NuScaleDCRaisPEm Resource

From:	Cranston, Gregory
Sent:	Friday, March 22, 2019 2:57 PM
To:	Request for Additional Information
Cc:	Lee, Samuel; Hayes, Michelle; Schaperow, Jason; Franovich, Rani; Chowdhury, Prosanta; NuScaleDCRaisPEm Resource
Subject:	Request for Additional Information No. 521 eRAI No. 9672 (19)
Attachments:	Request for Additional Information No. 521 (eRAI No. 9672).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 by May 22, 2019, to the RAI to the NRC Document Control Desk.

If you have any questions, please contact me.

Thank you.

Hearing Identifier: NuScale_SMR_DC_RAI_Public
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Request for Additional Information No. 521 (eRAI No. 9672)

Issue Date: 03/22/2019
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 19 - Probabilistic Risk Assessment and Severe Accident Evaluation
Application Section: 19

QUESTIONS

19-40

Regulatory Basis

10 CFR 52.47(a)(23) states that a DC application for light-water reactor (LWR) designs must contain an FSAR that includes a description and analysis of design features for the prevention and mitigation of severe accidents. Standard Review Plan (SRP) Section 19.0 includes the following guidance for the NRC reviewer to ensure that 10 CFR 52.47(a)(23) is met:

…the reviewer carries out an independent assessment of the plant response to selected severe accident scenarios using the latest version of the MELCOR computer code. The assessment should examine accident scenarios from the PRA, which are chosen based on a combination of frequency, consequence, and dominant risk. Some of these scenarios should be similar or identical to sequences analyzed by the applicant and reported in the PRA. The reviewer compares the results of corresponding sequences and release categories in the two studies. If the results of the assessment do not support and confirm the applicant's simulation of the accident progression, analysis methodology, and interpretations of its analyses of the reactor, containment, and system response to severe accidents, the reviewer engages with the applicant to resolve the differences in results.

The additional information requested by this RAI is necessary for the staff to make a reasonable assurance of safety finding related to the accident scenarios analyzed in Chapter 19 of the NuScale design certification application (DCA). Specifically, it will support the staff confirmation that the applicant's PRA and analysis of severe accident mitigation has sufficient technical acceptability to support the staff's finding that the NuScale design meets the Commission safety goals and containment performance objectives for new reactor designs as described in SECY-90-016, SECY-93-087, and the associated Staff Requirements Memoranda.

Request for additional information

In accordance with SRP Section 19.0, the staff selected the following three scenarios for detailed analysis using the staff's independently developed MELCOR model:

- Reactor vent valve (RVV) loss of coolant accident (LOCA). The initiator is a spurious opening of one RVV. The other 2 RVVs open when called on by the emergency core cooling system (ECCS) and permitted by the inadvertent actuation block. The reactor safety valves (RSVs) are operable. All injection and cooling systems (i.e., chemical and volume control system (CVCS), containment flooding and drain system (CFDS), and decay heat removal system (DHRS) fail. This scenario is summarized in DCA Part 2 Tier 2, Section 19.2.3.2 under the heading LEC-06T-00 and is documented in detail in non-docketed NuScale document ER-P060-4748.

- CVCS LOCA inside containment. The initiator is a charging line break inside containment. All three RVVs open when called on by the ECCS and permitted by the inadvertent actuation block. The RSV is operable. All injection and cooling systems (i.e., CVCS, DHRS, and CFDS) fail. This scenario is summarized in DCA Part 2 Tier 2, Section 19.2.3.2 under the heading LCC-05T-01 and is documented in detail in non-docketed NuScale document ER-P060-4749.

- CVCS LOCA outside containment. The initiator is a charging line break outside containment. No ECCS valves open. The RSV is operable. All injection and cooling systems (i.e., CVCS, DHRS, and CFDS) fail. This scenario is summarized in DCA Part 2 Tier 2, Section 19.2.3.2 under the heading LCU-03T-01 and is documented in detail in non-docketed NuScale document ER-P060-4750.

The staff ran simulations of the above three scenarios with its independently developed MELCOR model and will compare the results to those of the applicant. For each scenario, the staff will produce a timing-of-events table comparing the staff's and the applicant's results side by side. In addition, the staff will produce plots comparing the staff's and the applicant's results on the same chart. To enable the staff to make detailed comparisons per the above SRP Section 19.0 review guidance to help identify any potential issues with the applicant's safety analysis, the staff requests that the applicant provide the following information for each of the above three scenarios. The staff requests this information in electronic format to facilitate creating comparison plots.

- Total decay power

- Total oxidation power
- Pressure and temperature for the following locations:
    - Pressurizer
    - Reactor pressure vessel (RPV) riser
    - Core region
    - RPV lower plenum
    - Steam generators
    - Containment vessel (CNV) upper plenum
    - CNV lower plenum
- Instantaneous and integrated flow rates for the following locations:
    - RSVs
    - ECCS valves (reactor recirculation valves (RRVs) and RVVs)
    - CVCS break paths
    - CNV design leakage
    - Steam generator relief valves
- RPV, steam generator, and CNV water level and water mass
    - For RPV, provide swollen and collapsed liquid level
    - For steam generators, include water mass in all secondary lines that is in communication with the steam generators after the steam generators are assumed to isolate from the power conversion system at the beginning of the accident (NuScale's MELCOR variables FWIC, MSIC, DHRS)
- Cladding and corium temperature for each node
- RPV lower plenum and CNV lower plenum corium debris masses
- RPV lower head and CNV lower head heat structure temperature
- RPV lower head and CNV lower head heat loss
- Mole fraction of gasses (steam, oxygen, carbon dioxide, nitrogen, hydrogen, carbon monoxide) in the lower and upper head of the RPV and CNV
- Integrated hydrogen and carbon monoxide generation
- Released mass fraction of fission products from the fuel for each MELCOR class (as a fraction of core inventory)
- Fission product release (as a fraction of core inventory) in the following locations for each MELCOR class (both airborne and deposited)
    - Reactor coolant system
    - CNV

- Reactor building