NuScaleTRRaisPEm Resource

From: Chowdhury, Prosanta
Sent: Tuesday, June 5, 2018 9:19 AM
To: NuScaleTRRaisPEm Resource
Subject: Request for Additional Information Letter No. 9158 (eRAI No. 9158) Topical Report, Non-LOCA Analysis Methodology, 15.00.02, SRSB
Attachments: Request for Additional Information No. 9158 (eRAI No. 9158).pdf

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

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

The passcode will be sent separately.

If you have any questions, please contact me.

Thank you.

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Request for Additional Information No. 9158 (eRAI 9158)

Issue Date: 04/02/2018
Application Title: NuScale Topical Report
Operating Company: NuScale
Docket No. PROJ0769
Review Section: 15.00.02 - Review of Transient and Accident Analysis Methods 01/2006
Application Section: TR-0516-49416-P, Non-LOCA Analysis Methodology

QUESTIONS

15.00.02-1

EMDAP, Step 4: PIRT Evaluation

Topical report (TR) TR-0516-49416-P, "Non-Loss-of-Coolant Accident [Non-LOCA] Analysis Methodology," supports the conclusions in the NuScale Final Safety Analysis Report (FSAR), which under 10 CFR 52.47 must describe the facility, present the design bases and the limits on its operation, and present a safety analysis of the structures, systems, and components and of the facility as a whole.

Regulatory Guide (RG) 1.203, "Transient and Accident Analysis Methods," describes a process that the NRC staff considers acceptable for use in developing and assessing evaluation models (EMs) used to analyze transient and accident behavior. Step 4 of RG 1.203 discusses the identification and ranking of key phenomena and processes and states:

> *"When the identification has been completed, the ranking process begins. The reason to numerically rank the processes and phenomena is based on the need to provide a systematic and consistent approach to all subsequent EMDAP* [evaluation model development and assessment process] *activities."*

Section 5.1.4 of TR-0516-49416-P discusses the HIGH-ranked phenomena in the non-LOCA EM phenomena identification and ranking table (PIRT). TR-0516-49416-P, Section 5.2 discusses the methods by which the HIGH-ranked phenomena were addressed: assessment as part of the LOCA EM, additional code assessment performed against separate effects test (SET) or integral effects test (IET) data, code-to-code benchmarks, in the downstream subchannel analysis, or by specifying appropriately conservative input to the system transient analysis. TR-0516-49416-P, Table 5-3 shows that some HIGH-ranked phenomena were addressed through these methods, while others were addressed as follows:

- References to tests used in the LOCA EM development that have not been demonstrated to be applicable to the non-LOCA EM.
- Statements that have no referenced bases.
- Unclear references to other topical reports.
- Unreferenced evaluations.

The multiple processes for addressing the HIGH-ranked phenomena are not consistent or clear.

Information Requested:

Clarify the evaluations of the non-LOCA HIGH-ranked phenomena as follows:

1. For those non-LOCA HIGH-ranked phenomena that are addressed by other methodologies, update TR-0516-49416-P to cross-reference specific sections in the appropriate methodology document (e.g., the LOCA TR), as appropriate, and to describe how those methodologies address the HIGH-ranked phenomena.
2. Provide additional information, such as a summary of calculation results or references to specific tests, that demonstrates the stated behavior for the following items:
    - 5.1.4.41 - [[ ]] ,
    - 5.1.4.43 - [[ ]] ,
    - 5.1.4.44 - [[ ]] ,
    - 5.1.4.56 - [[ ]] : in particular, justify why this HIGH-ranked phenomenon is included if, according to TR Table 5-3, it can be neglected.
3. Update TR-0516-49416-P with the information requested in b. It is acceptable to incorporate this information by reference.

15.00.02-2

NIST TEST NLT-2a

TR-0516-49416-P supports the conclusions in the NuScale FSAR, which under 10 CFR 52.47 must describe the facility, present the design bases and the limits on its operation, and present a safety analysis of the structures, systems, and components and of the facility as a whole.

RG 1.203 describes the EMDAP, which the NRC staff considers acceptable for use in developing and assessing EMs used to analyze transient and accident behavior. Basic principle (4) of the EM development and assessment states:

> *"A key feature of the adequacy assessment is the ability of the EM or its component devices to predict appropriate experimental behavior. Once again, the focus should be on the ability to predict key phenomena, as described in the first principle."*

TR-0516-49416-P, Section 5.3.3.5 compares the NRELAP5 simulation results with the measured data from test NLT-2a and states that the discrepancy between the NRELAP5 [[ ]]. However, the documentation does not demonstrate that the code is capable of predicting the appropriate experimental behavior when the appropriate [[ ]] are represented in the model.

Information Requested:

a. Describe the basis for not using the same [[ ]] in the NRELAP5 simulation as was present in the test.
b. Assess the impact including accounting for uncertainties in the heat structures on the NRELAP5 simulations and the assessment compared to the calculations in TR-0516-49416-P if the [[ ]] that was present in the test were to be used in the simulation.

Update TR-0516-49416-P as appropriate.

15.00.02-3

NIST TEST NLT-2b, Phase 1

TR-0516-49416-P supports the conclusions in the NuScale FSAR, which under 10 CFR 52.47 must describe the facility, present the design bases and the limits on its operation, and present a safety analysis of the structures, systems, and components and of the facility as a whole.

RG 1.203 describes the EMDAP, which the NRC staff considers acceptable for use in developing and assessing EMs used to analyze transient and accident behavior. RG 1.203 discusses the identification and performance of SETs and IETs to complete the database against which the adequacy of the EM will be assessed. The EM should be capable of predicting experimental data, and wherever calculated results disagree with experimental data, causes for the discrepancy and the importance of the deficiency should be explained.

TR-0516-49416-P, Section 5.3.3.7 compares the NRELAP5 simulation results to the measured data for test NLT-2b and attributes the [[ ]] . In addition, the predicted conditions in Phase 1 of the test are generally poor, as exemplified by Figures 5-55, 5-58, 5-59, 5-65, 5-69, and 5-70, and lack adequate discussion. Consequently, the EM documentation for this test assessment is not complete.

Information Requested:

Provide further justification, preferably the results of evaluations or sensitivity studies, to confirm that NRELAP5 can adequately simulate test NLT-2b conditions. Update TR-0516-49416-P as appropriate.

15.00.02-4

NIST Test NLT-2b, Phase 4

TR-0516-49416-P supports the conclusions in the NuScale FSAR, which under 10 CFR 52.47 must describe the facility, present the design bases and the limits on its operation, and present a safety analysis of the structures, systems, and components and of the facility as a whole.

RG 1.203 describes the EMDAP, which the NRC staff considers acceptable for use in developing and assessing EMs used to analyze transient and accident behavior. RG 1.203 discusses the identification and performance of SETs and IETs to complete the database against which the adequacy of the EM will be assessed. The EM should be capable of predicting experimental data, and wherever calculated results disagree with experimental data, causes for the discrepancy and the importance of the deficiency should be explained.

Several aspects of the NLT-2b Phase 4 benchmarking studies in TR-0516-49416-P, Section 5.3.3.10 need further clarification. The condensate temperature is [[ ]] . Furthermore, the overall heat removal (Figures 5-115 and 5-116) is [[ ]] , yet the core inlet temperature (Figure 5-112) and SG outlet temperature (Figure 5-121) appear to be reasonably predicted. Finally, the statement in TR Section 5.3.3.11 that “integral response is insensitive to the CPV temperature response” is not supported.

Information Requested:

a. Provide the rationale for [[ ]] .
b. Explain the [[ ]] .
c. Explain the [[ ]].
d. Explain the basis for the statement that “integral response is insensitive to the CPV temperature response.” In addition, perform and provide the results of a sensitivity calculation that uses the prescribed CPV temperatures based on the measurements [[ ]].

Update TR-0516-49416-P as appropriate based on the above requests.

15.00.02-5

Assessment of NRELAP5 Using SIET Fluid Heated Test Facility (TF-2) Data (EC-T050-3638)

TR-0516-49416-P supports the conclusions in the NuScale FSAR, which under 10 CFR 52.47 must describe the facility, present the design bases and the limits on its operation, and present a safety analysis of the structures, systems, and components and of the facility as a whole.

RG 1.203 describes the EMDAP, which the NRC staff considers acceptable for use in developing and assessing EMs used to analyze transient and accident behavior. Step 7 of the EMDAP discusses the identification and performance of SETs and IETs to complete the database against which the EM will be assessed. Furthermore, Step 17 discusses the determination of the applicability of the model to simulate system components and states that before performing integrated analyses, the various EM options, special models, and inputs should be determined to have the inherent capability to model the major systems and subsystems required for the particular application.

The staff audited document EC-T050-3638, “Assessment of NRELAP5 Using SIET Fluid Heated Test Facility (TF-2) Data,” the purpose of which is to assess the NRELAP5 modeling of heat transfer and pressure drop on the primary and secondary sides of the helical coil SG. As described in that document, the NRELAP5 simulation of the experiments used a number of assumptions and heat transfer modeling options. The comparison of NRELAP5 calculations to the test data indicates that:

- Case 1 (using heat transfer geometry [[ ]]) shows the best agreement with the heated tests.
- The low primary flow tests were [[ ]].

Low flow is an inherent characteristic of the NPM response during a non-LOCA event, particularly during the periods exhibiting the stall-and-chug response. Consequently, this aspect of the findings and the recommendation should be implemented to determine if modifications to the non-LOCA evaluation model are needed.

Information Requested:

TR-0516-49416-P, Section 5.3.5 discusses the modeling of the NPM SG and the use of SIET test data, including the impact of nodalization studies. However, neither EC-T050-3638 nor TR-0516-49416-P, Section 5.3.5 discuss how the information gained from the experimental benchmarking studies was implemented in the NPM model. Describe how the findings and

recommendation noted above have resulted in any modeling changes to the NuScale power module for non-LOCA events, or provide a summary of the studies showing that the existing model is adequate. Update TR-0516-49416-P as appropriate.