July 26, 2017

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. 48 (eRAI No. 8842) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 48 (eRAI No. 8842)," dated June 02, 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. 8842:

- 05.02.05-3

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
NuScale Power, LLC

Distribution: Gregory Cranston, NRC, TWFN-6E55
Samuel Lee, NRC, TWFN-6C20
Bruce Bavol, NRC, TWFN-6C20

Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 8842

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 8842

NuScale Power

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

eRAI No.: 8842
Date of RAI Issue: 06/02/2017

NRC Question No.: 05.02.05-3

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.

RG 1.45, Regulatory Position C.3.3 provides guidance on the leakage monitoring systems in the main control room by stating:

> "The plant should provide output and alarms from leakage monitoring systems in the main control room. Procedures for converting the instrument output to a leakage rate should be readily available to the operators. (Alternatively, these procedures could be part of a computer program so that the operators have a real-time indication of the leakage rate as determined from the output of these monitors.)"

FSAR Tier 2 does not contain the level of information indicated by RG 1.45, Regulatory Position C.3.3.

The applicant is requested to provide the following information:

a. Clarify how NuScale would conform to the above guidance relating to control room instrumentation, and
b. Include a COL information item requiring COL applicants to develop appropriate procedures for leakage monitoring.

NuScale Response:

a.) Three methods are available to detect reactor coolant system leakage in the NuScale design. As described in Section 5.2 and 9.3.6, these methods include: containment pressure, CES sample vessel level, and CES radiation detection. Two of these methods, CNV pressure and CES sample tank level detection, can quantify leakage into the CNV. These methods provide alarms to the control room to alert the operators of a potentially degraded condition.

NuScale FSAR Section 5.2.5.1 states the following with regard to the leakage monitoring alarms in the main control room for the containment evacuation system (CES):

> A CES alarm is provided to the main control room (MCR) based on reaching 75 percent of the maximum allowable pressure-temperature for a given reactor pool temperature to signal to the operator the approaching operability limit. ...
>
> The CES inlet pressure instrumentation, which monitors containment pressure, is also used as an indicator to detect leakage. The CES inlet pressure instrumentation is designed to Seismic Category I, and provides indication in the MCR.

NuScale FSAR Section 9.3.6 "Containment Evacuation System and Containment Flooding and Drain System" provides discussion of the control room alarms for leakage monitoring.

Section 9.3.6.5 states:

> The CES and the CFDS have indication and alarms associated with system critical parameters [i.e. pressure and temperature] to alert operators in the MCR of potentially adverse conditions. ...
>
> The CES indication associated with determining CNV pressure for leak detection is supported by the MPS, providing a seismically qualified interface to the main control room.

9.3.6.3:

> The MCS calculates the leak rate by measuring the time interval for the condensate collected in the CES sample vessel to fill the known volume between the low-level and high-level setpoints. The high-level setpoint actuates the CES sample vessel drain valve, which allows the condensate to gravity drain to the liquid radioactive waste drain system. The low-level setpoint closes the CES sample vessel drain valve and reinitializes the timing cycle. An alarm is actuated if the leak rate exceeds the specified limit.

9.3.6.2.1:

> The MCS and sample vessel level instrumentation are configured to track the time interval required for a fixed quantity of condensate to accumulate in the sample vessel, which allows the MCS to calculate leak rates into the CNV.
>
> Sample vessel radiation instrumentation is used to provide an indication of the leakage source.

Section 5.2 of the NuScale FSAR has been updated to correct an error identified during development of the RAI response. As indicated in the markup provided with this response, "sample vessel level" was removed from the description of the CES alarm function.

b.) COL item 5.2-7 specifies that COL applicants will have to develop plant specific procedures and actions for leakage monitoring:

> A COL applicant that references the NuScale Power Plant design certification will establish plant-specific procedures that specify operator actions for identifying, monitoring, trending, and locating reactor coolant system leakage in response to prolonged low leakage conditions that exist above normal leakage rates and below the technical specification limits. The objective of the methods of detecting and locating the reactor coolant pressure boundary leak will be to provide the operator sufficient time to take actions before the plant technical specification limits are reached.

RCS leakage that meets the technical specification limits will be addressed in accordance with actions prescribed by the technical specifications actions and supplementing procedures.

Impact on DCA:

FSAR Section 5.2.5 has been revised as described in the response above and as shown in the markup provided in this response.

Water vapor and noncondensable gas are removed by the CES, and the water vapor is condensed. The condensed water collects into the CES sample vessel where it is monitored using pressure, temperature and radioactivity instrumentation. The radioactivity instrumentation aids in determining the source of containment leakage; higher radioactivity may indicate RCS leakage. The CES sample vessel also includes level instrumentation that is used to quantify and trend leak rates into the containment. Additionally, CES gaseous discharge radioactivity monitoring may detect a fuel leak or excessive RCS leakage.

The CES is a nonsafety-related system, and the CES components are reactor module-specific. The primary function of the CES is to decrease and maintain the internal containment pressure below the saturation pressure corresponding to the lowest surface temperature inside the CNV. As a result of maintaining the entrained water in a gaseous state, the CES vacuum pumps remove water vapor and noncondensable gas within the CNV.

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The CES condensate monitoring system provides indication and alarm in the main control room to monitor and trend liquid leakage into the containment atmosphere. The CES condensate monitoring system can detect an RCS leak rate of less than 1 gpm within one hour and has a minimum detectable leak rate of less than 0.05 gpm. A CES ~~sample vessel level~~ alarm is provided to the main control room (MCR) based on reaching 75 percent of the maximum allowable pressure-temperature for a given reactor pool temperature to signal to the operator the approaching operability limit. Refer to Section 9.3.6 for a description of the design and functions of the CES and associated sampling system.

The condensate measurement method is used to get a true leakage rate. Vapor pulled from the containment and condensed after leaving the vacuum pump is represented by measurement of the collected condensate. A correction factor is applied to ensure conservatism in the indicated leak rate. The correction factor is based on the calculated carryover rate past the CES condenser. Condensation of vapor within the containment must be avoided in order for the CES to properly account for leakage into containment. This method requires containment pressure to be stabilized below containment saturation pressure to ensure that the rate at which the water vapor is being drawn from containment is equivalent to the rate at which water mass is leaking into containment.

Leakage Monitoring - Containment Pressure

The CES inlet pressure instrumenation, which monitors containment pressure, is also used as an indicator to detect leakage. The CES inlet pressure instrumentation is designed to Seismic Category I, and provides indication in the MCR. The minimum pressure accuracy of the CES inlet pressure instrumentation allows for accurate trending of leakage data and can detect an RCS leak rate of less than 1 gpm in one hour with a minimum detectable leak rate of less than 0.05 gpm. Leak rate is calculated by using the time for pressure to change, gas load in containment, and the net mass flow rate inside containment.