RAIO-1218-63855

December 17, 2018

Docket No. 52-048

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 511 (eRAI No. 9613) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 511 (eRAI No. 9613)," dated November 20, 2018

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. 9613:

- 12.02-33

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
NuScale Power, LLC

Distribution: Gregory Cranston, NRC, OWFN-8G9A
Samuel Lee, NRC, OWFN-8G9A
Getachew Tesfaye, NRC, OWFN-8H12

Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9613

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9613

NuScale Power, LLC
1100 NE Circle Blvd., Suite 200 Corvalis, Oregon 97330, Office: 541.360.0500, Fax: 541.207.3928
www.nuscalepower.com

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

eRAI No.: 9613
Date of RAI Issue: 11/20/2018

NRC Question No.: 12.02-33

As a follow-up RAI to RAI 9266, Question 12.02-13, the staff is requesting additional information for the evaporation rate of the Reactor Building pool. More specifically the staff is seeking to understand the use of a non- conservative value for pool water temperature.

Basis:

10 CFR 52.47(a)(5) requires applicants to identify the kinds and quantities of radioactive materials expected to be produced during operation and the means for controlling and limiting radiation exposures within the limits set forth in 10 CFR Part 20. This relates to the assumed airborne concentrations of radionuclides as a result of assumed evaporation rates and other parameters that would impact the airborne concentrations.

10 CFR 20.1101(b) and 10 CFR 20.1003, require the use of engineering controls to maintain exposures to radiation as far below the dose limits in 10 CFR 20 as is practical. This relates to the design of the Reactor Building HVAC (RBV) system and its ability to remove heat and airborne radionuclides.

10 CFR 20.1204, "Determination of Internal Exposure", 10 CFR 20.1204, "Determination of Internal Exposure"; 10 CFR 20.1701, "Use of Process or Other Engineering Controls"; and 10 CFR 20.1702, "Use of Other Controls".

Background:

In discussions held with NuScale on RAI 9266, Question 12.02-12, the staff has questioned the use of 100°F pool surface water temperature when calculating the evaporation rate from the pool. The NuScale Technical Specification (TS) 3.5.3, "Ultimate Heat Sink" (UHS) bulk average

temperature limit of 140°F is significantly greater than the temperature assumed for determining the evaporation rate.

In their response to RAI 9266, Question 12.02-13, NuScale stated:

"*The calculated airborne activity in the airspace above the reactor pool water is based on an evaporation rate from the reactor pool while the pool water temperature is at the design basis temperature for the Reactor Building HVAC (RBV) system, which is 100°F air temperature. Above this temperature, the RBV system may be unable to adequately cool the Reactor Building atmosphere, thereby potentially resulting in compensatory measures, such as increasing pool heat removal via the pool cooling systems, to return the pool water temperature below 100°F."*

While operating within the design basis air temperature for the Reactor Building HVAC (RBV) would have some impact on pool surface water temperature, this does not necessarily limit UHS bulk average temperature to 100°F, the value used in NuScale's calculations to determine evaporation rates from pool. NuScale has not provided sufficient information related to elements of the Design Certification Application which establish a design basis for UHS bulk average temperature of 100°F that supports use as an initial condition the analysis of the evaporation rate from the pool. As such, since NuScale could foreseeably operate above 100°F UHS temperature, the staff requested the airborne equilibrium values of radioisotopes of concern when operating the UHS up to TS limit of 140°F or other appropriate limit justified by NuScale. NuScale has also not provided this information.

Staff confirmatory calculations have determined that an increased pool temperature would result in higher evaporation rates which would result in increased airborne radionuclide concentrations. The calculations indicate that operation near technical specification limits for UHS bulk temperature of 140° F could increase airborne tritium equilibrium values over 3 times the value provided by NuScale with UHS temperature of 100° F. In table 12.2-33:

Reactor Building Airborne Concentrations, NuScale has provided the airborne concentration of tritium as 1.87E-06 µCi/ml with the UHS temperature of 100° F. This value is approximately 9% of the Occupational Value of the Derived Air Concentration (DAC) for tritium (2.0E-05 µCi/ml).

10 CFR 20.1204(g)(2) Determination of internal exposure states:

(g) When a mixture of radionuclides in air exists, licensees may disregard certain radionuclides in the mixture if—

(2) The concentration of any radionuclide disregarded is less than 10 percent of its DAC,

and

(3) The sum of these percentages for all of the radionuclides disregarded in the mixture does not exceed 30 percent

With an assumption of 9% DAC value for airborne tritium, a licensee may take advantage of 10 CFR 20.1204(g)(2), and disregard the contribution of tritium in determination of internal exposure. Operation of the UHS bulk temperature above 100° F could foreseeably cause the airborne concentration of tritium to exceed the 10 CFR 20.1204(g)(2) threshold.

Questions:

To facilitate staff understanding of the application information in support of its reasonable assurance review regarding identifying the kinds and quantities of radioactive material expected to be produced during operations and the resulting radiation exposures, the staff requests the applicant respond to the following:

1. Revise DCA Table 12.2-36, "Input Parameters for Determining Facility Airborne Concentrations" to update the Pool surface water temperature to reflect NuScale TS 3.5.3, Ultimate Heat Sink (UHS) bulk average temperature limit of 140°F, or establish a design basis UHS temperature for controlling radionuclide evolution to limit evaporation and update the resultant change in Pool evaporation rate.

2. In addition the staff requests NuScale to update DCA Table 12.2-33, "Reactor Building Airborne Concentrations," to reflect changes to reactor building equilibrium airborne concentrations as a result of increased pool evaporation rate.

OR

1. Provide a COL Item in DCA section 12.5 that states that the COL Applicant is responsible for developing the operational programmatic elements that ensure internal and external occupational exposures resulting from an increased UHS temperature remain below regulatory limits.

NuScale Response:

NuScale's original response to RAI 9266 actually states:

> *"The calculated airborne activity in the airspace above the reactor pool water is based on an evaporation rate from the reactor pool while the pool water temperature is at the design basis temperature for the Reactor Building HVAC (RBV) system, which is 100°F. Above this temperature, the RBV system may be unable to adequately cool the Reactor Building atmosphere, thereby potentially resulting in compensatory measures, such as increasing pool heat removal via the pool cooling systems, to return the pool water temperature below 100°F."*

RAI 9613 misquotes this part of NuScale's response. The design basis for the RBV is not based on the Reactor Building air temperature, but the reactor pool water temperature.

The NuScale design basis airborne source term has recently been revised in response to NRC audit feedback (total tritium curie generated was less than the total curies released) and modeling improvements (pool evaporation rate under the bioshield was previously neglected in determining the pool water equilibrium tritium value). The results show the peak airborne concentration of tritium in the air space above the reactor pool is approximately 7.3% of a DAC, and the total airborne is approximately 8% of a DAC. NuScale Technical Specification (TS 3.5.3) has also recently been revised (as described in the NuScale response to RAI 06.02.01.01.A-18) to limit the UHS pool water bulk average temperature to a maximum of 110°F. It is unlikely that a slight increase in pool water temperature would result in exceeding the 10% of a DAC limit for tritium above the reactor pool.

The stated value of pool water temperature of 100°F represents the parameter used for the radiological analysis that assessed the adequacy of the Reactor Building HVAC system design because it was the basis of the design of the Reactor Building HVAC system. Therefore, plant operations with the pool temperature higher could not be sustained by the design. This analysis also assumes that twelve power modules are operating with the design basis fuel failure for the entire cycle for every cycle and that the pool water radionuclide concentration is at its peak value resulting from refueling operations. Therefore, this analysis provides reasonable assurance that the facility can be operated in conformity with the regulations.

Regarding 10 CFR 20.1204(g)(2), internal occupational doses are not assigned to plant personnel based on airborne values documented in FSAR tables. 10 CFR 20.1204 requires that the licensee take suitable and timely measurements of concentrations of radioactive materials in air in work areas, or quantities of radionuclides in the body, or quantities of radionuclides excreted from the body, or combinations of these measurements. Occupational doses are assigned based on these contemporary measurements, not FSAR tables. These occupational doses are assigned in accordance with procedures developed as part of the radiation protection program (COL Item 12.5-1).

NuScale has provided a COL item (COL Item 12.5-1) that states that the COL applicant is responsible for developing an operational radiation protection program to ensure occupational radiation internal and external exposures remain below regulatory limits regardless of the plant condition, including increased UHS temperature. The regulatory radiation occupational exposure limits in 10 CFR 20 are not dependent upon plant conditions, but include "the dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation or to radioactive material from licensed and unlicensed sources of radiation, whether in the possession of the licensee or other person." Therefore, the operational radiation protection program is provided to ensure occupational exposures comply with regulations.

Additionally, a nuclear facility that is issued a license to operate a commercial nuclear facility is required to operate in conformity with the application and within the rules and regulations of the NRC. Therefore, the licensing basis for the operation of the facility, as documented in the safety analysis report, establishes the parameters of operation, and the licensee is required to operate the facility in accordance with its licensing basis. As such, operation of the facility with the pool temperature above 100°F would not be in accordance with the licensing basis, and cannot be sustained.

Impact on DCA:

There are no impacts to the DCA as a result of this response.