RAIO-1117-57226

November 16, 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. 230 (eRAI No. 9064) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 230 (eRAI No. 9064)," dated September 20, 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 Enclosures to this letter contain NuScale's response to the following RAI Questions from NRC eRAI No. 9064:

- 20.01-6
- 20.01-7

NuScale requests that the security-related information in Enclosure 1 be withheld from public disclosure in accordance with the requirements of 10 CFR § 2.390. Enclosure 2 contains a public version of the NuScale response.

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

If you have any questions on this response, please contact Steven Mirsky at 240-833-3001 or at smirsky@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

Distribution: Gregory Cranston, NRC, OWFN-8G9A
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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9064, nonpublic

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 9064, public

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Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9064, nonpublic Security-Related Information - Withhold Under 10 CFR §2.390

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Enclosure 2:

NuScale Response to NRC Request for Additional Information eRAI No. 9064, public

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

eRAI No.: 9064
Date of RAI Issue: 09/20/2017

NRC Question No.: 20.01-6

The U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-051 following the NRC staff's evaluation of the earthquake and tsunami, and resulting nuclear accident, at the Fukushima Dai-ichi nuclear power plant in March 2011. Order EA-12-051 requires reliable spent fuel pool instrumentation for beyond-design-basis external events. In Commission Order EA-12-051, the Commission describes the key parameters used to determine that a level instrument is to be considered reliable.

NEI 12-02, Revision 1,"Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," provides an acceptable approach for satisfying the applicable requirements. JLD-ISG-2012-03, Revision 0, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation," issued August 29, 2012, endorses NEI 12-02, Revision 1, "Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," with exceptions and clarifications.

Attachment 2 to Commission Order EA-12-051 states that trained personnel shall be able to identify three (3) key pool water levels.

In FSAR Tier 2 Section 20.1.4.1, the applicant states that the ultimate heat sink (UHS) level instruments meet the guidance of NEI 12-02. The applicant describes the 3 water levels in accordance with the approved guidance, but does not identify the pool elevation that corresponds to each of the water levels.

Therefore, the staff requests the applicant to identify the water level elevation that correspond to each of the water levels identified in Commission Order EA-12-051, and to update the FSAR accordingly.

NuScale Response:

Tier 2, FSAR Section 9.2.5, Table 9.2.5-1 has been revised to identify the three key water levels

identified in Commission Order EA-12-051. Tier 2, FSAR Section 20.1.4.1 has been revised to point to Table 9.2.5-1.

Impact on DCA:

The FSAR has been been revised as described in the response above and as shown in the markup provided with the response to question 20.01-7.

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

eRAI No.: 9064
Date of RAI Issue: 09/20/2017

NRC Question No.: 20.01-7

The U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-051 following the NRC staff's evaluation of the earthquake and tsunami, and resulting nuclear accident, at the Fukushima Dai-ichi nuclear power plant in March 2011. Order EA-12-051 requires reliable spent fuel pool instrumentation for beyond-design-basis external events. In Commission Order EA-12-051, the Commission describes the key parameters used to determine that a level instrument is to be considered reliable.

NEI 12-02, Revision 1,"Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," provides an acceptable approach for satisfying the applicable requirements. JLD-ISG-2012-03, Revision 0, "Compliance with Order EA-12- 051, Reliable Spent Fuel Pool Instrumentation," issued August 29, 2012, endorses NEI 12-02, Revision 1, "Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," with exceptions and clarifications.

In FSAR Tier 2 Section 20.1.4.1, the applicant states that the ultimate heat sink (UHS) level instruments meet the guidance of NEI 12-02. NEI 12-02, Revision 1, Section 3.6 indicates that replaceable batteries should be accessible and have sufficient capacity to support reliable instrument channel operation until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049.

The staff evaluated the applicant description of the instrument power connections provided in FSAR Section 20.1.4. The staff noted that the instruments can be powered by the EDSS or a replaceable battery that is independent of the plant power distribution systems. The design description does not address time window when these power sources can be expected to maintain level indication.

Therefore, the staff requests the applicant to discuss in the FSAR the replaceable battery capacity to maintain the level indication function until offsite resource availability is reasonably assured.

NuScale Response:

The design of the four (4) ultimate heat sink (UHS) level instruments meets the guidance of NEI 12-02. Power to the UHS level instruments is normally fed from the plant protection system, which is powered by the highly reliable DC power system (EDSS). The EDSS is equipped with battery capacity designed to provide a minimum of 72 hours of electrical power to support specified loads for post-accident monitoring. If power is not restored to the EDSS within 72 hours of an event (via the backup diesel generator or the offsite source) and the EDSS batteries deplete, the backup replaceable battery pack supplied with each UHS level instrument will become the power source for the level instruments. The capacity of the replaceable battery pack is sufficient to supply a minimum of 72 hours of power for the level instrument. Should this battery pack power be depleted, a replacement battery pack can be provided to power the level instrument until the EDSS is restored.

Discussion of the replaceable battery capacity to maintain the level indication function until offsite resource availability is reasonably assured has been added to Section 20.1.4.1 in the FSAR.

Impact on DCA:

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

RAI 09.02.05-2, RAI 20.01-6, RAI 20.01-7

Table 9.2.5-1: Relevant Ultimate Heat Sink Parameters

UHS Parameter		
Level	**Building Elevation (ft)**	**Pool Level (ft)**
Normal operating level range	Withheld - See Part 9	68-69
Minimum level assumed for reactor building crane operation[1]	Withheld - See Part 9	66
Minimum level for 30 day coverage for DHRS[2]	Withheld - See Part 9	~~61.1~~63.4
Minimum level for SFPCS and RPCS suction penetrations[3]	85	60
Minimum level for long term cooling	Withheld - See Part 9	55
Minimum level for FHA scrub[~~3~~4]	Withheld - See Part 9	52
Spent fuel pool weir wall	Withheld - See Part 9	20
Minimum level to support radiation shielding[4~~5~~]	Withheld - See Part 9	20
Top of spent fuel rack	Withheld - See Part 9	10
Reactor pool and spent fuel pool floor	Withheld - See Part 9	0
Temperature	**Temperature (°F)**	
Minimum operating	40	
Normal operating	100	
Maximum operating	140	

Notes:

[1] Maximum Reactor Building crane lifting capacity is calculated assuming a pool level of 66 ft and a pool temperature of 140 degrees F for calculating water density.

[2] ANSI/ANS 5.1-2014 is used to calculate decay heat for up to 12 NPMs and stored spent fuel assemblies with a pool water starting temperature of 140 degrees F.

[3] Penetration height for SFPCS and RPCS suction piping in the SFP and RFP level assures suction capability for coolant pumps.~~Level for iodine scrubbing includes: weir height + 8 ft damaged fuel + 1 ft weir clearance + 23 ft scrub~~

[4] Level for iodine scrubbing includes: weir height + 8 ft damaged fuel + 1 ft weir clearance + 23 ft scrub~~ANSI/ANS 57.2-1983 maximum radiation dose of 2.5 mrem/hr~~

[5] ANSI/ANS 57.2-1983 maximum radiation dose of 2.5 mrem/hr

20.1.4 Spent Fuel Pool and Reactor Pool Level Instrumentation

20.1.4.1 Design Bases

The design of the four (4) UHS level instruments meet the guidance of NEI 12-02. The design basis functions of the pool level instrumentation are to provide plant personnel with a reliable wide-range water level indication of the UHS level until the UHS level decreases below the SFP weir when the RFP and reactor pool inventory is separate from the inventory in the SFP and reactor pool relative to the following water levels:

RAI 20.01-6, RAI 20.01-7

- Level 1 - level that is adequate to support operation of the normal pool cooling systems (See Table 9.2.5-1, Relevant Ultimate Heat Sink Parameters, Minimum level for SFPCS and RPCS suction penetrations),

RAI 20.01-6, RAI 20.01-7

- Level 2 - level that is adequate to provide substantial radiation shielding for a person standing on the operating deck (See Table 9.2.5.1, Relevant Ultimate Heat Sink Parameters, Minimum level to support radiation shielding),

RAI 20.01-6, RAI 20.01-7

- Level 3 - level where stored fuel remains covered and actions to implement make-up water should no longer be deferred (See Table 9.2.5-1, Relevant Ultimate Heat Sink Parameters, Top of spent fuel rack).

During refueling, the NPM is disassembled in the RFP area to allow transferring of new and spent fuel to and from the reactor core. When an NPM is disassembled, the water level in the RFP area will be monitored to ensure the fuel in the reactor is covered during an ELAP event.

The UHS level instruments are designed to withstand external hazards; such as seismic, flooding, high winds (including applicable missiles) extreme temperatures, and snow and ice; without loss of capability to perform their monitoring function.

The UHS instruments are designed to withstand the effects of and to be compatible with the environmental conditions associated with the expected conditions in the Reactor Building during normal operations and an ELAP event.

The UHS level instruments and their power supplies are physically and electrically separated and independent.

20.1.4.2 Description

Two (2) wide-range water level instruments are provided for both the spent fuel pool and the reactor pool, for a total of four (4) instruments. The wide-range instruments encompass the elevations from the top of the fuel storage racks to near the operating deck. The pool water level instrumentation is consistent with the guidance of NEI 12-02, Revision 1.

Instruments

Two (2) permanent wide-range instruments monitor the level of the SFP. Two permanent wide-range instruments are also installed to monitor the UHS water level, one in the RP area and one in the RFP area. The instruments transmit signals to the main control room. All four of these instruments are capable of monitoring Levels 1 and 2. The two (2) SFP level instruments are capable of monitoring Level 3, when the RP water level is below the weir wall elevation. The two (2) level instruments in the RP and RFP areas are capable of monitoring the level of the water above the fuel in the reactor core when the NPM is disassembled in the RFP during refueling.

Arrangement

The two (2) SFP level instruments are arranged in opposite corners of the SFP. The two (2) UHS level instruments are located in the one (1) in the RFP area and the other instrument is located in the RP area. The separation of these instruments is adequate to provide protection from missiles that may be generated within the reactor building from affecting all instruments. Protection from external missiles is provided by the Reactor Building structure.

The instrument cables are also separated to provide protection against a single missile damaging both trains.

Mounting

The four (4) UHS instruments are seismically mounted such that the instruments will maintain their design configuration during and following an SSE (Seismic Category I).

Qualification

The four (4) UHS instruments and associated cabling are environmentally qualified to operate following a BDBEE in the following environmental conditions:

- SSE seismic event (Seismic Category I)
- Concentrated borated water environment,
- Temperature of approximately 212 degrees Fahrenheit and 100 percent relative humidity,
- Boiling water or steam environment,
- Radiological conditions existing from a normal refueling with a freshly discharged fuel batch that remains covered with SFP water (Level 3).

Independence

The four (4) UHS level instruments are both physically and electrically independent.

Power Supplies

RAI 20.01-6, RAI 20.01-7

The power to the four (4) UHS level instruments is supplied by the highly reliable DC power system (EDSS) with interface through the plant protection system (PPS). Power to the redundant level instruments is from separate bus sources such that the loss of one supply will not result in a loss of power supply function to both divisions of UHS level instrumentation. Additionally, a replaceable battery that is isolated from faults on the normal power supply provides an alternate source of power independent from the plant AC and DC power systems. Batteries are designed for easy replacement to indefinitely power UHS monitoring level instruments.

Accuracy

The instrument channels are designed to maintain the minimum accuracy following a power interruption or change in power source without recalibration.

Testing

The permanently installed UHS level instruments are designed such that testing and calibration can be performed in-situ.

Display

The four (4) UHS level instruments transmit signals to the main control room and the remote shutdown panel, and are immediately available to the operators following an event. The instrument signals also initiate high or low level alarms, both locally and in the main control room.

Programs

COL Item 20.1-8: A COL applicant that references the NuScale Power Plant design certification will develop procedures, training and qualification program for operations, maintenance, testing, and calibration of UHS level instrumentation to ensure the level instruments will be available when needed and personnel are knowledgeable in interpreting the information as addressed in NEI 12-02.

Safety Evaluation

The four (4) UHS level instruments are designed to withstand and be protected from natural phenomena such as earthquakes, tornados, hurricanes, floods, tsunamis and seiches without loss of function.

These instruments are also designed to accommodate or be protected from the effects of the postulated environmental conditions, including missiles, pipe whipping, and jet impingement.

The instruments and associated cabling is protected by both physical and electrical separation such that a failure in one channel will leave the other channel functional.