December 12, 2017

Docket No. 52-048

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 261 (eRAI No. 9063) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 261 (eRAI No. 9063)," dated October 13, 2017

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

The Enclosure to this letter contains NuScale's response to the following RAI Question from NRC eRAI No. 9063:

- 09.01.03-2

The response schedule for question 09.01.03-1 will be provided by January 5, 2018.

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 Carrie Fosaaen at 541-452-7126 or at cfosaaen@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9063

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9063

NuScale Power™

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

eRAI No.: 9063
Date of RAI Issue: 10/14/2017

NRC Question No.: 09.01.03-2

10 CFR 52.47(a)(2) requires that a standard design certification applicant provide a description and analysis of the structures, systems, and components (SSCs) of the facility, with emphasis upon performance requirements, the bases, with technical justification therefor, upon which these requirements have been established, and the evaluations required to show that safety functions will be accomplished.

10 CFR 50, Appendix A, General Design Criterion (GDC) 61 requires, in part, the fuel storage and handling, radioactive waste, and other systems which may contain radioactivity shall be designed to assure adequate safety under normal and postulated accident condition.

SRP 9.1.3.III.B states that the cooling loop may be constructed to nonseismic Category I requirements, provided the spent fuel pool water makeup system and the building ventilation and filtration system are:

1) designed to Quality Group C and seismic Category I requirements;

2) are protected from the effects of tornadoes; and

3) meet the single-failure requirements.

The staff evaluated FSAR Tier 2, Section 9.1.3, where the applicant describes the makeup sources available for the spent fuel pool (SFP). The applicant discussed several nonsafety-related water systems capable of providing makeup to the SFP. For an accident condition that disables the nonsafety-related makeup, FSAR 9.1.3.3.5 credits the available volume of water on the ultimate heat sink (UHS) above the weir (over 4 million gallons) as the primary safety-related makeup water source. FSAR 9.2.5 also describes a single seismic Category I makeup line from the outside of the building into the SFP as the backup makeup source. This 6 inch (0.1524 meters) is sloped and has capacity to provide more than the credited 100 gpm of water makeup.

FSAR 9.2.5 describes the SFP as part of the UHS, therefore the staff finds that crediting the UHS volume of water above the weir as makeup does not follow the guidance of the SRP. The UHS water volume (above the weir) is always shared with the SFP; any event that causes the SFP water level to drop to the point makeup is needed would also cause the UHS water level to drop. The staff finds that the SFP is provided with only 1 seismic Category I makeup line which

does not meet the recommendation of SRP 9.1.3, since this does not meet single failure criteria.

Therefore, the staff requests the applicant to identify an additional makeup water source to the SFP in order to meet the design criteria identified in SRP 9.1.3, or to provide a justification for departing from the SRP guidance that the pool should be provided with redundant makeup capability.

NuScale Response:

The NuScale design deviates from the suggested approach within DSRS Section 9.1.3.III "Review Procedures" to demonstrate compliance with GDC 61 "Fuel Storage and Handling and Radioactivity Control".

Instead, NuScale complies with the DSRS Acceptance Criteria using an alternative approach following the Technical Rationale described under 9.1.3.II Acceptance Criteria, Item 4.

The Nuscale design complies with the requirement that the fuel storage system be designed to ensure adequate safety under normal and postulated accident conditions with capability to prevent a significant reduction in fuel storage coolant inventory under accident conditions by providing adequate makeup capability and by a design such that the coolant can neither be drained nor siphoned below a specified level.

Specifically the NuScale design meets the DSRS Acceptance Criteria because:

The 12 modules in the NuScale standard plant are housed in a common seismic class 1 reactor building and immersed in a common pool of water that serves as the UHS anytime the main condenser is not available. This UHS is sized to accommodate the decay heat from 12 reactor modules and can substantially exceed 30 days without electric power, operator action, or additional inventory to either the reactor pressure vessel or the UHS.

The Seismic Category I makeup line from the outside of the building into the SFP (described in FSAR 9.2.5) provides redundancy to the unique configuration of the NuScale UHS that includes water volume above the weir.

Section 9.1.3 has been revised to clarify the description of the SFP with regards to crediting the water above the weir as a makeup water supply.

Impact on DCA:

FSAR Section 9.1.3.3 has been revised as described in the response above and as shown in the markup provided in this response.

The final case is another that is not expected to occur during operations. The following applies if the SFPCS and RPCS are needed for cooling the SFAs stored from five or more years of operation plus a full-core offload from each of the 12 NPMs. Under this scenario, the total decay heat in the UHS for each of the NPM offloads must be evaluated before the additional core is offloaded to ensure that the bulk pool water temperature is maintained at less than the 140°F limit established by Technical Specifications.

As described in Section 9.1.2.3.2, when cooling of just the SFP is considered, a single heat exchanger in the SFPCS can keep a full SFP with a recent core offload from one NPM below the maximum pool water temperature limit of 140°F in the Technical Specifications. This demonstrates that the SFPCS has a minimum heat removal capability for maintaining the SFP temperature within the design for the structure.

9.1.3.3.5 Prevent Coolant Inventory Reduction for Accident Conditions

The requirements of GDC 61 to prevent loss of SFP coolant for accident conditions were considered in the design of the structures and systems supporting spent fuel cooling and shielding. The design provides the makeup water and prevents draining, siphoning, or other loss of water.

The safety function of providing makeup for spent fuel cooling and shielding is preformed passively for accident conditions, for the long-term safety period, and for a longer time period based on the design of the UHS pools in the RXB. As shown in Figure 9.1.3-5, the top of the weir wall between the SFP and RFP is at the 20 ft pool water depth. The tops of the fuel storage racks are below the 10 ft pool water depth. The water in the SFP below the top of the weir is the inventory of water that provides 10 ft of water above the tops of the fuel storage racks for cooling the SFAs. This minimum depth of water also provides shielding for operators to keep dose rates low while they are working around the SFP.

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Preventing a reduction of the SFP coolant inventory below the top of the weir wall for accident conditions is performed by the large inventory of water in the UHS pools and by an emergency makeup line in the UHS system as described in Section 9.2.5. The water inventory above the top of the weir wall is contained within Seismic Category I structures. The UHS makeup line also meets Seismic Category I design requirements. The~~se redundant~~ Seismic Category I flow path~~s~~ for supply of makeup water to the lower portion of the SFP, coupled with the design of the UHS, meet Position C.8 of Regulatory Guide 1.13.

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The capacity of each flow path exceeds the 100 gpm needed to supply makeup water to account for the maximum evaporation rate or the liner leakage rate from a dropped fuel assembly. The large inventory of water in the UHS above the top of the weir wall provides a supply of more than 4 million gallons of water. This ~~amount of makeup supply~~ automatically feeds into the lower portion of the SFP without the need for operator action to initiate the ~~makeup water~~ flow because the

open channel above the top of the weir allows unrestricted flow between pools and there is no gate in the wall that could block flow. As described in Section 9.2.5, the large quantity of water in the UHS provides a supply of ~~makeup~~ water that would take weeks to evaporate to the level of the top of the weir. This allows time for operators to connect a water supply to the emergency makeup line outside of the RXB. As shown in Figure 9.2.5-2, the emergency makeup line in the UHS system has a 6 inch diameter and slopes from outside of the RXB to the SFP. This line has the capability of providing several times the needed 100 gpm and permits operators to make the connections and flow alignments from a location remote from the operating floor near the SFP.

In addition to the capability to add makeup, the design prevents the loss of pool water inventory. The large inventory of water in the UHS increases the time needed for leaking, draining, or siphoning to impact the water level in the pools. Each foot of water depth in the UHS pools contains more than 90,000 gallons of water. At a leakage rate of 100 gpm, more than 900 minutes, or 15 hours, is needed for a one-foot drop in water level. The large amount of water to be lost and the time needed ensures that operators would be alerted to stop the loss of water. Sufficient time is available to preclude a loss of pool water that would create an unsafe water level in the UHS pools.

The design of the UHS pools meets Position C.6(b) of Regulatory Guide 1.13 and has no drains, piping, or other systems that would allow pool water to drain below the minimum level needed to support plant safety analyses, which is above the level needed for adequate shielding of the SFAs. The elevation of the bottom of each of the piping penetrations through the walls of the UHS pools and the dry dock is above the 55 ft pool water level. Also, the elevations of the open ends of the piping in the pools or the antisiphon devices on the piping are above this elevation. As shown in Figure 9.1.3-5, this elevation ensures that sufficient pool water inventory is available to support the plant safety analyses. A failure of the piping in these pool support systems does not drain the water to adversely affect the inventory of water available for cooling and shielding the NPMs or SFAs. The CFDS has an intake pipe with an open end above the 55 ft pool water level. The CFDS pipe exits the pool water surface and does not penetrate the wall of a UHS pool. There are no other penetrations in the UHS pools or dry dock.

Identifying leakage from components in the pool support systems prevents a loss of pool inventory and is another means to ensure an adequate water level in the SFP for cooling and shielding the stored spent fuel. Leakage from piping or components in the spent fuel pool cooling system, reactor pool cooling system, pool cleanup system, and pool surge control system in the RXB is collected by local floor drains, which flow to sumps monitored by level instrumentation. An increase in sump level and subsequent alarm indicates an abnormal amount of water in the sump and possible system leakage. Each major component train in these systems has manual valves that allow isolation of the train for maintenance or repair.

Leakage from the UHS pool liner removes inventory from the SFP. The PLDS collects leakage from the liners and directs it to the floor sumps in the RWDS. The RWDS supports the leakage detection function of the PLDS by providing local and control room indication and associated alarms. When the leakage rate into a sump