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U.S. Nuclear Regulatory Commission
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Washington, DC 20555-0001

CATAWBA NUCLEAR STATION, UNIT NOS. 1 AND 2
DOCKET NOS. 50-413 AND 50-414
RENEWED LICENSE NOS. NPF-35 AND NPF-52

SUBJECT: RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION (RAI) FOR THE PROPOSED METHOD TO MANAGE AGING DUE TO ENVIRONMENTALLY ASSISTED FATIGUE FOR THE SAFETY INJECTION NOZZLE

References:

1. Duke Energy letter, Request for Acceptance of Proposed Method to Manage Aging due to Environmentally Assisted Fatigue (EAF) for the Safety Injection Nozzle, dated April 21, 2022 (ADAMS Accession No. ML22111A297).

1. NRC E-Mail, Request For Additional Information Proposed Method to Manage Aging Due To Environmentally Assisted Fatigue For The Safety Injection Nozzle, dated June 3, 2022 (ADAMS Accession No. ML22154A131).

By letter dated April 21, 2022 (Reference 1), Duke Energy Carolinas, LLC (Duke Energy) submitted a document to the U.S. Nuclear Regulatory Commission (NRC) which proposed Duke Energy's inspection plan addressing License Renewal Commitment (LRC) No.10 for the safety injection nozzle (ML22111A297). The letter documents Duke Energy's proposed method to manage the aging effects of environmentally assisted fatigue (EAF) through flaw tolerance evaluation and inservice inspections of fatigue-sensitive safety injection nozzle locations at Catawba Nuclear Station (Catawba), Units 1 and 2.

In Section 4.3.2 of NUREG-1772, the NRC staff states that Duke Energy agreed not to use flaw tolerance and inspection procedures specified in Note 1 unless such procedures have been accepted by the NRC staff. Accordingly, the licensee submitted the request for NRC staff's review of the proposed application of flaw tolerance evaluation and inservice inspections to address environmentally assisted fatigue for the safety injection nozzle.

By correspondence dated June 3, 2022 (Reference 2), the NRC staff requested additional information from Duke Energy that is needed to complete its review.

The enclosure to this letter provides Duke Energy's response to the NRC RAI.

There are no new regulatory commitments contained in this submittal.

If there are any questions or if additional information is needed, please contact Mr. Ryan Treadway, Manager – Nuclear Fleet Licensing at (980) 373-5873.

I declare under penalty of perjury that the foregoing is true and correct. Executed on June 29, 2022.

Sincerely,

Tom Simril

Tom Simril
Vice President, Catawba Nuclear Station

Enclosure: Response to Request for Additional Information cc (with Enclosure):

L. Dudes, USNRC Region II – Regional Administrator
J.D. Austin, USNRC Senior Resident Inspector – CNS
Z. Stone, Project Manager – CNS

Lynne Garner, Manager, Radioactive and Infectious Waste Management (SCDHEC)
Anuradha Nair, Director, Division of Emergency Response (SCDHEC)
Daemon Hobbs, Manager, Nuclear Response (SCDHEC)

Duke Energy Carolinas
Catawba Nuclear Station, Units 1 and 2
Docket Nos. 50-413 and 50-414

Response to Request for Additional Information (RAI) Regarding the Proposed Method to Manage Aging Due to Environmentally Assisted Fatigue for the Safety Injection Nozzle

Enclosure

Response to Request for Additional Information

Request for Additional Information (RAI)

By letter dated April 21, 2022, Duke Energy Carolinas, LLC (Duke Energy) submitted a document to the U.S. Nuclear Regulatory Commission (NRC) which proposed Duke Energy's inspection plan addressing License Renewal Commitment (LRC) No.10 for the safety injection nozzle (ML22111A297). The letter documents Duke Energy's proposed method to manage the aging effects of environmentally assisted fatigue (EAF) through flaw tolerance evaluation and inservice inspections of fatigue-sensitive safety injection nozzle locations at Catawba Nuclear Station (Catawba), Units 1 and 2.

In Section 4.3.2 of NUREG-1772, the NRC staff states that Duke Energy agreed not to use flaw tolerance and inspection procedures specified in Note 1 unless such procedures have been accepted by the NRC staff. Accordingly, the licensee submitted the request for NRC staff's review of the proposed application of flaw tolerance evaluation and inservice inspections to address environmentally assisted fatigue for the safety injection nozzle.

The NRC staff requested additional information from Duke Energy that is needed to complete its review:

RAI 1
In Section 4.3.2 of NUREG-1772, NRC staff stated that Duke Energy identified relatively high design basis fatigue usage factors for the reactor pressure vessel outlet nozzle, surge line hot leg nozzle, charging nozzle, and safety injection nozzle for McGuire and Catawba in their July 9, 2002, submittal (ML021960467). As part of their license renewal, Duke Energy committed to performing further evaluations of these components, considering environmental effects, prior to the period of extended operation. In RA-22-0115, the licensee stated that the location of concern for EAF-adjusted cumulative usage factor (CUF) at Catawba Nuclear Station, Units 1 and 2, are the safety injection nozzles.

Please clarify whether the safety injection nozzle locations analyzed in the flaw tolerance evaluation are the only Class 1 piping and component locations that are projected to have 60-year environmental cumulative usage factor (CUF_{en}) greater than 1.0. If not, please explain why the request does not address the other Class 1 locations that may have 60-year CUF_{en} greater than 1.0.

Duke Energy Response to RAI 1
In addition to the safety injection nozzle locations, calculated CUF_{en} values for Catawba Unit 1 pressurizer surge line locations were also determined to exceed the ASME Code allowable usage factor of 1.0 when EAF is considered during the Period of Extended Operation (PEO). No other Class 1 piping and component locations are projected to have 60 year environmental cumulative usage factor (CUF_{en}) greater than 1.0.

The 60-year projected CUF_{en} for the limiting pressurizer surge line location is 1.06. This location will continue to be monitored in accordance with Thermal Fatigue Management Program. The Thermal Fatigue Management Program requires an additional action three years prior to reaching the ASME Code allowable usage factor of 1.0, which is currently projected to occur in 2037. This is far enough in the future to allow for consideration of additional operating history and evolving alternatives before application of flaw tolerance methods.

RAI 2
Table 1 in RA-22-0115 provides the safety injection nozzle crack growth results from the licensee's fatigue flaw tolerance evaluation.

Please provide the following information regarding the flaw tolerance evaluation:

a) Please describe the initial flaw depth and length for the flaw tolerance evaluation and the basis of the initial flaw size (i.e., how the initial flaw size was determined in the evaluation)

b) Please describe how the acceptable flaw sizes were determined for the flaw tolerance evaluation.

Duke Energy Response to RAI 2

a) The initial flaw depth and length of the postulated flaw for the flaw tolerance evaluation of the safety injection nozzle crack growth results follows guidance from ASME Code, Section XI, Appendix L (L-3210). The initial flaw depth is determined using the applicable inservice inspection acceptance standard in Table IWB-3410-1 for austenitic stainless steel. The initial flaw length is determined by calculating the initial flaw aspect ratio for a semi-elliptical surface flaw from Appendix L, Table L-3210-2, using the ratio of the membrane-to-gradient cyclic stress from finite element analyses.

b) The acceptable flaw sizes for the flaw tolerance evaluation follows the guidance from ASME Code, Section I, Appendix L (L-3000) and is based on the rules of Subsections IWB-3640 and Appendix C.

RAI 3
Table 2 in RA-22-0115 provides the safety injection nozzle weld locations that are to be inspected.

Please clarify:

a) Whether the safety injection nozzle locations (paths P1 and P2) evaluated in Table 1 are the weld locations that will be inspected in accordance with Table 2. If not, please explain why the flaw tolerance evaluation locations are not consistent with the inspection locations.

b) Whether the flaw tolerance evaluation locations are the limiting locations in terms of crack growth.

Duke Energy Response to RAI 3

a) Table 1 in RA-22-0155 provides flaw tolerance evaluation results for two stress paths. The two through-wall stress paths are defined in the butt weld region based on examination of the stress around the weld region for all the various transient events and the pressure stress result. Path 1 bounds the thermal loads and Path 2 bounds the pressure load. Both paths are located in the safety injection nozzle butt weld region that are inspected in accordance with Table 2 of the RA-22-0115 letter.

b) A three-dimensional (3-D) finite element model (FEM) of the safety injection nozzle was developed. Mapped through-wall stresses are extracted at the defined paths through the butt weld and are used for crack growth analyses. To the extent the evaluated stress paths are bounding for thermal and pressure loads, the flaw tolerance evaluation locations are the limiting locations in terms of evaluated crack growth.

RAI 4

RA-22-0115 states that the inspections of the safety injection nozzles are included in Catawba's risk-informed inservice inspections per ASME Code Section XI, Code Case N-716-1. Please describe the specific item number of the inspections according to Code Case N-716-1, Table 1, "Examination Categories."

Duke Energy Response to RAI 4

All the welds listed in Table 2 of RA-22-0115 are classified as item number R1.11 (welds subject to thermal fatigue) in accordance with ASME Code Case N-716-1.

RAI 5

In RA-22-0115, the licensee stated that all safety injection nozzle welds were inspected in 2021 for Catawba, Units 1 and 2. Please clarify whether these inspections revealed any indications of cracking. If so, please clarify whether the flaw tolerance evaluation considers the presence of the crack.

Duke Energy Response to RAI 5

No indications of cracking were identified during the 2021 safety injection nozzle weld ultrasonic examinations for Catawba, Units 1 and 2 (i.e., C1R26 and C2R24, respectively).