Response to SDAA Audit Question

Question Number: A-3.9.2-26

Receipt Date: 10/16/2023

Question:

"In Audit Question A-3.9.2-1, the NRC staff requested the following:

Item (a)
Provide the calculation details of the bounding transient assessment in slide 15 of PM-134372, Revision 0. Include all steps of the dynamic load analysis methodology, any uncertainty or bias associated with that methodology, the final assumed loads, and the resulting alternating stress analysis and assessment of its relative importance per ASME fatigue guidelines.

NuScale's response states that a DWO transient to be used for dynamic loading considerations is in development. The NRC staff request that NuScale provide a schedule when the requested information will be available. Without the requested information, the staff cannot make a safety finding on the steam generator component structural integrity for the standard design approval application (SDAA).

Item (b)
Provide assessments of sliding between the tubes and tube supports and any resulting long-term wear (if sliding occurs).

NuScale's response states that the licensee is responsible for the steam generator tube analysis that considers transient loading due to DWO. The NRC staff request that NuScale provide a schedule when the requested information will be available. Without the requested information, the staff cannot make a safety finding on the steam generator component structural integrity for the SDAA.

Item (d)
Include estimates of the number of cycles where the NPM could be operating at DWO

conditions during an operational cycle and between inspections, as well as over the NPM 60-year life.

NuScale's response states that the transient information is developed as part of the ASME design progression. responsible for the steam generator tube analysis that considers transient loading due to DWO. The NRC staff request that NuScale provide a schedule when the requested information will be available. Without the requested information, the staff cannot make a safety finding on the steam generator component structural integrity for the SDAA."

Response:

Item (a)
The NRC clarified that the slide of interest in PM-134372, Revision 0, "Methodology for Determination of Onset of Density Wave Oscillations Post-Application Presentation" is slide 14, not slide 15, in a call on March 27, 2023.

NuScale has provided EC-130109, Revision 2, "RPV Feedwater Plenum DWO Transient Evaluation" in the electronic reading room (eRR). Calculation EC-130109, Revision 2 evaluates the fatigue on the tube-to-tubesheet weld, tube, and tubesheet when a density wave oscillation (DWO) transient is applied to a single steam generator tube, while other analyzed tubes are at steady-state conditions.

Calculation EC-130109, Revision 2 uses the DWO transient definition shown in Figure 1. {{

}}[2(a),(c)]

Figure 1: {{

}}2(a),(c).ECI

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}}2(a),(c)

Item (b)

NuScale has provided EC-155351, Revision 0, “Steam Generator Tube Sliding and Wear Evaluation for the Low Power Density Wave Oscillation Transient” in the eRR.

Calculation EC-155351, Revision 0 provides the sliding and long-term wear results between the NuScale Power Module (NPM-20) steam generator (SG) tubes and tube supports during DWO

and is conservative, as discussed below. {{

}}2(a),(c)

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}}2(a),(c) Technical Specification 5.5.4 states:

Tubes found by inservice inspection to contain flaws with a depth equal to or exceeding 40 percent of the nominal tube wall thickness shall be plugged.

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}}2(a),(c)

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}}2(a),(c)

The maximum wear depth is expected to be conservatively large based on the conservatism used in the analyzed DWO transient and cycles.

Response to feedback given on 10/22/2024:

NuScale provides EC-155351, Revision 1, “Steam Generator Tube Sliding and Wear Evaluation for the Low Power Density Wave Oscillation Transient” in the Chapter 3 eRR.

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}}2(a),(c)

NuScale provided EC-152384, Revision 1, “Density Wave Oscillation Thermal Transient” in the Chapter 3 eRR with audit response A-3.9.1-3.

NuScale provided EC-101144, Revision 3, “Pressure and Thermal Transient Definitions for Analysis of NSSS Components” in the Chapter 3 eRR with audit response A-3.9.2-28.

Item (d)

The response to audit question A-3.9.2-28 provides a detailed update for the DWO transient along with an update to FSAR Section 3.9.

No changes to the SDAA are necessary.