NuScaleDCRaisPEm Resource

From:	Cranston, Gregory
Sent:	Monday, April 16, 2018 12:11 PM
To:	Request for Additional Information
Cc:	Lee, Samuel; Tabatabai, Omid; Martinez Navedo, Tania; Otto, Ngola; NuScaleDCRaisPEm Resource; Chowdhury, Prosanta
Subject:	Request for Additional Information No. 424 eRAI No. 9327 (20.1)
Attachments:	Request for Additional Information No. 424 (eRAI No. 9327).pdf

Attached please find NRC staff's request for additional information (RAI) concerning review of the NuScale Design Certification Application.

Please submit your technically correct and complete response within 60 days of the date of this RAI to the NRC Document Control Desk.

If you have any questions, please contact me.

Thank you.

Gregory Cranston, Senior Project Manager
Licensing Branch 1 (NuScale)
Division of New Reactor Licensing
Office of New Reactors
U.S. Nuclear Regulatory Commission
301-415-0546

Hearing Identifier: NuScale_SMR_DC_RAI_Public
Email Number: 458

Mail Envelope Properties (CY4PR09MB1287D350070A0875882DEF8390B00)

Subject: Request for Additional Information No. 424 eRAI No. 9327 (20.1)
Sent Date: 4/16/2018 12:10:49 PM
Received Date: 4/16/2018 12:10:54 PM
From: Cranston, Gregory

Created By: Gregory.Cranston@nrc.gov

Recipients:
"Lee, Samuel" <Samuel.Lee@nrc.gov>
Tracking Status: None
"Tabatabai, Omid" <Omid.Tabatabai-Yazdi@nrc.gov>
Tracking Status: None
"Martinez Navedo, Tania" <Tania.MartinezNavedo@nrc.gov>
Tracking Status: None
"Otto, Ngola" <Ngola.Otto@nrc.gov>
Tracking Status: None
"NuScaleDCRaisPEm Resource" <NuScaleDCRaisPEm.Resource@nrc.gov>
Tracking Status: None
"Chowdhury, Prosanta" <Prosanta.Chowdhury@nrc.gov>
Tracking Status: None
"Request for Additional Information" <RAI@nuscalepower.com>
Tracking Status: None

Post Office: CY4PR09MB1287.namprd09.prod.outlook.com

Files	**Size**	**Date & Time**
MESSAGE	561	4/16/2018 12:10:54 PM
Request for Additional Information No. 424 (eRAI No. 9327).pdf	132122	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Request for Additional Information No. 424 (eRAI No. 9327)

Issue Date: 04/16/2018
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 20.01 - Mitigating Strategies for Beyond Design-Basis External Events (NuScale SMR design)
Application Section: 20

QUESTIONS

20.01-XX

The applicant has indicated that it intends to follow the most recent guidance regarding Mitigation Strategies for Beyond Design Basis External Events (BDBEE).

In November 2015, the staff issued draft Regulatory Guide (RG) DG-1301, “Flexible Mitigation Strategies for Beyond Design Basis Events,” ~~is~~ as proposed new RG 1.226 and identifies methods and procedures acceptable for nuclear power reactor applicants to demonstrate compliance with NRC regulations covering integrated planning and preparedness for beyond-design-basis events, as required by 10 CFR 50.155. DG-1301 endorses, with clarifications, the methods and procedures in technical document NEI 12-06, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” Revision 1A.
JLG-ISG-2012-01, Rev. 1, (February 2017) “Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design Basis External Events,” provides guidance for Mitigation Strategies for Beyond Design Basis External Events (BDBEE) and endorses NEI-12-06, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” Rev. 2. The applicant has indicated in clarification call on January 9, 2018 that the design is following the guidance in NEI 12-06, Rev 2.
NuScale Final Safety Analysis Report (FSAR) Tier 2, Section 20.1, “Mitigating Strategies for Beyond Design-Basis External Events,” states that NEI 12-06, Revision 2 is the NRC endorsed guidance for developing FLEX. Furthermore, TR-0816-50797-P, Rev. 0, “Mitigation Strategies for Extended Loss of AC Power Event,” Section 2.1.3.2, “NRC Draft Guidance,” states, in part, that DG-1301 endorses, with clarification, NEI 12-06 (Reference 13.1.16) as acceptable to meet these portions of proposed regulation (10 CFR 50.155). Reference 13.1.16 in the TR-0816-50797-P, Rev. 0 is NEI 12-06, Revision 2.

FSAR Tier 2, Table 1.9-2, “Conformance with Regulatory Criteria,” the applicant specified that the NuScale design partially conforms to RG 1.226, (i.e., Draft Regulatory Guide (DG)-1301). In addition, the applicant stated that the RG, presently in draft, endorses, NEI 12-06, Revision 1A.

The staff's understanding is that the design partially conforms to NEI 12-06, Rev. 1A, and references Rev. 2 of NEI 12-06 in the Design Certification Application (DCA), as discussed above. The staff is unclear on the partial or full conformance to NEI 12-06, Rev. 2. Considering that two different revisions are discussed in the DCA, the staff has the following clarification question.

QUESTION:

In the January 9, 2018, clarification conference call, the applciant indicated that teh NuScale design was following teh guidance in NEI 12-06, Rev. 2. Confirm whether the design partially conforms to one or both revisions of NEI 12-06. Modify the FSAR (including FSAR Tier 2 Table 1.9-2) and other applicable documents to clearly indicate conformance to the applicable revision(s) of NEI 12-06.

20.01-XX

The applicant has indicated that it intends to follow the most recent guidance regarding Mitigation Strategies for Beyond Design Basis External Events (BDBEE).

JLG-ISG-2012-01, Rev. 1, (February 2017) “Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design Basis External Events,” provides guidance for Mitigation Strategies for Beyond Design Basis External Events (BDBEE) and endorses NEI-12-06, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” Rev. 2.

TR-0816-50797-P, Rev. 0, “Mitigation Strategies for Extended Loss of AC Power Event,” as incorporated by reference (IBR) in the NuScale Design Certification Application (DCA), describes the NuScale response to extended loss of alternating current power (ELAP) in accordance with the NEI 12-06.

FSAR Tier 2, Section 20.1.4, “Spent Fuel Pool and Reactor Pool Level Instrumentation,” explains that the four (4) ultimate heat sink (UHS) level instruments are powered by the highly reliable DC power system (EDSS). FSAR Tier 2, Section 20.1.3,” Mitigating Strategies for an Extended Loss of AC Power Event,” explains that monitoring of the UHS pool level will occur in Phase 3 of Beyond Design-Basis External Events (BDBEE). Additionally, TR-0816-50797-P, Rev. 0, Section 5.6, ‘Highly Reliable Direct Current Power System,” explains that the EDSS-common (EDSS-C) batteries are designed to supply required loads for a minimum of 72 hours.

Since the EDSS provides power to the UHS level instruments for 72 hours, and the applicant, in FSAR Tier 2, Section 20.1, explained that the UHS instruments monitor parameters in Phase 3 beyond the 72 hours timeframe, the staff requested clarification about the power source for UHS instruments. Specifically, in **RAI 9100, Question 20.01-8**, the staff requested information about power source for the UHS instruments beyond 72 hours following a BDBEE.

In response to **RAI 9100, Question 20.01-8**, dated November 1, 2017 (ADAMS Accession No. ML17305A878), the applicant stated, in part, that following a BDBEE, the UHS level instruments will be powered from the EDSS-C for a minimum of 72 hours, then power to the each instrument will be provided by its instrument-specific backup battery power supply. In **RAI 9064, Question 20.01-7**, the staff asked the applicant about the UHS instrument-specific backup battery capacity. In the response to **RAI 9064, Question 20.01-7** (ADAMS Accession No. ML17320B041), dated November 16, 2017, the applicant confirmed the UHS instrument-specific backup battery capacity to be 72 hours. The applicant further stated that a replacement battery pack can be provided for the UHS instrument-specific backup battery.

Since the UHS instrument-specific backup batteries are used after 72 hours following a BDBEE, the staff is requesting information in the FSAR for how the design satisfies the NEI 12-06,

Revision 2 guidance. NEI 12-06, Section 3.2.1.3, “Initial Conditions,” Initial Condition number 7 and of TR-0816-50797-P, Section 4.2.3, Initial Event Assumption Number 8, state, in part, that other equipment, such as portable back up dc power supplies, spare batteries, may be used as onsite FLEX equipment provided it is reasonably protected from the applicable external hazards and has predetermined hookup strategies with appropriate procedures or guidance and the equipment is stored in a relative close vicinity of the site. NEI 12-06, Section 11.3, “Equipment Storage,” states that FLEX equipment should be stored and maintained in a manner that is consistent to assure that the equipment does not degrade over long periods of storage and is accessible for periodic maintenance and testing. The staff does not have sufficient information regarding how the instrument-specific backup batteries and replaceable battery pack conform to the NEI 12-06 guidance.

QUESTIONS:

1) Discuss how the UHS instrument-specific backup batteries and replaceable battery packs satisfy the NEI 12-06 guidance with respect to protection, as described above, and revise the FSAR and TR-0816-50797-P accordingly to include a discussion of conformance to NEI 12-06.

2) Identify the place in the FSAR, where the COL responsibility is discussed regarding how the UHS instrument-specific backup batteries are protected, maintained, and periodically tested. If not specified in the FSAR, provide a COL Item for the COL applicant to assure that the UHS instrument-specific backup batteries are protected, maintained, and periodically tested, with procedures in place to ensure that the batteries will be available beyond 72 hours following a BDBEE.

20.01-XX

The applicant has indicated that it intends to follow the most recent guidance regarding Mitigation Strategies for Beyond Design Basis External Events (BDBEE).

JLD-ISG-2012-03, Revision 0, “Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation,” 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. NEI 12-02, Revision 1, provides guidance for assuring reliable level indication for spent fuel pool (SFP) following beyond design basis external events (BDBEEs). Furthermore, NEI 12-02, Revision 1, states that the time duration for which SFP level instrumentation should be functional is until additional off-site resources can be obtained as well as deployed and SFP conditions stabilized as described in NEI 12-06.

NEI-12-06, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” Rev. 2, Section 3.2.2, “Minimum Baseline Capabilities,” states that each site should establish the minimum coping capabilities consistent with unit-specific evaluation of the potential impacts and

responses to an extended loss of alternating current (ac) power (ELAP) and loss of normal access to the ultimate heat sink (LUHS). In general, this coping can be in three phases:

- Phase 1: Cope relying on plant equipment.
- Phase 2: Augment or transition from plant equipment to on-site FLEX equipment and consumables to maintain or restore key functions.
- Phase 3: Obtain additional capability and redundancy from off-site equipment until power, water, and coolant injection systems are restored or commissioned.

The minimum coping capabilities assures that the key safety functions (core cooling, containment, and SFP cooling) are maintained.

In FSAR Tier 2, Section 20.1.3.1, "Phase 1," the applicant states that the key safety functions are maintained for greater than 30 days with installed plant equipment. The applicant further stated that no operator actions or supplemental equipment are necessary to perform these functions. In FSAR Tier 2, Section 20.1.3.3, "Phase 3," the applicant stated that baseline coping capability utilizing installed plant equipment is greater than 30 days, and therefore, immediate actions after 72 hours are not necessary. In the TR 0816-50797-P, Rev. 0, "Mitigation Strategies for Extended Loss of AC Power Event," Section 5.6.3, "System Response to an Extended Loss of Alternating Current Power," the applicant explains that the highly reliable direct-current power system (EDSS) provides power to the UHS level instruments (includes SFP instruments) for the 1st 72 hours following a BDBEE for post-accident monitoring (PAM) variables.

The SFP water level parameter is monitored following a BDBEE, as described in FSAR Tier 2, Section 20.1.3, "Mitigating Strategies for an Extended Loss of AC Power Event." The staff in **RAI 9100, Question 20.01-8**, requested clarification regarding the power source for the UHS level instruments beyond 72 hours following a BDBEE. In the response to **RAI 9100, Question 20.01-8**, the applicant stated, in part, that when the EDSS batteries are depleted, each UHS uses its instrument-specific backup battery power supply.

In **RAI 9064, Question 20.01-7**, the staff requested clarification regarding the UHS instrument-specific battery capacity to assure that UHS level indication was available until offsite resources were available. In response to **RAI 9064, Question 20.01-7**, the applicant stated, in part, that the capacity of the UHS instrument-specific backup battery is 72 hours, and a replacement battery pack can be provided if the instrument-specific backup battery is depleted.

Therefore, the staff notes that following a BDBEE, the EDSS provides power to the UHS instruments for the 1st 72 hours (3 days), the instrument-specific backup battery packs the next 72 hours (3 days), and the replacement battery packs for an additional 72 more hours (3 days).

It is unclear to the staff on how power is provided to the UHS instruments to meet Phase 1, which is greater than 30 days per FSAR Tier 2, Section 20.1.3.1. Furthermore, the staff is unclear on the power source for Phase 3 (i.e., beyond 30 days).

QUESTIONS:

1) Since onsite power sources (EDSS and instrument-specific backup battery packs) are used to provide power to the UHS instruments for monitoring of key safety functions following a BDBEE, please discuss how the UHS instruments are powered during Phases 1, and 3,

including up to and beyond 30 days. Please modify the FSAR to add a discussion on power sources for the UHS level instruments in Phases 1, and 3.

2) The staff understands that the UHS instrument-specific backup battery pack and UHS replacement battery pack are considered portable equipment. Confirm whether these batteries are part of the Phase 1 strategy.

3) If not specified in the FSAR, provide a COL Item for the COL applicant to assure that the power is provided to the UHS instruments during all Phases.

20.01-XX

The applicant has indicated that it intends to follow the most recent guidance regarding Mitigation Strategies for Beyond Design Basis External Events (BDBEE).

JLG-ISG-2012-01, Rev. 1, “Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design Basis External Events,” endorses NEI-12-06, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” Rev. 2, and states that NEI 12-06, Revision 2, provides an acceptable method for developing an approach to mitigate and cope with BDBEEs.

NEI-12-06, Rev. 2, Section 3.2.2, “Minimum Baseline Capabilities,” guidance states, in part, that coping in Phase 3 involves additional capability and redundancy from offsite equipment until power, water, and coolant injection systems are restored or commissioned. Since the applicant in response to **RAI 9100, Question 20.01-8**, and **RAI 9064, Question 20.01-7**, explained that the NuScale design relies on onsite power sources, the staff is requesting information regarding how the NuScale design conforms to the Phase 3 guidance in NEI-12-06, Rev. 2.

QUESTION:

Since the NuScale design relies on onsite plant equipment for Phase 3, please discuss how the design conforms to the Phase 3 guidance of relying on offsite resources, as discussed in NEI 12-06, Rev. 2, or provide a justification for not conforming to the guidance.

20.01-XX

The applicant has indicated that it intends to follow the most recent guidance regarding Mitigation Strategies for Beyond Design Basis External Events (BDBEE).

Japan Lesson-Learned Project Directorate Interim Staff Guidance (JLD-ISG)-2012-01, Revision 1, “Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for BDBEE,” endorses Nuclear Energy Institute (NEI) 12–06, “Diverse and Flexible Strategies (FLEX) Implementation Guide,” Revision 2. NEI-12-06, Rev. 2, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” Section 3.2.2, “Minimum Baseline Capabilities,” explains that areas requiring access for instrumentation monitoring or equipment operation may require lighting as necessary to perform essential functions. In addition, 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 guidance for spent fuel pool (SFP) instrumentation.

Technical Report (TR)-0816-50797-P, Rev. 0, “Mitigation Strategies for Extended Loss of AC Power Event,” Section 5.6, states that the highly reliable DC power system (EDSS) is the source of power to the main control room (MCR) emergency lighting, with the EDSS providing power to loads for 72 hours following a BDBEE. To establish whether lighting was needed in the MCR for monitoring the ultimate heat sink (UHS) instruments after 72 hours following a BDBEE, the staff in **RAI 9100, Question 20.01-9** requested additional information for the power source for the emergency lighting in the MCR. In response to **RAI 9110, Question 20.01-9**, the applicant stated that the NuScale Power Plant design does not require emergency lighting in the MCR beyond 72 hours following a design basis event; therefore, there is no power source for MCR lighting in Phase 3 (i.e. beyond 72 hours in a BDBEE scenario).

The UHS and SFP water levels are monitored for FLEX strategies as described in FSAR Tier 2, Section 20.1.3, “Mitigating Strategies for an Extended Loss of AC Power Event.” In FSAR Tier 2, Section 20.1.3.3, “Phase 3,” the applicant states that the Phase 3 FLEX strategy is to monitor UHS pool level, utilizing the level instruments. NEI 12-02 provides guidance for trained personnel to monitor the SFP instruments, and specifically, Section 3.9, “Display,” states that trained personnel shall be able to monitor the SFP water level from the control room, alternate shutdown panel, or appropriate and accessible location.

Since the UHS instruments are being monitored beyond 72 hours following a BDBEE, and Section 3.2.2 of the NEI 12-06 guidance explains that lighting may be required for instrumentation monitoring, the staff would like information about lighting needed in the accessible location (e.g. Remote Shutdown Panel or another appropriate location) for trained personnel to monitor the UHS instruments (includes SFP instruments) following a BDBEE.

Also, in response to **RAI 9064, Question 20.01-7**, the applicant explained EDSS is equipped to power the UHS instruments for minimum of 72 hours (3 days), then the instrument-specific battery packs then provides power for 72 hours (3 days). The applicant in response to **RAI 9064, Question 20.01-7**, stated in part that the instrument-specific battery packs can be replaced by a replacement battery pack once depleted. Staff would like information about lighting needed for UHS instrument battery pack replacement after 6 days following a BDBEE.

QUESTIONS:

1) At what location are the UHS instruments monitored (i.e. MCR, RSS or other location)? Please discuss the lighting provided and the power sources for the lighting for trained personnel to monitor UHS parameters and provide a summary in the FSAR, if needed.

2) Since the UHS instrument-specific batteries are replaced after 6 days, discuss the lighting available for trained personnel to replace UHS instrument-specific battery packs.