NuScaleDCRaisPEm Resource

From: Chowdhury, Prosanta
Sent: Thursday, May 3, 2018 4:51 PM
To: Request for Additional Information
Cc: Lee, Samuel; Cranston, Gregory; Tabatabai, Omid; Karas, Rebecca; Budzynski, John; NuScaleDCRaisPEm Resource
Subject: Request for Additional Information No. 463 eRAI No. 9486 (20.01)
Attachments: Request for Additional Information No. 463 (eRAI No. 9486).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.

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Licensing Branch 1 (NuScale)
Division of New Reactor Licensing
Office of New Reactors
U.S. Nuclear Regulatory Commission
301-415-1647

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Request for Additional Information No. 463 (eRAI No. 9486)

Issue Date: 05/03/2018
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:

QUESTIONS

20.01-17

Regulatory Basis:

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. In SECY 12-0025, the staff provided the Commission with proposed orders requiring mitigation strategies for beyond-design-basis external events to be issued to all power reactor licensees and holders of construction permits. In the paper, the staff indicated that for New Reactors that are currently under active staff review, the staff plans to ensure that the Commission-approved Fukushima recommended actions are addressed prior to licensing. On March 12, 2012, the NRC issued Orders EA-12-049 requiring operating nuclear plants to develop and implement strategies that will allow them to cope without ac power for an indefinite amount of time. The strategies must ensure that the reactor core and spent fuel pool are adequately cooled, and containment function is maintained. Currently the NRC is using JLD-ISG-2012-01, “Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,” which endorses NEI 12-06, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” as guidance for review of how a reactor design responds to an external beyond-design-basis event. The Commission is currently proposing to amend its regulations to establish regulatory requirements for nuclear power reactor applicants and licensees to mitigate beyond-design-basis events (FRN Vol. 80, No. 219 pages 70610-701647, dated November 13, 2015), and such rule would put the responsibility of addressing the plant response to a beyond-design-basis to the COL applicant. Because the rule is not yet final and there is not an SRP or DSRS section covering this chapter, the staff is using the JLD-ISG-2012-01 guidance to review this chapter.

Background:

During the Chapter 20.1 audit, the staff reviewed the station blackout transient analysis, which includes analytic results in support of the Extended Loss of AC Power (ELAP) conclusions in FSAR Chapter 20, and observed large fluctuations of the following parameters:

- Steam generator water level from 18 - 24 hours during DHRS operation and from 24 - 47 hours during ECCS operation,
- Energy transfer rates from 18 - 24 hours,
- ECCS flow rates from 24 - 72 hours,

- Core exit and lower riser void fractions form 18 – 24 hours during DHRS operation, and 24-72 hours during ECCS operation, and
- Core temperatures from 18 - 24 hours.
- DHRS flow rate from 18 - 24 hours.

Request:

The staff requests the applicant to:

1. Identify and describe in sufficient detail the mechanism(s) responsible for the large fluctuations during DHRS operation from 18 - 24 hours, and
2. Identify and describe in sufficient detail the mechanism(s) responsible for the large fluctuations during ECCS operation, after 24 hours, for the parameters identified above, and
3. Provide an explanation of the effects on the core parameters due to these fluctuations.

20.01-18

Regulatory Basis:

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. In SECY 12-0025, the staff provided the Commission with proposed orders requiring mitigation strategies for beyond-design-basis external events to be issued to all power reactor licensees and holders of construction permits. In the paper, the staff indicated that for New Reactors that are currently under active staff review, the staff plans to ensure that the Commission-approved Fukushima recommended actions are addressed prior to licensing. On March 12, 2012, the NRC issued Orders EA-12-049 requiring operating nuclear plants to develop and implement strategies that will allow them to cope without ac power for an indefinite amount of time. The strategies must ensure that the reactor core and spent fuel pool are adequately cooled, and containment function is maintained. Currently the NRC is using JLD-ISG-2012-01, “Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,” which endorses NEI 12-06, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” as guidance for review of how a reactor design responds to an external beyond-design-basis event. The Commission is currently proposing to amend its regulations to establish regulatory requirements for nuclear power reactor applicants and licensees to mitigate beyond-design-basis events (FRN Vol. 80, No. 219 pages 70610-701647, dated November 13, 2015), and such rule would put the responsibility of addressing the plant response to a beyond-design-basis to the COL applicant. Because the rule is not yet final and there is not an SRP or DSRS section covering this chapter, the staff is using the JLD-ISG-2012-01 guidance to review this chapter.

Background:

During an audit, NRC staff identified that the station blackout analysis, which is referenced in the Extended Loss of AC Power calculation as forming the basis for multiple conclusions, uses assumed "nominal" design characteristics for the emergency core cooling system (ECCS)

valves, and that verification of these assumed characteristics was not performed. Additionally, based on statements made in the station blackout engineering calculation, the applicant does not intend to verify the assumed ECCS valve characteristics used in the station blackout analysis. This is causing NRC staff to question whether the modeling of the ECCS valves in the station blackout analysis is suitable.

Request:

NRC staff requests that the applicant provide evidence to demonstrate that the modeling of the ECCS valves in the station blackout analysis is consistent with design commitments made in the NuScale design certification application.

20.01-19

Regulatory Basis:

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. In SECY 12-0025, the staff provided the Commission with proposed orders requiring mitigation strategies for beyond-design-basis external events to be issued to all power reactor licensees and holders of construction permits. In the paper, the staff indicated that for New Reactors that are currently under active staff review, the staff plans to ensure that the Commission-approved Fukushima recommended actions are addressed prior to licensing. On March 12, 2012, the NRC issued Orders EA-12-049 requiring operating nuclear plants to develop and implement strategies that will allow them to cope without ac power for an indefinite amount of time. The strategies must ensure that the reactor core and spent fuel pool are adequately cooled, and containment function is maintained. Currently the NRC is using JLD-ISG-2012-01, “Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,” which endorses NEI 12-06, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” as guidance for review of how a reactor design responds to an external beyond-design-basis event. The Commission is currently proposing to amend its regulations to establish regulatory requirements for nuclear power reactor applicants and licensees to mitigate beyond-design-basis events (FRN Vol. 80, No. 219 pages 70610-701647, dated November 13, 2015), and such rule would put the responsibility of addressing the plant response to a beyond-design-basis to the COL applicant. Because the rule is not yet final and there is not an SRP or DSRS section covering this chapter, the staff is using the JLD-ISG-2012-01 guidance to review this chapter.

Background:

In the station blackout transient analysis, Table A-5, Parameter Extreme Values and Timing Summary for Case: EDSS Available, the total final value of mass flow rate through the RRVs is approximately 5 times greater than the total mass flow rate through the RVVs. This indicates that the RPV level is increasing above the core, which is conservative for reactor core protection. However, if this mass flow rate imbalance continues beyond 72 hours, there is a potential for vortexing through the RRVs where eventually mostly steam is flowing through

RRVs. In this case, the ECCS heat transfer function is impacted, which may have an adverse effect on core parameters, particularly the fuel temperature.

Request:

The staff requests the applicant to

1. provide an explanation for the difference between the mass flow rates at and beyond 72 hours,
2. demonstrate that vortexing does not occur beyond 72 hours and include the design elevation of the RRVs and the analytical CNV water level,
3. provide the elevation difference between the CNV water level and RRV intake centerline at 72 hours, and
4. discuss, if vortexing is occurring, the impact it has on ECCS heat transfer capability, effects on core parameters, boron dilution and precipitation.