 2, FSAR Section 1.2.2.5.1, 'Turbine Generator Building', states that NuScale Power Plant has two separate turbine generator buildings and each building houses six turbine generator sets. The applicant is requested to clarify if the structural barrier is designed to protect it against the spectrum of turbine-generated missile associated with the failure of a single turbine and provide a technical justification for not considering the missiles due to multiple turbine failure, , given that the turbine speed is twice of a typical turbine used on a nuclear power plant and they don't have independent and diverse over speed protection system.
3. In the event missile parameters (i.e. mass, velocity, impact area, shape and hardness of missile) for the turbine-generated spectrum of missiles are not bounded and are different in comparison with the corresponding parameters for design basis tornado and hurricane missiles parameters provided in FSAR Table 3.5-1, the applicant is requested to provide a justification for the applicability of the penetration, perforation and scabbing equations in FSAR Section 3.5.3, "Barrier Design procedures".
4. The applicant is requested to provide dimensioned plan and elevation layout drawings which include information on wall or slab thicknesses and materials of pertinent structures (turbine building, reactor building, and control building) that are considered in barrier evaluation for the turbine-generated missiles.
5. The applicant in Enclosure 1 of the submittal stated that "because NuScale's design already contained barriers meeting the requirements for protection against aircraft and

vehicle impact, NuScale considered it reasonable that those same barriers might also be credited for protection against turbine-generated missiles." The applicant is requested to provide technical basis for crediting the aircraft impact -a 'beyond design basis' event- for the protection against the turbine generated missiles that is a design basis event.

6. The applicant is requested to provide a summary of the structural analysis of all barriers for the local and overall damage due to the impact of the spectrum of turbine-generated missiles and demonstrate that barriers are sufficiently thick enough to prevent back face scabbing to protect the essential SSCs if the missile characteristics are not bounded by those of wind born missiles.