NuScaleDCRaisPEm Resource

From: Cranston, Gregory
Sent: Friday, May 26, 2017 4:13 PM
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Cc: NuScaleDCRaisPEm Resource; Lee, Samuel; Chowdhury, Prosanta; Karas, Rebecca; Thomas, Matt
Subject: RE: Request for Additional Information No. 36, RAI 8815
Attachments: Request for Additional Information No. 36 (eRAI No. 8815).pdf

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

Please submit your 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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301-415-0546

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Request for Additional Information No. 36 (eRR No, 8815)

Issue Date: 05/26/2017
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 15 - Introduction - Transient and Accident Analyses
Application Section: 15

QUESTIONS

15-2

In accordance with 10 CFR 50 Appendix A GDC 35, "Emergency Core Cooling," the emergency core cooling system (ECCS) safety function shall be to transfer heat from the reactor core following any loss of reactor coolant at a rate such that (1) fuel and clad damage that could interfere with continued effective core cooling is prevented and (2) clad metal-water reaction is limited to negligible amounts. Suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and containment capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished, assuming a single failure. The staff notes that the applicant departs from GDC 35 by adopting principle design criteria (PDC) 35 presented in FSAR Tier 2, Section 3.1.

To meet the requirements mentioned above, as they relate to the ECCS providing abundant core cooling during an accident, the accident analysis should show that fuel and clad damage that could interfere with continued effective core cooling is prevented assuming a single failure.

In FSAR Tier 2, Section 15.0.0.5, "Limiting Single Failures," the applicant discusses, in general, how single failures are applied throughout the accident analysis. However, the applicant does not discuss an ECCS valve single failure, in terms of failing to remain closed when required to be closed. The staff notes that when an ECCS valve fails by opening when required to stay closed, the resulting transient could produce more limiting consequences in terms of minimum critical heat flux ratio (MCHFR), containment pressure, etc. One example of this is given in FSAR Tier 2, Section 15.6.6, "Inadvertent Operation of Emergency Core Cooling System," and is discussed in the following paragraph.

The staff understands that, for the NuScale design, as discussed in FSAR Tier 2, Section 6.3 and Section 15.6.6, in order for the ECCS valves to open, two things need to happen: 1.) the direct current (DC) solenoid-operated trip pilot valve must open either on an ECCS actuation signal or loss of power; and 2.) the inadvertent actuation block (IAB) valve must open. As stated in FSAR Tier 2, Section 15.6.6.1, "Identification and Causes of Accident Description," the staff recognizes that the applicant does not analyze this event assuming the cause described above where two things need to occur. However, the applicant analyzes this event assuming the cause of the ECCS valve opening is a mechanical failure of the valve itself and takes no single failure in the analysis. Assuming a loss of all power and applying a single failure to one IAB valve in the applicant's current analysis in FSAR Tier 2, Section 15.6.6, then, concurrent with the initiating event (i.e. one ECCS valve fails mechanically and opens) another ECCS valve opens at time t=0 due to a loss of power to its DC solenoid-operated trip pilot valve and a single failure of its IAB valve. Applying the above assumptions results in two ECCS valves opening at time t=0 with the reactor still at power (the staff notes there is a delay in reactor trip after a loss of all power at time t=0). The resulting minimum departure from nucleate boiling ratio (MDNBR) of this event could be more limiting than how the applicant currently analyzes the event in the FSAR. Furthermore, reviewing other Chapter 15 events, the staff understands that taking the single failure of an IAB valve may produce more severe consequences than what the applicant has currently analyzed.

Based on docketed information, the staff is unable to determine if the applicant's current Chapter 15 analyses represent the most limiting events because the applicant does not apply the single failure assumption to the IAB valve. Furthermore, the staff recognizes that GDC 35 requires application of the single failure. The staff requests the applicant provide justification in the FSAR for why it does not assume the single failure of an IAB valve in any of the Chapter 15 accident analyses. The staff requests the applicant to modify the FSAR as necessary to address the single failure of an IAB concern.