NuScale Power

RAIO-1217-57818

December 20, 2017

Docket No. 52-048

U.S. Nuclear Regulatory Commission
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SUBJECT: NuScale Power, LLC Supplemental Response to NRC Request for Additional Information No. 113 (eRAI No. 8986) on the NuScale Design Certification Application

REFERENCES:
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 113 (eRAI No. 8986)," dated July 30, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 113 (eRAI No.8986)," dated September 28, 2017

The purpose of this letter is to provide the NuScale Power, LLC (NuScale) supplemental response to the referenced NRC Request for Additional Information (RAI).

The Enclosure to this letter contains NuScale's supplemental response to the following RAI Question from NRC eRAI No. 8986:

- 19-21

This supplemental information augments the original response (Reference 2).

This letter and the enclosed response make no new regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions on this response, please contact Marty Bryan at 541-452-7172 or at mbryan@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
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Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8986

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8986

Response to Request for Additional Information
Docket No. 52-048

eRAI No.: 8986
Date of RAI Issue: 07/30/2017

NRC Question No.: 19-21

10 CFR 50.150 (a) (1) requires the applicant to perform a design-specific assessment of the effects on the facility of the impact of a large, commercial aircraft. 10 CFR 50.150 (b) requires that the applicant include a description of the design features and function capabilities identified in the design-specific assessment and how these design features and function capabilities identified in the design-specific assessment meet the assessment requirements in 10 CFR 50.150 (a) (1).

a. In FSAR Section 19.5.5.4, the applicant described that the spent fuel pool (SFP) design is a key design feature that prevents SFP perforation and maintains SFP integrity. However, this description lacks sufficiently detailed information about the specific characteristics of the SFP, and its components, that are credited to maintain SFP integrity. The staff requests the applicant to provide a more detailed description in FSAR about the walls, liner and support structure for the SFP credited for maintaining SFP integrity, and describe how any leakage below the required minimum water level of the SFP is avoided.
b. In FSAR Section 19.5.5.3, the applicant described that SFP cooling is provided by the large water mass of the ultimate heat sink (UHS), and the integrity of the UHS is ensured by the RXB structure as described in Section 19.5.5.5. Based on 10 CFR 50.150 (b), the staff requests the applicant to provide a description of the key design features (i.e. material, size, thickness, and liner etc.) for the UHS and address how these key design features are utilized in maintaining UHS integrity.
c. In FSAR Section 19.5.5.6, the applicant described that the general arrangement of the structures, specifically the location of the Radwaste Building (RWB), is a key design feature that limits potential strike locations to the west end of the RXB. However, this description lacks sufficiently detailed information about the extent of the west wall of the RXB that is protected by the RWB. Therefore, the staff requests the applicant to provide a more detailed description in FSAR about the extent of protection provided by the RWB to the west wall of the RXB.

NuScale Response:

Subquestion a)

The design of the spent fuel pool walls is described in FSAR Section 3.8.5, Appendix 3B, and Section 19.5 and is summarized as follows:

East pool wall - 5’ thick interior concrete wall with 3 layers of 3 bundled #11 bar @ 12” on center (O.C.) each way each face (EWEF) w/ 2 #8 headed bars @ 24” O.C. (Reference FSAR Section 3B.2.2.2, Wall at Grid Line 3)

North pool wall - 6' thick interior concrete wall with 4 layers of #11 bar @ 12" O.C. EWEF w/ 2-leg #6 bar stirrups @ 12" O.C. (Reference FSAR Section 19.5.5.3, Spent Fuel Pool Integrity)

South and West pool wall - 5’ thick interior concrete wall with 4 layers of #11 bar @ 12” O.C. EWEF w/ 2-leg #6 bar stirrups @ 12” O.C. (Reference FSAR Section 3B.2.7.2, Pool Wall)

The design of the spent fuel pool foundation slab is summarized as follows:

10’ thick reinforced concrete with 4 layers of #11 bar @ 12” O.C. EWEF w/ 1-leg #6 bar stirrups @ 12" O.C. each way. (Reference FSAR Section 3.8.5.1, Description of Foundations)

The RXB pool liner is a 304L, or equivalent, stainless steel ¼” thick min. (Reference FSAR Section 3.8.4.1.7, Reactor Building Pools and Section 9.2.5.2.1, General Design Description of the Ultimate Heat Sink)

Although the RXB pool is a continuous body of water, a break in the pool wall outside of the spent fuel storage pool does not cause a loss of inventory that affects the SFP. As illustrated in FSAR Figure 3B-11, the SFP is separated from the other pool areas with a weir wall. The top of the weir is at an elevation such that the SFP ability to house the fuel safely is not jeopardized in the event that a leak occurs outside the SFP.

Inside the SFP, loss of coolant is minimized by the weir wall as discussed above, in addition to the pool liner being designed as seismic category I, the leak detection system, the design of the reinforced concrete walls and foundation slab (as discussed above), wall penetrations being located above the minimum water elevation, and by the UHS makeup system. The UHS makeup functions are discussed in FSAR Section 9.1.3, Spent Fuel Pool Cooling and Cleanup System, and Section 9.2.5, Ultimate Heat Sink.

Subquestion b)

FSAR Section 19.5.5.3 includes reference to FSAR Section 3B.2 and Section 3.8.4 for description of the SFP concrete and steel liner respectively. See response to Subquestion a above.

Subquestion c)

FSAR Section 19.5.3.2, Impact Locations, includes discussion of the RWB. Reference to FSAR Section 3.5.3.1.1, 3.8.4.1.3, and Figure 1.2-33 is included for the RWB key design features.

The RWB east exterior wall is 2' thick reinforced concrete with a minimum of #8 bar @ 12" O.C. (Reference FSAR Section 3.5.3.1.1).

FSAR Section 3.8.4.1.3 indicates that the RWB is designed as Seismic Category II and is separated approximately 25 ft from the RXB above grade . FSAR Figure 1.2-33 shows the RWB west wall (facing east) and the RXB in dotted outline to represent its location behind the RWB. The RWB extends to El 149'-0" and spans most of the width of the RXB.

Impact on DCA:

FSAR Tier 2 Section 19.5.5.3 has been revised as described in the response above and as shown in the markup provided in this response.

piping in the Turbine Building does not affect DHRS passive cooling capability. DHRS initiation includes closure of the associated main steam and feedwater isolation valves inside the RXB, thereby preventing a loss of secondary side water through the damaged piping.

RAI 19.05 Aircraft Impact Assessment (APR1400)-1

Upon notification of an imminent aircraft threat, the operators in the Main Control Room scram the reactors, actuate DHRS and isolate containment. Heat from the DHRS is passively transferred to the reactor pool that serves as the Ultimate Heat Sink (described in Section 9.2.5 and Section 3B.2) that is located below grade in the RXB.

RAI 19.05 Aircraft Impact Assessment (APR1400)-1

There are no systems with open-water sources (e.g., circulating water system) located in the RXB physical damage footprint for any strike. As such, internal flooding is not an issue of concern.

RAI 19.05 Aircraft Impact Assessment (APR1400)-1

All containment penetrations are on the CNV which is protected from impact by the RXB exterior walls. The location of the CNV penetrations and isolation valves as described in Section 6.2.4 is a key design feature that ensures containment isolation.

RAI 19.05 Aircraft Impact Assessment (APR1400)-1

There are no control or protective functions that are necessary after aircraft impact for 72 hours, as described in Section 9.2.5.4.

RAI 19.05 Aircraft Impact Assessment (APR1400)-1

The NPMs, RCS, CNV, DHRS, containment isolation valves, and UHS are key design features for ensuring core cooling, as described above. The closure of the MSIVs and FWIVs, as described in Section 5.4.3.2 and Section 6.2.4, are key design features for ensuring DHRS operation. The ability to scram the reactors, isolate containment, and actuate DHRS from the MCR, as described in Section 7.0.4.1.2, Section 7.0.4.1.3, Section 5.4.3.2, and Section 6.2.4, are key design features for ensuring the reactor is tripped, containment is isolated, and DHRS is actuated prior to aircraft impact. Since there is no physical damage to any core cooling equipment in the RXB, the Control Rod Drive System is undamaged and available to initiate a scram, either manually from the MCR or by manually tripping the reactor trip breakers. The design and location of the Control Rod Drive System, as described in Section 4.6, is a key design feature for ensuring a scram can be initiated after impact if the reactor was not scrammed prior to impact.

RAI 19.05 Aircraft Impact Assessment (APR1400)-1

19.5.5.3 ~~Design Features for Spent Fuel Cooling~~Spent Fuel Pool Integrity

RAI 19.05 Aircraft Impact Assessment (APR1400)-1, RAI 19-21S1

~~The nonsafety-related spent fuel pool cooling system is assumed to fail. Spent fuel cooling is provided by the large water mass of the ultimate heat sink. No additional cooling is required. The integrity of the ultimate heat sink is ensured by the RXB~~

~~structure as described in Section 19.5.5.5.~~The east, west, and south SFP walls are constructed as described in Section 3B.2. The north SFP wall is a 6 foot thick interior concrete wall with 4 layers of #11 reinforcing bar spaced 12 inches on center in both the horizontal and vertical direction on both faces of the wall. The foundation of the SFP is constructed as described in Section 3.8.5. The reinforced concrete walls and floor have a stainless steel liner, as described in Section 3.8.4. The SFP is integrated into the RXB structure and is located below grade. Because the SFP is completely below grade, an aircraft impact cannot strike the pool or the pool liner. Because there is no damage to the pool structure or liner, there is no loss of water level and SFP integrity is maintained. The location of the SFP as described in Section 9.1.2 and shown on Figure 1.2-10 through Figure 1.2-16 is a key design feature for maintaining SFP integrity from a direct aircraft impact.

RAI 19.05 Aircraft Impact Assessment (APR1400)-1

There are three hoist systems inside the RXB that can be operated over the SFP area: the Fuel Handling Machine (FHM), the New Fuel Jib Crane (NFJC), and the New Fuel Elevator (NFE). Provisions are in place to prevent the RBC from being moved over the SFP, as described in Section 9.1.5.3 and shown on Figure 9.1.5-1 and Figure 9.1.5-2. There are seismic restraints on the RBC, as shown on Figure 9.1.5-3. Because the exterior wall of the RXB is not perforated, the trolleys cannot be dislodged to fall into the Reactor Pool. Additionally, there are seismic restraints on the FHM, as described in Section 9.1.4.2.2 and shown on Figure 9.1.4-2. The design and location of the fuel handing equipment, as described above, is a key design feature for ensuring the hoists remain intact and cannot fall into the SFP and perforate the SFP liner.

RAI 19.05 Aircraft Impact Assessment (APR1400)-1

19.5.5.4 ~~Design Features for Maintaining Spent Fuel Pool Integrity~~Spent Fuel Pool Cooling

RAI 19.05 Aircraft Impact Assessment (APR1400)-1

~~The SFP is constructed of thick, reinforced concrete walls and floor. The SFP is integrated into the RXB structure and is located below grade. This design is a key design feature that prevents SFP perforation and maintains SFP integrity.~~Spent fuel pool cooling is not maintained for all postulated strike locations due either to shock or to loss of power. However, as described in Section 19.5.5.3, SFP integrity is maintained, and SFP cooling is not required. Although forced cooling is lost, the SFP is part of the UHS which provides a very large water inventory and ensures adequate water level is maintained above the spent fuel assemblies for beyond the mission time, even with the loss of forced SFP cooling, as described in Section 9.1.3.3.5.

RAI 19.05 Aircraft Impact Assessment (APR1400)-1

19.5.5.5 ~~Reactor Building~~Plant Monitoring and Control

RAI 19.05 Aircraft Impact Assessment (APR1400)-1

~~The RXB is a reinforced concrete structure that prevents aircraft perforation, limits physical damage, and prevents fire from entering the building. Vulnerable exterior openings are protected with aircraft impact resistant barriers (e.g., awnings, equipment door). The combination of the RXB exterior wall and roof thickness, rebar ratios,~~