

NuScaleTRRaisPEm Resource

From: Bavol, Bruce
Sent: Monday, May 08, 2017 3:05 PM
To: NuScaleTRRaisPEm Resource
Cc: Drzewiecki, Timothy; Travis, Boyce
Subject: Topical Report - Request for Additional Information Letter No. 13 (eRAI No. 8795)
Section 04.04 - Thermal and Hydraulic Design
Attachments: RAI 8795_TR-0116-21012.docx

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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Hearing Identifier: NuScale_SMR_DC_TR_Public
Email Number: 14

Mail Envelope Properties (7c9a8dd6dcdd4302960480c6aa60e973)

Subject: Topical Report - Request for Additional Information Letter No. 13 (eRAI No. 8795) Section 04.04 - Thermal and Hydraulic Design
Sent Date: 5/8/2017 3:05:24 PM
Received Date: 5/8/2017 3:05:25 PM
From: Baval, Bruce

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Tracking Status: None

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Tracking Status: None

Post Office: HQPWMSMRS03.nrc.gov

Files	Size	Date & Time
MESSAGE	560	5/8/2017 3:05:25 PM
RAI 8795_TR-0116-21012.docx		28201

Options

Priority: Standard

Return Notification: No

Reply Requested: No

Sensitivity: Normal

Expiration Date:

Recipients Received:

RAI No. 8795

Section 04.04 - Thermal and Hydraulic Design (Questions 29724 - 29726)

TR-0116-21012, Revision 0, “NuScale Power Critical Heat Flux Correlation NSP2”

(Question 29724) 04.04 - Thermal and Hydraulic Design

Title 10 of the Code of Federal Regulations (10 CFR) Part 52, Section 47 and Section 79 require a final safety analysis report (FSAR) to analyze the design and performance of the structures, systems, and components (SSCs). Safety evaluations, performed to support the FSAR, include accident analyses to (1) demonstrate that specified acceptable fuel design limits (SAFDLs) are not exceeded during normal operation, including the effects of anticipated operational occurrences (AOOs), and (2) determine the number of fuel failures associated with critical heat flux (CHF) that need to be included in the radiological consequences for postulated accidents. An approved CHF correlation is used in establishing a SAFDL for use in such analyses. Thus, an approved CHF correlation is used to establish a partial basis for demonstrating compliance with the following applicable regulations from Title 10 of the Code of Federal Regulations (10 CFR) which include the General Design Criteria (GDCs) of Appendix A to 10 CFR Part 50:

GDC 10, Reactor design, which requires that the reactor core and associated coolant, control, and protection systems be designed with appropriate margin to assure that SAFDLs are not exceeded during any condition of normal operation, including the effects of AOOs.

10 CFR 52.47(a)(2)(iv)(A), 10 CFR 52.47(a)(2)(iv)(B), and GDC 19 as they relate to the evaluation and analysis of the radiological consequences of postulated accidents.

Section 3.1 of TR-0116-21012 describes the data sources used to develop the CHF correlation and provides the test matrices used for testing at Stern Laboratories and the KATHY test loop. NRC staff was not able to identify any discussion regarding the statistical design of the experiments. In particular, NRC staff is questioning whether randomization of the test points was conducted in an effort to preclude the potential for introducing bias into the figure of merit (i.e., CHF). As part of the review of TR-0116-21012, NRC staff needs to establish a finding that the statistical design of the experiment is acceptable. Accordingly, NRC staff requests that NuScale describe how the statistical design of experiments was treated during testing at Stern Laboratories and the KATHY test loop.

(Question 29725) 04.04 - Thermal and Hydraulic Design

Title 10 of the Code of Federal Regulations (10 CFR) Part 52, Section 47 and Section 79 require a final safety analysis report (FSAR) to analyze the design and performance of the structures, systems, and components (SSCs). Safety evaluations, performed to support the FSAR, include accident analyses to (1) demonstrate that specified acceptable fuel design limits (SAFDLs) are not exceeded during normal operation, including the effects of anticipated operational occurrences (AOOs), and (2) determine the number of fuel failures associated with critical heat flux (CHF) that need to be included in the radiological consequences for postulated accidents. An approved CHF correlation is used in establishing a SAFDL for use in such

analyses. Thus, an approved CHF correlation is used to establish a partial basis for demonstrating compliance with the following applicable regulations from Title 10 of the Code of Federal Regulations (10 CFR) which include the General Design Criteria (GDCs) of Appendix A to 10 CFR Part 50:

GDC 10, *Reactor design*, which requires that the reactor core and associated coolant, control, and protection systems be designed with appropriate margin to assure that SAFDLs are not exceeded during any condition of normal operation, including the effects of AOOs.

10 CFR 52.47(a)(2)(iv)(A), 10 CFR 52.47(a)(2)(iv)(B), and GDC 19 as they relate to the evaluation and analysis of the radiological consequences of postulated accidents.

Section 3.1.1.3 and Section 3.1.2.7 of TR-0116-21012 describe the data acquisition systems at Stern Laboratories and the KATHY test loop, respectively. These sections describe the instrumentation used to measure heater power, coolant flow, pressure, and temperature. The measurements for heater power are described as redundant and diverse at both facilities. The coolant pressure and temperature measurements are described as redundant at both facilities. The flow measurement at Stern Laboratories is described as redundant and diverse. However, from the description of the flow measurement at the KATHY test loop, it is unclear to the NRC staff whether measurement redundancy and diversity were considered. NRC staff relies upon adequate measurement redundancy and diversity to support a finding that the experimental data has been accurately measured. Accordingly, NRC staff requests that NuScale describe how flow measurement redundancy and diversity were treated for the testing at the KATHY test loop, and describe how this treatment is assessed to support application of the KATHY test loop results.

(Question 29726) 04.04 - Thermal and Hydraulic Design

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, Section 47 and Section 79 require a final safety analysis report (FSAR) to analyze the design and performance of the structures, systems, and components (SSCs). Safety evaluations, performed to support the FSAR, include accident analyses to (1) demonstrate that specified acceptable fuel design limits (SAFDLs) are not exceeded during normal operation, including the effects of anticipated operational occurrences (AOOs), and (2) determine the number of fuel failures associated with critical heat flux (CHF) that need to be included in the radiological consequences for postulated accidents. An approved CHF correlation is used in establishing a SAFDL for use in such analyses. Thus, an approved CHF correlation is used to establish a partial basis for demonstrating compliance with the following applicable regulations from Title 10 of the Code of Federal Regulations (10 CFR) which include the General Design Criteria (GDCs) of Appendix A to 10 CFR Part 50:

GDC 10, *Reactor design*, which requires that the reactor core and associated coolant, control, and protection systems be designed with appropriate margin to assure that SAFDLs are not exceeded during any condition of normal operation, including the effects of AOOs.

10 CFR 52.47(a)(2)(iv)(A), 10 CFR 52.47(a)(2)(iv)(B), and GDC 19 as they relate to the evaluation and analysis of the radiological consequences of postulated accidents.

Section 3.1.2.7 of TR-0116-21012 provides a high level discussion on the use of “reference points” at the KATHY test loop, which are used to verify test repeatability. There is no similar description of repeatability testing at Stern Laboratories within TR-0116-21012. During an audit of the KATHY test loop, NRC staff noted that, “Test repeatability [at the KATHY test loop] is verified by returning the test loop to pre-defined points and repeating tests at these points. This is in contrast to CHF testing at Stern where random state points within the testing domain are rerun.” NRC staff has not obtained sufficiently detailed information (e.g., repeatability test results, acceptance criteria) to demonstrate acceptable test repeatability for either Stern Laboratories or the KATHY test loop. As part of the review of TR-0116-21012, NRC staff needs to establish a finding that the variability in the CHF measured at repeated test points is acceptably low. Accordingly, NRC requests that NuScale provide evidence to show that repeatability tests were conducted at both Stern Laboratories and the KATHY test loop, and that the variability in the results are acceptably low.