NRR-PMDAPEm Resource

From: Galvin, Dennis
Sent: Tuesday, July 11, 2017 3:47 PM
To: Arthur.Zaremba@duke-energy.com
Cc: Dijamco, David; Rudland, David; Joshua.Duc@duke-energy.com
Subject: Duke Energy Fleet RAIs – Alternative for Reactor Pressure Vessel Flange Threads Examination (MF9513 to MF9521)
Attachments: RAI - Duke Units - Alternative to Flange Thread Requirements (MF9513 thru MF9521) Final 2017-07-11.pdf

Mr. Zaremba,

By letter dated March 29, 2017, Duke Energy Carolinas, LLC and Duke Energy Progress, LLC (the licensee) (Agencywide Documents Access and Management System Accession No. ML17088A846) submitted a request in accordance with Paragraph 50.55a(z)(1) of Title 10 of the *Code of Federal Regulations* (10 CFR) for a proposed alternative to the requirements of 10 CFR 50.55a and the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (ASME B&PV Code) for Brunswick Steam Electric Plant, Unit No. 1; Catawba Nuclear Station, Unit No. 2; Shearon Harris Nuclear Power Plant, Unit 1 (Harris); McGuire Nuclear Station, Unit Nos. 1 and 2; Oconee Nuclear Station, Unit Nos. 1, 2 and 3; and H. B. Robinson Steam Electric Plant, Unit No. 2. The proposed alternative would allow the licensee to eliminate the reactor pressure vessel flange threads volumetric examination requirement ASME B&PV Code Section XI, Examination Category B-G-1, Item Number B6.40 for the remainder of the current 10-year inservice inspection interval for each facility. In addition, the licensee request the proposed alternative also be applied to the next 10-year inservice inspection interval for Harris (the fourth interval).

The U.S. Nuclear Regulatory Commission (NRC) staff has determined that additional information is needed to complete its review. The enclosed requests for additional information (RAIs) were e-mailed to the licensee in draft form on July 6, 2017. A clarification call was held July 11, 2017, which resulted in no changes to the RAIs. The licensee has agreed to provide the responses to these RAIs by August 11, 2017. The NRC staff agrees with this date.

If you have any questions, please contact me at (301) 415-6256.

Respectfully,

Dennis Galvin
Project Manager
U.S Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Operating Reactor Licensing
Licensing Project Branch 2-2
301-415-6256

Docket Nos. 50-325, 50-414, 50-369,
50-370, 50-400, 50-269, 50-270,
50-287, and 50-261

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REQUEST FOR ADDITIONAL INFORMATION

ALTERNATIVE FOR REACTOR PRESSURE VESSEL

FLANGE THREADS EXAMINATION

DUKE ENERGY CAROLINAS, LLC AND DUKE ENERGY PROGRESS, LLC

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 1,

CATAWBA NUCLEAR STATION, UNIT NO. 2,

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT NO. 1,

MCGUIRE NUCLEAR STATION, UNITS NOS. 1 AND 2,

OCONEE NUCLEAR STATION, UNIT NOS. 1, 2 AND 3, AND

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2,

DOCKET NOS. 50-325, 50-414, 50-369, 50-370, 50-400,

50-269, 50-270, 50-287, and 50-261

CAC NOS. MF9513 THROUGH MF9521

By letter dated March 29, 2017, Duke Energy Carolinas, LLC and Duke Energy Progress, LLC (the licensee) (Agencywide Documents Access and Management System Accession No. ML17088A846) submitted a request in accordance with Paragraph 50.55a(z)(1) of Title 10 of the *Code of Federal Regulations* (10 CFR) for a proposed alternative to the requirements of 10 CFR 50.55a and the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (ASME B&PV Code) for Brunswick Steam Electric Plant, Unit No. 1; Catawba Nuclear Station, Unit No. 2; Shearon Harris Nuclear Power Plant, Unit 1 (Harris); McGuire Nuclear Station, Unit Nos. 1 and 2; Oconee Nuclear Station, Unit Nos. 1, 2 and 3; and H. B. Robinson Steam Electric Plant, Unit No. 2. The proposed alternative would allow the licensee to eliminate the reactor pressure vessel flange threads volumetric examination requirement ASME B&PV Code Section XI, Examination Category B-G-1, “Pressure Retaining Bolting, Greater than 2 inches (50 mm) in Diameter,” Item Number B6.40 for the remainder of the current 10-year inservice inspection interval for each facility. In addition, the licensee request the proposed alternative also be applied to the next 10-year inservice inspection interval for Harris (the fourth interval).

The RPV flange threads are required to be inspected, every inservice inspection (ISI) interval, under the ISI program of the ASME B&PV Code. The technical bases for the licensee’s proposed alternative are contained in Electric Power Research Institute (EPRI) report number 3002007626 (ADAMS Accession No. ML16221A068).

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the application and determined that the following information is needed for the staff to complete its review.

RAI-1

For Harris, the licensee is requesting the proposed alternative for two consecutive ten-year ISI intervals, the remainder of the third interval and the entire fourth interval, while for the other units in the submittal, the licensee is requesting the alternative for only one (the current) ten-year ISI interval. The NRC staff has previously approved the elimination of the RPV flange threads examination for one ten-year ISI interval for Vogtle/Farley (ADAMS Accession No. ML17006A109), Millstone (ADAMS Accession No. ML17132A187), and Exelon plants (ADAMS Accession No. ML17170A013). The NRC staff typically expects additional justification in order to apply an alternative for more than one ten-year ISI interval. The NRC staff, for instance, accepted a probabilistic fracture mechanics approach in topical report BWRVIP-05 "BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations (BWRVIP-05)," as additional justification for approving the elimination of volumetric examinations for RPV circumferential welds for more than one ten-year ISI interval. (For an example of an RPV circumferential weld examination alternative request, see NRC safety evaluation in ADAMS Accession No. ML16355A429.) Therefore, for Harris, the NRC staff requests the licensee to provide additional justification for applying the proposed alternative for more than one ten-year ISI interval. Possible additional technical justification could include discussion of characteristics of the Harris plant that supports the requested relief interval and/or the use of a risk-informed approach to determine the potential for failure during the requested relief interval.

RAI-2

The licensee indicated on page 3 of Enclosure 1 to the submittal that the pressurized water reactor (PWR) design was selected for analysis. One of the 9 Duke Energy units in the submittal is a boiling water reactor (BWR). The NRC staff requests the licensee to explain how the PWR thread geometry used in the analysis bounds or is representative for a BWR thread geometry. The NRC staff defines thread geometry as the pitch (number of threads per inch) and depth of a thread (distance from crest to root).

RAI-3

The licensee showed on page 4 of Enclosure 1 to the submittal the equation used to calculate the bolt/stud preload stress of 42,338 psi used in the analysis and the unit-specific preload stress shown in the column "Stud Preload Stress" in Table 2 of Enclosure 1 to the submittal. The NRC staff requests the licensee confirm that the actual bolt/stud preload stress applied to the RPV bolt/studs of each of the 9 Duke Energy units is equal to or less than 42,338 psi.

RAI-4

Table 3 of Enclosure 1 to the submittal shows values of applied stress intensity factor (K_I) for two load cases:

(1) "Preload," which occurs at the temperature the bolt preload is applied.
(2) "Preload + Heatup + Pressure," which occurs at high or operating temperature.

However, the submittal provided a comparison of K_I with the allowable value ($K_{IC}/\sqrt{10}$) only for the "Preload + Heatup + Pressure" case. K_{IC} is defined to be the material fracture toughness of the RPV flange that contains the bolt hole threads. The NRC staff observed that the "Preload" case could be more limiting than the "Preload + Heatup + Pressure" case because: (1) the value

of K_{IC} is expected to be lower at the temperature the bolt preload is applied, and (2) most of the applied K_I comes from the "Preload" case.

Therefore, the NRC staff requests the licensee to provide a comparison of K_I with K_{IC} /√10 for the "Preload" case for the most limiting RPV flange threads of the 9 Duke Energy units listed in the submittal. The most limiting threads are those RPV flange threads whose applied K_I from the "Preload" case in Table 3 is closest to the unit-specific value of K_{IC} /√10.