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RA-22-0158
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10 CFR 50.4
10 CFR Part 54

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Duke Energy Carolinas, LLC (Duke Energy)
Oconee Nuclear Station (ONS), Units 1, 2, and 3
Docket Numbers 50-269, 50-270, 50-287
Renewed License Numbers DPR-38, DPR-47, DPR-55
Subsequent License Renewal Application
Response to ONS SLRA Second Round RAI B2.1.9-2a

References:

1. Duke Energy Letter (RA-21-0132) dated June 7, 2021, Application for Subsequent Renewed Operating Licenses, (ADAMS Accession Number ML21158A193)
2. NRC Letter dated July 22, 2021, Oconee Nuclear Station, Units 1, 2, and 3 - Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for a Hearing Regarding Duke Energy Carolinas' Application for Subsequent License Renewal (ADAMS Accession Number ML21194A245)
3. NRC E-mail dated September 22, 2021, Oconee SLRA - Request for Additional Information B2.1.27-1 (ADAMS Accession Number ML21271A586)
4. Duke Energy Letter (RA-21-0281) dated October 22, 2021, Subsequent License Renewal Application, Response to Request for Additional Information B2.1.27-1 (ADAMS Accession Number ML21295A035)
5. NRC E-mail dated November 23, 2021, Oconee SLRA – Request for Additional Information - Set 1 and Second Round Request for Additional Information RAI B2.1.27-1a (ADAMS Accession Number ML21327A277)
6. Duke Energy Letter (RA-21-0332) dated January 7, 2022, Subsequent License Renewal Application Responses to NRC Request for Additional Information Set 1 and Second Round Request for Additional Information B2.1.27-1a (ADAMS Accession Number ML22010A129)
7. NRC E-mail dated January 11, 2022, Oconee SLRA – Request for Additional Information - Set 2 (ADAMS Accession Numbers ML22012A043 and ML22012A042)
8. Duke Energy Letter (RA-22-0036) dated February 14, 2022, Subsequent License Renewal Application Responses to NRC Request for Additional Information Set 2 (ADAMS Accession Number ML22045A021)
9. NRC E-mail dated January 18, 2022, Oconee SLRA – Request for Additional Information Set 3 (ADAMS Accession Numbers ML22019A103 and ML22019A104)

10. Duke Energy Letter (RA-22-0040) dated February 21, 2022, Subsequent License Renewal Application Responses to NRC Request for Additional Information Set 3 (ADAMS Accession Numbers ML22052A002)
11. NRC E-mail dated March 16, 2022, Oconee SLRA – Request for Additional Information Set 4 (ADAMS Accession Numbers ML22080A077 and ML22080A079)
12. NRC E-mail dated March 21, 2022, Oconee SLRA – 2nd Round RAI B4.1-3 (ADAMS Accession Numbers ML22080A077 and ML22080A079)
13. NRC E-mail dated March 29, 2022, Oconee SLRA – 2nd Round RAI 4.6.1-1a (ADAMS Accession Numbers ML22091A091 and ML22091A092)
14. Duke Energy Letter (RA-22-0129) dated April 20, 2022, Subsequent License Renewal Application Responses to Oconee SLRA - 2nd Round RAI B4.1-3 (ADAMS Accession Number ML22110A207)
15. NRC E-mail dated April 20, 2022, Oconee SLRA – Request for Additional Information 3.1.2-1 (ADAMS Accession Numbers ML22113A008 and ML22113A009)
16. Duke Energy Letter (RA-22-0124) dated April 22, 2022, Subsequent License Renewal Application Responses to NRC Request for Additional Information Set 4 (ADAMS Accession Numbers ML22112A016)
17. NRC E-mail dated April 28, 2022, Oconee SLRA – 2nd Round RAI B2.1.9-2a (ADAMS Accession Numbers ML22122A018 and ML22122A019)
18. Duke Energy Letter (RA-22-0137) dated May 20, 2022, Response to ONS SLRA Second Round RAI 4.6.1-1a (ADAMS Accession Number ML22140A016)
19. Duke Energy Letter (RA-22-0159) dated May 27, 2022, Response to ONS SLRA – Request for Additional Information 3.1.2-1 (ADAMS Accession Number ML22147A001)
20. Duke Energy Letter (RA-22-0111) dated March 31, 2022, Subsequent License Renewal Application Follow-up Request for Additional Information Set 2 and 3 Updates (ADAMS Accession Number ML22090A046)

By letter dated June 7, 2021 (Reference 1), Duke Energy Carolinas, LLC (Duke Energy) submitted an application for the subsequent license renewal of Renewed Facility Operating License Numbers DPR-38, DPR-47, and DPR-55 for the Oconee Nuclear Station (ONS), Units 1, 2, and 3 to the U.S. Nuclear Regulatory Commission (NRC). On July 22, 2021 (Reference 2), the NRC determined that ONS subsequent license renewal application (SLRA) was acceptable and sufficient for docketing. In emails from the NRC to Steve Snider (Duke Energy) dated September 22, 2021, November 23, 2021, January 11, 2022, January 18, 2022, March 16, 2022, March 21, 2022, March 29, 2022, and April 20, 2022 (References 3, 5, 7, 9, 11, 12, 13, and 15), the NRC transmitted specific requests for additional information (RAI) to support completion of the Safety Review. The responses were provided to the NRC on October 22, 2021, January 7, 2022, February 14, 2022, February 21, 2022, March 31, 2022, April 20, 2022, April 22, 2022, May 20, 2022, and May 27, 2022 (References 4, 6, 8, 10, 20, 14, 16, 18, and 19).

In an email from Angela X. Wu (NRC) to Steve Snider (Duke Energy) dated April 28, 2022 (Reference 17), the NRC transmitted a second round for RAI B2.1.9-2a also to support completion of the Safety Review. Enclosure 1 contains the response for RAI B2.1.9-2a. SLRA changes are provided along with the affected SLRA section(s), SLRA page number(s), and SLRA mark-ups. For clarity, deletions are indicated by strikethrough and inserted text by underlined red font. As directed by the NRC Project Manager, the revised due date for this response is June 8, 2022. This submittal contains a revision to the Bolting Integrity program in Table A6.0-1, Commitment 9.

Should you have any questions regarding this submittal, please contact Paul Guill at (704) 382-4753 or by email at paul.guill@duke-energy.com.

I declare under penalty of perjury that the foregoing is true and correct. Executed on June 8, 2022.

Sincerely,

Steven M. Snider
Site Vice President
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Enclosure:

1. Response to ONS SLRA Second Round RAI B2.1.9-2a

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ENCLOSURE 1

OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3
SUBSEQUENT LICENSE RENEWAL APPLICATION
RESPONSE TO ONS SLRA 2ND ROUND RAI B2.1.9-2a

Enclosure 1
Response to ONS SLRA 2nd Round RAI B2.1.9-2a

Request for Additional Information (RAI) B2.1.9-2a:

Regulatory Basis:
Title 10 of the *Code of Federal Regulations* (CFR) Section 54.21(a)(3) requires an applicant to demonstrate that the effects of aging for each structure and component identified in 10 CFR 54.21(a)(1) will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation. One of the findings that the U.S. Nuclear Regulatory Commission (NRC) staff must make to issue a renewed license (10 CFR 54.29(a)) is that actions have been identified and have been or will be taken with respect to managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis.

In order to complete its review and enable making a finding under 10 CFR 54.29(a), the staff requires additional information in regard to the matters described below.

Background:
SLRA Section B2.1.9, "Bolting Integrity," states that the Oconee Bolting Integrity AMP, with the enhancements provided in the SLRA, will be consistent with the ten program elements of GALL-SLR Report AMP XI.M18, "Bolting Integrity." To ensure consistency with the "detection of aging effects" program element, the SLRA included enhancement no. 4 to demonstrate that the program will perform inspections of closure bolting in locations that preclude detection of joint leakage or for which leakage is difficult to detect.

The "detection of aging effects" program element of the GALL-SLR Report AMP states, in part, that the Bolting Integrity program seeks to detect degradation of pressure boundary closure bolting due to crack initiation, loss of preload, or loss of material that may result in leakage from the mating surfaces or joint connections of pressure boundary components. Since these aging effects may be difficult to detect for submerged closure bolting, the GALL-SLR Report AMP recommends the use of visual inspection in bolt heads and threads to detect loss of material during opportunistic maintenance activities (e.g., when made accessible, and when joints are disassembled) for a representative sample population as applicable to the site. When opportunistic maintenance activities will not provide access to the minimum required sample of the population over a 10 year period, the GALL-SLR Report AMP recommends the use of alternate means of inspections or testing to adequately manage the aging of submerged closure bolting for pressure retaining components. Examples of acceptable alternative inspections for submerged bolting recommended in the GALL-SLR Report AMP include: (a) periodic pump vibration measurements are taken and trended; or (b) sump pump operator walkdowns are performed demonstrating that the pumps are appropriately maintaining sump levels.

By letter dated March 31, 2022 (ADAMS Accession No. ML22090A046), Duke Energy provided a revised response to RAI B2.1.9-2. In its response to request no. 2, Duke Energy described the proposed alternative means of inspections and the acceptance criteria that will be used for submerged bolting by the Bolting Integrity program. Specifically, Duke Energy stated that, "alternative inspections for submerged bolting include diver inspections and remote video/photo inspections. Submerged bolted connections where diver inspections are performed will include visual inspections for degraded bolts,

missing or broken bolts and, where possible, the torque of bolts verified to be hand tight. Remote video and photo inspections may be performed to inspect for degraded, loose, or missing bolts."

Issue:
Additional justification is necessary to demonstrate that the proposed alternative means of inspections can effectively detect the aging effects associated with the degradation of pressure boundary submerged closure bolting before there is a loss of system or component intended function(s). Specifically, the staff identified the following issues as requiring additional clarification:

- It is not clear how the use of remote video and photo inspection will be sufficient to provide clear indications to detect degradations in submerged closure bolting of a pressure retaining boundary. It is noted that the GALL-SLR Report recommends detecting degradation due to crack initiation, loss of preload, or loss of material that may result in leakage from the mating surfaces or joint connections of pressure boundary components, and the use of remote video and photo inspections appear to be limited in their capability to detect some of these aging effects.

- It is not clear how the use of hand tight check will be adequate to detect loss of preload in systems requiring a specific torque value (e.g., 30 lb-ft) at their connections. It is noted that bolts and nuts that can be verified to be hand tight may still leak if the connection is not set to the specified torque value necessary to maintain the pressure boundary of the components.

Request:
Considering the issues identified above, clarify how the proposed alternative means of inspections for submerged bolting, as described in the revised response to RAI B2.1.9-2, can effectively detect the aging effects associated with the degradation of pressure boundary closure bolting (i.e., loss of preload, crack initiation, loss of material) before there is a loss of system or component intended function(s).

If the currently proposed alternative inspection methods cannot be justified to be sufficiently capable of detecting the referenced aging effects, provide revised alternative means of inspections of submerged bolting that are effective in detecting and managing these aging effects. Update the SLRA as necessary.

Response to RAI B2.1.9-2a:

There are two populations of submerged bolting in the Oconee Bolting Integrity Aging Management Program (AMP). One population is associated with the spent fuel pool transfer tube isolation valves. These valves are identified with the Spent Fuel Cooling (SF) System in the Oconee SLRA. The second population is installed in the Condenser Circulating Water (CCW System) intake pump casings. The preferred inspection method for both bolting populations is direct visual inspection (e.g., bolt head and shank) performed during maintenance activities (opportunistic inspections).

Alternative inspection methods are available if opportunistic inspections do not yield the required sample size. Visual inspection via remote video or photography is the alternative inspection method for submerged bolting in the spent fuel pool transfer tube isolation valves. Diver inspections and periodic vibration monitoring (per the attached supplement) are the alternative inspection methods for the submerged bolting in the CCW intake pump casings.

Spent Fuel Pool Cooling Fuel Transfer Tube Isolation Valves

Two 30" manually operated gate valves per unit are submerged in the spent fuel pools and provide isolation for the spent fuel transfer tubes. Each valve contains stainless steel bolting in the connecting flange and the body-to-bonnet joint. The bolting has a pressure boundary component level function for subsequent license renewal. The spent fuel pools contain treated borated water environments. The aging effects of concern for the bolting material/environment combination are loss of preload, cracking (for treated borated water >140°F), and loss of material.

Alternative inspection of the bolting in the spent fuel pool transfer tube isolation valves will consist of visual inspection by remote video or photograph. The spent fuel pools provide an appropriate environment for the use of remote video or photographic inspection methods. The spent fuel pool treated borated water provides high visibility and the pool areas are well lit. High definition cameras will be used to perform the underwater inspections. Remote video or photographic inspection of the subject bolting will demonstrate the integrity of the bolted joints by identifying degraded, visibly loose, or missing bolts. Comparison to previous video or photographic inspection results (if available) will be performed to identify changes related to loss of material, bolt loosening or signs of leakage. Cracking is managed by the One Time Inspection and Water Chemistry AMPs per SLRA Table 3.3.2-17, Auxiliary Systems - Spent Fuel Cooling System - Aging Management Evaluation. Evidence of loose or missing bolting or significant loss of material (i.e., appreciable material loss that could adversely affect intended function) identified during inspections will be entered into the corrective action program.

The remote video or photographic alternative inspection method will provide reasonable assurance that loss of material and loss of preload will be adequately managed such that the intended function of the bolting in the spent fuel pool valves is maintained during the subsequent period of extended operation.

Condenser Circulating Water Intake Pump Casings

Four large (177K GPM nominal capacity) vertical CCW intake pumps per unit are submerged in the plant intake structure. The bolting in the uppermost flange of each pump casing has a pressure boundary component level function for subsequent license renewal and is constructed from steel. The intake structure contains a raw water environment. The aging effects of concern for the bolting material/environment combination are loss of preload and loss of material.

Alternative inspection of the bolting in the CCW intake pump casing upper flange will consist of visual inspections by divers and periodic vibration monitoring (measurement). Checks for hand tightness of the bolting by divers as specified in the Duke Energy response to RAI B2.1.9-2 (ADAMS Accession No. ML22090A046) will not be credited for subsequent license renewal. Divers will inspect for degraded, visibly loose, missing, or broken bolts. Evidence of loose or missing bolting and significant loss of material (i.e., appreciable material loss that could adversely affect intended function) identified during inspections will be entered into the corrective action program. In addition to the diver inspections, periodic (minimum semiannual) vibration monitoring of the pump/motor assembly will also be performed as an alternative inspection method. Increased vibration could be an indication of degradation of the pump casing upper flange bolted joint. Vibration readings will be trended, and any unacceptable vibration levels will be entered into the corrective action program for evaluation and resolution.

The diver inspection and periodic vibration monitoring alternative inspection methods will provide reasonable assurance that loss of material and loss of preload will be adequately managed such that the intended function of the CCW intake pump casing upper flange bolted joints is maintained.

SLRA Revisions:

Note that in the letter dated March 31, 2022 (ADAMS Accession No. ML22090A046), Duke Energy provided a supplement for SLRA Sections A2.9, B2.1.9, and Table A6.0-1 (Bolting Integrity). This supplement added a new enhancement and a new commitment to Table A6.0-1, Bolting Integrity AMP for closure boltings that are not normally pressurized. The revisions provided below will clarify the alternate inspections for the in-scope submerged bolting in the CCW intake pump casing upper flanges and the spent fuel pool transfer tube isolation valves.

SLRA Appendix A2.9 (page A-11) is revised as follows:

A2.9 Bolting Integrity

Enhancements

4. Perform visual inspections of a representative sample of 20 percent of closure bolting where leakage is difficult to detect ~~such as~~ **(**submerged connections or systems containing air/gas**)** or a maximum of 17 bolts for each material and environment population per unit, whichever is less, during each ten year period. If the minimum sample size is not achieved during a ten year period, then alternative inspections ~~may be performed~~ **will be credited**.

   For submerged bolting **in the Condenser Circulating Water intake pump casing upper flanges**, alternative inspections ~~may~~ **will** include ~~(a)~~ diver inspections **and periodic (minimum semiannual) vibration monitoring of the pump/motor assemblies.** ~~or (b)~~ **Divers will inspect for degraded, visibly loose, missing, or broken bolts. Evidence of loose or missing bolting and significant loss of material (i.e., appreciable material loss that could adversely affect intended function) identified during inspections will be entered into the corrective action program. Vibration readings will be trended, and any unacceptable vibration levels will be entered into the corrective action program for evaluation and resolution.**

   For submerged bolting in the Spent Fuel Pool fuel transfer tube isolation valves, alternative inspections will include remote video **or photographic** inspections. **Comparison to previous video or photographic inspection results (if available) will be performed to identify changes related to loss of material, bolt loosening or signs of leakage. Evidence of loose or missing bolting or significant loss of material (i.e., appreciable material loss that could adversely affect intended function) identified during inspections will be entered into the corrective action program.**

   For systems containing air/gas, alternative inspections ~~may~~ **will** include **one or more of the following:** (a) visual inspection for discoloration when leakage from inside the piping system would discolor the external surfaces of the component; (b) monitoring and trending of pressure decay when the bolted connection is located within an isolated boundary; (c) soap bubble testing on the external mating surface of the bolted component; or (d) thermography, when the temperature of the process fluid is higher than ambient conditions around the component.

SLRA Table A6.0-1, Commitment Column, (page A-75) is revised as follows:

4. Perform visual inspections of a representative sample of 20 percent of closure bolting where leakage is difficult to detect ~~such as~~ **(**submerged connections or systems containing air/gas**)** or a maximum of 17 bolts for each material and environment population per unit, whichever is less, during each ten year period. If the minimum sample size is not achieved during a ten year period, then alternative inspections ~~may be performed~~ **will be credited**.

   For submerged bolting **in the Condenser Circulating Water intake pump casing upper flanges**, alternative inspections ~~may~~ **will** include ~~(a)~~ diver inspections **and periodic (minimum semiannual) vibration monitoring of the pump/motor assemblies.** ~~or (b)~~ **Divers will inspect for degraded, visibly loose, missing, or broken bolts. Evidence of loose or missing bolting and significant loss of material (i.e., appreciable material loss that could adversely affect intended function) identified during inspections will be entered into the corrective action program. Vibration readings will be trended, and any unacceptable vibration levels will be entered into the corrective action program for evaluation and resolution.**

   For submerged bolting in the Spent Fuel Pool fuel transfer tube isolation valves, alternative inspections will include remote video **or photographic** inspections. **Comparison to previous video or photographic inspection results (if available) will be performed to identify changes related to loss of material, bolt loosening or signs of leakage. Evidence of loose or missing bolting or significant loss of material (i.e., appreciable material loss that could adversely affect intended function) identified during inspections will be entered into the corrective action program.**

   For systems containing air/gas, alternative inspections ~~may~~ **will** include **one or more of the following:** include (a) visual inspection for discoloration when leakage from inside the piping system would discolor the external surfaces of the component; (b) monitoring and trending of pressure decay when the bolted connection is located within an isolated boundary; (c) soap bubble testing on the external mating surface of the bolted component; or (d) thermography, when the temperature of the process fluid is higher than ambient conditions around the component.

SLRA Appendix B2.1.9 (page B-88) is revised as follows:

B2.1.9 BOLTING INTEGRITY

Enhancements

4. Perform visual inspections of a representative sample of 20 percent of closure bolting where leakage is difficult to detect ~~such as~~ **(**submerged connections or systems containing air/gas**)** or a maximum of 17 bolts for each material and environment population per unit, whichever is less, during each ten year period. If the minimum sample size is not achieved during a ten year period, then alternative inspections ~~may be performed~~ **will be credited**.

   For submerged bolting **in the Condenser Circulating Water intake pump casing upper flanges**, alternative inspections ~~may~~ **will** include ~~(a)~~ diver inspections **and periodic (minimum semiannual) vibration monitoring of the pump/motor assemblies.** ~~or (b)~~ **Divers will inspect for degraded, visibly loose, missing, or broken bolts. Evidence of loose or missing bolting and significant loss of material (i.e., appreciable material loss that could adversely affect intended function) identified during inspections will be entered into the corrective action program. Vibration readings will be trended, and any unacceptable vibration levels will be entered into the corrective action program for evaluation and resolution.**

   For submerged bolting in the Spent Fuel Pool fuel transfer tube isolation valves, alternative inspections will include remote video **or photographic** inspections. **Comparison to previous video or photographic inspection results (if available) will be performed to identify changes related to loss of material, bolt loosening or signs of leakage. Evidence of loose or missing bolting or significant loss of material (i.e., appreciable material loss that could adversely affect intended function) identified during inspections will be entered into the corrective action program.**

   For systems containing air/gas, alternative inspections ~~may~~ **will** include **one or more of the following:** (a) visual inspection for discoloration when leakage from inside the piping system would discolor the external surfaces of the component; (b) monitoring and trending of pressure decay when the bolted connection is located within an isolated boundary; (c) soap bubble testing on the external mating surface of the bolted component; or (d) thermography, when the temperature of the process fluid is higher than ambient conditions around the component.

   (Element**s** 4 **and 6**)