Vogtle PEmails

From: Patel, Chandu
Sent: Wednesday, March 28, 2018 11:28 AM
To: 'Thomas, Corey (SNC)'; 'Sparkman, Wesley A.' (WASPARKM@southernco.com)
Cc: Vogtle PEmails; Dixon-Herrity, Jennifer; Mitchell, Matthew
Subject: Draft Request for Information for Alternate 7 for Vogtle 3 and 4
Attachments: ALT-07 Clarification Request.3-28-18.docx

Hi Corey,

Please see the attached draft RAIs for the proposed Alternative 7 for Vogtle 3 and 4. Please let me know if you need to have a clarification call as soon as possible. Otherwise we will finalize the RAIs and issue it.

Sincerely,
Chandu Patel

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Clarification Request for Vogtle, Units 3 and 4 ALT-07

The NRC staff has reviewed the information submitted by Southern Nuclear Company (SNC) in letters dated July 6, 2017, December 8, 2017, and March 8, 2018, in support of their request to perform an VT-1 for preservice inspection of the nozzle inner radius section of the Vogtle, Units 3 and 4 reactor vessel inlet, outlet, and direct vessel injection (DVI) nozzles in lieu of ultrasonic examination required by the American Society of Mechanical Engineers (ASME) Code, Section XI, Table IWB-2500-1, Examination Category B-D, Item B3.100.

In order to determine whether the operational experience from the current operating fleet applies to the AP1000 nozzles, the NRC staff requested the design stress state and operating stresses at the nozzle corner region from the AP1000 design report for each inlet, outlet, and DVI nozzle. In the March 8, 2018, letter, SNC stated that the pressure stresses in the AP1000 nozzle inner radius section are similar to operating vessels of a similar size and geometry, however, the stresses from the thermal transients would be different for the AP1000 design. Because of this difference, SNC requested, in the March 8, 2018, letter, that the NRC staff review and compare the fracture assessment performed for the AP1000 nozzle inner radius section with the fracture assessment performed for the nozzle inner radius section for the operating fleet. The fracture assessment for the nozzle corner region for the operating fleet was done as part of the technical basis for ASME Code, Section XI, Code Case N-648-1.

Finite element analyses were performed to determine the stresses for the nozzle inner radius sections for both the AP1000 and the operating fleet. The stresses were then used in a flaw tolerance evaluation.

The allowable flaw sizes in the nozzle inner radius section for the operating fleet were determined using linear elastic fracture mechanics (LEFM) in accordance with Section XI, Appendix A. The technical basis for Code Case N-648-1 states that the allowable flaw sizes for the nozzle inner radius section for the operating fleet are greater than 3 inches. The allowable flaw sizes for the AP1000 were also determined using LEFM in accordance with Section XI, Appendix A resulting in average allowable flaw sizes for the inlet, outlet, and DVI nozzles of 1.01 inches, 1.04 inches, and 0.36 inch, respectively. SNC stated that because the LEFM resulted in smaller allowable flaw sizes than for the operating fleet, they also determined the allowable flaw sizes using elastic plastic fracture mechanics (EPFM) following Code Case N-749. EPFM calculations resulted in average allowable flaw sizes for the AP1000 inlet, outlet, and DVI nozzles of 6 inches, 5 inches, and 4.75 inches, respectively.

Request #1: Provide the cumulative fatigue usage factor (CUF) from the applicable design reports for each AP1000 inlet, outlet, and DVI nozzle. In addition, provide a discussion of the basis for the CUF for each AP1000 inlet, outlet, and DVI nozzle.

Given that the material fracture toughness for the AP1000 and the operating fleet nozzles are comparable, the smaller allowable flaw sizes in the nozzle corner region for the AP1000 nozzles appear to be driven by more severe thermal stresses and thermal transients. With more severe thermal transients, the NRC staff has concerns with the nozzle inner radius regions for the AP1000 having higher CUF due to thermal fatigue. A higher CUF would mean there is a higher probability to initiate and propagate fatigue cracks during service. The NRC staff observed in the technical basis for Code Case N-648-1 that all nozzle inner radius regions for the operating fleet are cited as having CUF of less than 0.1, which means the operating fleet has a very low probability of initiating and propagating fatigue cracks during service.

Observing that, at least by comparison of the LEFM results, it cannot be determined that the critical flaw sizes for the AP1000 nozzles are bounded by the critical flaw sizes calculated for the operating fleet (i.e., that there exists inherently less margin for the AP1000 nozzles than for those of the operating fleet), a more detailed understanding of the potential for crack initiation due to thermal fatigue is necessary to determine if an adequate basis exists for approving the requested alternative for Vogtle, Units 3 and 4.

Request #2: Please describe the EPFM methodology used and provide the basis for the average allowable flaw sizes for the AP1000 inlet, outlet, and DVI nozzles.

The staff is requesting more information regarding the EPFM analyses because some of the results cited are difficult to interpret, for example the EPFM critical flaw cited for the DVI nozzle being larger than the DVI nozzle section thickness.

Observing again that, at least by comparison of the LEFM results, it cannot be determined that the critical flaw sizes for the AP1000 nozzles are bounded by the critical flaw sizes calculated for the operating fleet (i.e., that there exists inherently less margin for the AP1000 nozzles than for those of the operating fleet), the staff requires a thorough understanding of the EPFM results in order to determine if an adequate basis exists for approving the requested alternative for Vogtle, Units 3 and 4.