NuScaleDCRaisPEm Resource

From:	Chowdhury, Prosanta
Sent:	Tuesday, May 1, 2018 4:45 PM
To:	Request for Additional Information
Cc:	Lee, Samuel; Cranston, Gregory; Franovich, Rani; Karas, Rebecca; Thomas, Matt; NuScaleDCRaisPEm Resource
Subject:	Request for Additional Information No. 456 eRAI No. 9478 (15.01.05)
Attachments:	Request for Additional Information No. 456 (eRAI No. 9478).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)
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U.S. Nuclear Regulatory Commission
301-415-1647

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Request for Additional Information No. 456 (eRAI No. 9478)

Issue Date: 05/01/2018
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 15.01.05 - Steam System Piping Failures Inside and Outside of Containment (PWR)
Application Section:

QUESTIONS

15.01.05-2

In accordance with 10 CFR 52.47(a)(2)(iv)(A) and 10 CFR 52.47(a)(2)(iv)(B), an evaluation and analysis of the postulated fission product release events must demonstrate that a dose to an individual at any point on the boundary of the exclusion area for any 2-hour period following the onset of the postulated fission product release will not exceed 25 roentgen equivalent man (rem) total effective dose equivalent (TEDE), and that a dose to an individual at any point on the outer boundary of the low population zone (LPZ) shall not exceed 25 rem TEDE from exposure to the radioactive cloud resulting from the postulated fission product release.

To meet the requirements mentioned above, as they relate to the steam system piping failure events, the accident analysis should assume initial conditions and input parameters that maximize the severity of the accident by maximizing the mass and energy release out of the break.

In Final Safety Analysis Report (FSAR) Tier 2, Section 15.1.5.3.2, "Input Parameters and Initial Conditions," under the "[steam line break (SLB)] Cases Resulting in Limiting Radiological Consequences" heading, the applicant states that, for the two limiting radiological consequences cases it analyzed, nominal intial conditions are used. The staff understands that biasing certain initial conditions, within their uncertainty ranges and tolerances, can exacerbate the severity of the event. Based on the docketed information, the staff cannot understand why the applicant's current assumptions (i.e. nominal initial conditions) make the event limiting with respect to maximizing the mass and energy release through the break. The staff requests the applicant to justify in the FSAR its current assumptions of using nominal initial conditions as opposed to using conservatively biased initial conditions for the limiting radiological consequences SLB case. If justification cannot be provided, the staff requests the applicant to provide in the FSAR the results of a limiting radiological consequences SLB case that utilizes conservatively biased initial conditions and input parameters. The staff requests the applicant to make changes to the FSAR as necessary.

15.01.05-3

10 CFR 50, Appendix A, General Design Criterion (GDC) 28, "Reactivity limits," requires that the reactivity control systems shall be designed with appropriate limits on the potential amount and rate of reactivity increase to ensure that the effects of postulated reactivity accidents will neither (1) result in damage to the reactor coolant pressure boundary greater than limited local yielding nor (2) sufficiently disturb the core, its support structures or other reactor pressure vessel internals to impair significantly the capability to cool the core. These postulated reactivity

accidents shall include consideration of rod ejection (unless prevented by positive means), rod dropout, steam line rupture, changes in reactor coolant temperature and pressure, and cold water addition.

To meet GDC 28, as it relates to a steam line break that minimizes the critical heat flux ratio in the core, the applicant should demonstrate that the potential amount and rate of reactivity increase due to the steam line break cooldown does not produce a minimum critical heat flux ratio (MCHFR) that sufficiently disturbs the core and impairs significantly the capability to cool it.

In FSAR Tier 2, Section 15.1.5.3.2, "Input Parameters and Initial Conditions," the applicant states that initial conditions and assumptions used in the evaluation of a SLB result in a conservative calculation. The staff, as part of the Chapter 15 audit, reviewed calculation files that support this statement. For the limiting MCHFR case, the staff could not verify some initial condition assumptions used that supposedly would result in conservative calculations. For example, the staff could not verify the SG heat transfer and tube plugging/fouling assumption used for the limiting MCHFR case. The staff understands that a high steam generator (SG) heat transfer bias along with no tube plugging/fouling will exacerbate the cooldown resulting in a more pronounced increase in power and thus a more limiting MCHFR. Because the staff cannot verify the conservative nature of some input parameters/assumptions, the staff cannot determine if the applicant's analysis meets GDC 28. The staff requests the applicant to provide in the FSAR the assumptions used for important parameters directly affecting the outcome of the case, e.g. in the case of the limiting MCHFR the applicant should provide the SG heat transfer uncertainty and tube plugging/fouling assumptions used.

The staff also notes that in FSAR Tier 2, Section 15.1.5.3.2, under the heading "Steam Line Break Cases Resulting in the Limiting Minimum Critical Heat Flux Ratio," the applicant states: "the most negative [moderator temperature coefficient (MTC)] and least negative doppler temperature coefficient (DTC)] are used to ***minimize*** the power response for this event." The staff believes "minimize" should actually read "maximize," since a cooldown with a strongly negative MTC will accentuate the power increase. The staff requests the applicant to consider this potential error and make any necessary changes to ensure the information in the FSAR is clear and consistent if it is not already so.