NuScaleTRRaisPEm Resource

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TR-0516-49417-P, “Evaluation Methodology for Stability Analysis of the NuScale Power Module” RAI 8808

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TR-0516-49417-P, "Evaluation Methodology for Stability Analysis of the NuScale Power Module"
RAI 8808 Questions (29740 - 29742)

(Question 29740) 15.09 - DSRS NuScale Thermal Hydraulic Stability

Title 10 of the Code of Federal Regulations (CFR), Part 50, Appendix A, General Design Criterion (GDC) 10 – Reactor Design, states that the reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits (SAFDLs) are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences (AOOs). Title 10 of the CFR, Appendix A, GDC 12 states that the reactor core and associated coolant, control, and protection system shall be designed to assure that power oscillations which can result in conditions exceeding SAFDLs are not possible or can be reliably and readily detected and suppressed. The SRP 15.0.2 acceptance criteria with respect to evaluation models states that the chosen mathematical models and the numerical solution of those models must be able to predict the important physical phenomena reasonably well from both qualitative and quantitative points of view.

Section 5.6.4.1 of the topical report, TR-0516-49417-P, describes the pellet heat transfer model and provides a correlation for the fuel thermal time constant, but no basis is provided. To demonstrate compliance with GDCs 10 and 12:

1. Provide the technical basis for the fuel thermal time constant correlation.
2. Clarify whether the correlation is fuel-design-specific; if not, justify the application of this correlation generally.
3. Describe the method for determining the correlation in licensing calculations.

(Question 29741) 15.09 - DSRS NuScale Thermal Hydraulic Stability

Title 10 of the Code of Federal Regulations (CFR), Part 50, Appendix A, General Design Criterion (GDC) 10 – Reactor Design, states that the reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits (SAFDLs) are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences (AOOs). GDC 12 – Suppression of reactor power oscillations, states that the reactor core and associated coolant, control, and protection system shall be designed to assure that power oscillation which can result in conditions exceeding SAFDLs are not possible or can be reliably and readily detected and suppressed. The Standard Review Plan 15.0.2 acceptance criteria with respect to evaluation models states that the chosen mathematical models and the numerical solution of those models must be able to predict the important physical phenomena reasonably well from both qualitative and quantitative points of view.

Section 5.6.4.4 of the topical report, TR-0516-49417-P, describes the pellet centerline and average temperature calculations. This section is not clear as to the basis for the burnup dependent factor: "a." Further it does not provide the value used for the temperature weighting. To demonstrate compliance with GDCs 10 and 12:

1. Provide the temperature weighting.
2. Describe the method for determining the burnup dependent factor for licensing calculations. Be clear in this description if the method is fuel-design-specific.
3. Justify the method.

(Question 29742) 15.09 - DSRS NuScale Thermal Hydraulic Stability

Title 10 of the Code of Federal Regulations (CFR), Part 50, Appendix A, General Design Criterion (GDC) 10 – Reactor Design, states that the reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits (SAFDLs) are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences (AOOs). GDC 12-Suppression of reactor power oscillations, states that the reactor core and associated coolant, control, and protection system shall be designed to assure that power oscillation which can result in conditions exceeding SAFDLs are not possible or can be reliably and readily detected and suppressed. The Standard Review Plan 15.0.2 acceptance criteria with respect to evaluation models states that the chosen mathematical models and the numerical solution of those models must be able to predict the important physical phenomena reasonably well from both qualitative and quantitative points of view.

Section 5.7 of the topical report, TR-0516-49417-P, describes the source of material properties used in the PIM method. However, this section is not clear how the fuel conductivity is determined. In particular, since only an average fuel assembly is considered, the derivation of the core-average quantities is unclear. To demonstrate compliance with GDCs 10 and 12:

1. Describe the method for determining a core average fuel conductivity.
2. Describe how exposure dependence is captured.
3. Justify the method for averaging quantities across multiple exposures.