UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 20, 2021

Mr. Steven M. Snider
Vice President, Oconee Nuclear Station
Duke Energy Carolinas, LLC
7800 Rochester Highway
Seneca, SC 29672-0752

SUBJECT: OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3 – PROPOSED ALTERNATIVE TO IMPLEMENT ASME CODE CASE OMN-26 (EPID L-2021-LLR-0053)

Dear Mr. Snider:

By letter dated July 29, 2021, as supplemented by letter dated August 19, 2021, Duke Energy Carolinas, LLC (Duke Energy, the licensee) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) for the use of an alternative to certain American Society of Mechanical Engineers (ASME) *Operation and Maintenance of Nuclear Power Plants* (OM Code) requirements at Oconee Nuclear Station (ONS), Units 1, 2, and 3, during the sixth 10-year inservice testing (IST) program interval.

Pursuant to the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a "Codes and Standards," specifically 10 CFR 50.55a(z)(1), the licensee requested to implement ASME OM Code Case OMN-26, "Alternate Risk-Informed and Margin Based Rules for Inservice Testing of Motor Operated Valves," for certain active motor-operated valves (MOVs) on the basis that the alternative provides an acceptable level of quality and safety.

The NRC staff has reviewed the subject request, and concludes, as set forth in the enclosed safety evaluation, that the licensee has adequately addressed the regulatory requirements set forth in 10 CFR 50.55a(z)(1). Therefore, the NRC staff authorizes the proposed alternative request ON-MOV-OMN-26 for the sixth 10-year IST program interval for ONS Units 1, 2, and 3.

All other ASME OM Code requirements for which relief or an alternative was not specifically requested and approved remain applicable.

If you have any questions, please email Shawn.Williams@nrc.gov.

Sincerely,

Michael T. Markley

Digitally signed by Michael T. Markley
Date: 2021.12.20 09:35:38 -05'00'

Michael T. Markley, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-269, 50-270, and 50-287

Enclosure:
Safety Evaluation

cc: Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

PROPOSED ALTERNATIVE REQUEST ON-MOV-OMN-26

RELATED TO THE INSERVICE TESTING PROGRAM SIXTH 10-YEAR INTERVAL

DUKE ENERGY CAROLINAS, LLC (DUKE ENERGY)

OCONEE NUCLEAR STATION, UNITS NO. 1, 2, AND 3

DOCKET NOS. 50-269, 50-270, AND 50-287

1.0 INTRODUCTION

By a letter dated July 29, 2021 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21210A341), as supplemented by letter dated August 19, 2021 (ADAMS Accession No. ML21231A069), Duke Energy Carolinas, LLC (Duke Energy, the licensee), submitted to the U.S. Nuclear Regulatory Commission (NRC) a proposed alternative test plan (ON- MOV-OMN-26) in lieu of certain inservice testing (IST) requirements of the American Society of Mechanical Engineers (ASME) *Operation and Maintenance of Nuclear Power Plants*, Division 1, OM Code: Section IST [inservice testing] (OM Code) for the IST programs at Oconee Nuclear Station (ONS), Units 1, 2, and 3, during the sixth 10-year IST program interval.

Specifically, pursuant to subparagraph (1) in paragraph (z), "Alternatives to codes and standards requirements," of Section 55a, "Codes and standards," in Part 50, "Domestic Licensing of Production and Utilization Facilities," in Title 10, "Energy," of the *Code of Federal Regulations* (10 CFR 50.55a(z)(1)), the licensee requested to implement ASME OM Code Case OMN-26, "Alternate Risk-Informed and Margin Based Rules for Inservice Testing of Motor Operated Valves," for certain active motor-operated valves (MOVs) on the basis that the alternative provides an acceptable level of quality and safety.

2.0 REGULATORY EVALUATION

The NRC regulations in 10 CFR 50.55a(f), "Preservice and inservice testing requirements," states, in part, that systems and components must meet the requirements of the ASME Boiler and Pressure Vessel Code and ASME OM Code as specified in this paragraph (f) for Class 1, 2, and 3 components, except where alternatives have been authorized pursuant to paragraphs 10 CFR 50.55a(z)(1) or 10 CFR 50.55a(z)(2).

In proposing alternatives, a licensee must demonstrate that the proposed alternatives provide an acceptable level of quality and safety (10 CFR 50.55a(z)(1)) or compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety (10 CFR 50.55a(z)(2)).

3.0 TECHNICAL EVALUATION

3.1 Applicable ASME OM Code

The applicable ASME OM Code for the IST Programs at ONS Units 1, 2, and 3, for the sixth 10-year IST program interval, is the 2017 Edition, which is currently scheduled to commence on July 1, 2022, and end on June 30, 2032.

3.2 ASME Code Components Affected

The components affected are the active safety-related MOVs that are required by Subsection ISTC of the ASME OM Code, 2017 Edition, to be tested in accordance with Appendix III entitled "Preservice and Inservice Testing of Active Electric Motor-Operated Valve Assemblies in Water-cooled Reactor Nuclear Power Plants."

3.3 Licensee's Proposed Alternative

As stated by the licensee, applicable ASME OM Code Requirements include:

Mandatory Appendix III, "Preservice and Inservice Testing of Active Electric Motor Operated Valve Assemblies in Light-Water Reactor Power Plants," paragraph III-3310, "Inservice Test Interval," subparagraph (c) states, in part, that "The maximum inservice test interval shall not exceed 10 yr [years]."

Mandatory Appendix III, paragraph III-3700, "Risk-Informed MOV Inservice Testing," states that "Risk-informed MOV inservice testing that incorporates risk insights in conjunction with performance margin to establish MOV grouping, acceptance criteria, exercising requirements and testing interval may be implemented."

Mandatory Appendix III, paragraph III-3721, "HSSC [high safety significant component] MOVs," states that "HSSC MOVs shall be tested in accordance with para. III-3300 and exercised in accordance with para. III-3600. HSSC MOVs that can be operated during plant operation shall be exercised quarterly, unless the potential increase in core damage frequency (CDF) and large early release (LER) associated with a longer exercise interval is small."

Mandatory Appendix III, paragraph III-3722, "LSSC [low safety significant component] MOVs," subparagraph (d), states that "LSSC MOVs shall be inservice tested at least every 10 yr in accordance with para. III-3310."

Alternative testing is requested for safety-related MOVs that are currently required to meet these ASME OM Code requirements.

Reason for Request

The licensee states, in part:

> Code Case OMN-26 better aligns the inservice test intervals in Mandatory Appendix III to the Risk and Margin Based Licensee Motor Operated Valve (MOV) Programs developed in response to NRC Generic Letter 96-05, "Periodic Verification of Design-Basis Capability of Safety-Related Motor Operated Valves," that have been in effect since 1998. There is no formal technical basis in Appendix III for limiting the maximum inservice test interval to 10 years. Code Case OMN-26

establishes a structured risk-informed approach for determining inservice intervals that provides an acceptable level of quality and safety while providing Oconee additional inservice test schedule flexibility.

Proposed Alternative

ONS proposes to implement the ASME OM Code Case OMN-26 alternative risk and margin informed rules for inservice testing of MOVs in its entirety.

Proposed Alternative to III-3310(c)

The maximum inservice test interval shall not exceed 10 years unless Risk Informed Inservice Testing [is implemented] under the alternative provisions of Code Case OMN-26 to para. III-3700. MOV inservice tests conducted per para. III-3400 may be used to satisfy this requirement.

Proposed Alternative to III-3700

Risk-informed MOV inservice testing that incorporates risk insights in conjunction with MOV Functional Margin to establish MOV grouping, acceptance criteria, exercising requirements and test interval may be implemented.

Proposed Alternative to III-3721

HSSC MOVs shall be tested in accordance with para. III-3300 and exercised in accordance with para. III-3600 while applying the following HSSC MOV Risk insights and limitations.

a) HSSC MOVs that can be operated during plant operation shall be exercised quarterly, unless the potential increase in core damage frequency (CDF) and large early release (LER) associated with a longer exercise interval is small.

b) For HSSC MOVs, the maximum inservice test interval shall be established in accordance with Table 1 of OMN-26 as shown below.

Table 1
HSSC MOV – Margin Based Maximum Inservice Test Intervals

HSSC MOV Functional Margin(D)	Maximum Inservice Test Interval (Years)	If MOV is routinely(A) operated at Design Basis Pressure Conditions – Max Inservice Test Interval (Years)(B)
Low (< 5%)	2	4
Medium (≥ 5% and < 10%)	4	9
High (≥ 10% and < 20%)	9	9
Very High (≥ 20%)	9	12

OMN-26 Table 1 – Notes

(A) Occurs at a periodicity no less frequent than once a refueling outage.

(B) To utilize these intervals, test strokes at or exceeding design basis system conditions must be in the applicable safety function direction(s) and have no applicable operating experience, degradation or diagnostic test anomaly with the potential for adverse impact on MOV functional margin or the capability of the MOV to perform its design basis function.

(D) For the purpose of this code case, the MOV functional margin limits apply to the As-Left MOV conditions at the start of the inservice test interval and include applicable test uncertainties and allowance for service-related degradation.

Proposed Alternative to III-3772(d)

For LSSC MOVs, the maximum inservice test interval shall be established in accordance with Table 2 of OMN-26, as shown below.

OMN-26 – Table 2

LSSC MOV – Margin Based Maximum Inservice Test Intervals

LSSC MOV Functional Margin(D)	Maximum Inservice Test Interval (Years)	If MOV is routinely(A) operated at Design Basis Pressure Conditions – Max Inservice Test Interval (Years)(B)
Low (< 5%)	4	9
Medium (≥ 5% and < 10%)	9	12
High (≥ 10% and < 20%)	12	12
Very High (≥ 20%)	12	16(C)

OMN-26 Table 2 – Notes

(A) Occurs at a periodicity no less frequent than once a refueling outage.

(B) To utilize these intervals, test strokes at or exceeding design basis system conditions must be in the applicable safety function direction(s) and have no applicable operating experience, degradation or diagnostic test anomaly with the potential for adverse impact on MOV functional margin or the capability of the MOV to perform its design basis function.

(C) Operating plants that have acquired the requisite test data to satisfy Appendix III, paragraphs III-3310(b) or III-3722(c) must complete one cycle of collecting diagnostic test data at an extended test interval, minimum 9 and maximum 12 years, before extending the test interval by engineering evaluation to the maximum 16-year test interval.

(D) For the purpose of this code case, the MOV functional margin limits apply to the As-Left MOV conditions at the start of the inservice test interval and include applicable test uncertainties and allowance for service-related degradation.

Basis for Use

In its letters dated July 29 and August 19, 2021, the licensee describes the basis for its proposed alternative to implement ASME OM Code Case OMN-26 for ONS Units 1, 2, and 3. In summary, the licensee considers the requested alternative to adopt OMN-26 to be in line with the current Joint Owners Group (JOG) MOV Periodic Verification Test Program that ONS has implemented since the late 1990's in response to Generic Letter (GL) 96-05 (ADAMS Accession No. ML031110010). Both the JOG MOV Periodic Verification Program and Code Case OMN-26 provide a risk-margin based methodology that establishes limitations for maximum IST intervals for MOVs. The licensee considers OM Code Case OMN-26 to provide a reasonable extension of this risk-informed philosophy based on the lessons learned and accumulated MOV performance data gathered during JOG MOV Periodic Verification Testing Program. The licensee states that Appendix Ill alone, in isolation from OMN-26, provides no such methodology other than a maximum limit for the IST interval regardless of risk or margin.

3.4 NRC Staff Evaluation

The NRC regulations in 10 CFR 50.55a(b)(3)(ii) require nuclear power plant licensees to comply with the provisions of the ASME OM Code incorporated by reference in 10 CFR 50.55a, and must establish a program to ensure that MOVs continue to be capable of performing their design-basis safety function. The NRC staff considers ASME OM Code testing specified in Mandatory Appendix III with the conditions in 10 CFR 50.55a(b)(3)(ii), and the MOV diagnostic test programs developed in response to NRC GL 89-10, “Safety-Related Motor-Operated Valve Testing and Surveillance,” (ADAMS Accession No. ML031150300) and GL 96-05 together will provide reasonable assurance that the regulatory requirements of 10 CFR 50.55a(b)(3)(ii) are met.

In GL 89-10, the NRC staff requested information concerning the licensee’s program to address NRC Bulletin 85-03, “Motor-Operated Valve Common Mode Failures During Plant Transients Due to Improper Switch Settings,” or Supplement 1 of that Bulletin. The NRC requested information from each nuclear power plant licensee to confirm a program to demonstrate that safety-related MOVs are capable of performing their design-basis functions. During the implementation of GL 89-10, the NRC staff provided four acceptable methods the licensee could use to demonstrate the design basis capability of safety-related MOVs. The four methods for demonstrating capability in descending order of acceptability are:

1) Dynamic testing at or near design basis conditions with diagnostics of each MOV where practicable. Valves dynamically tested at less than design basis conditions may be extrapolated with proper justification.

2) Electric Power Research Institute (EPRI) MOV Performance Prediction Methodology (PPM). This method was developed for those valves that could not be dynamically tested. The PPM required internal valve measurements to provide assurance that the valve performance was predictable. The NRC staff began accepting the use of the PPM even where dynamic testing for an MOV was practicable.

3) MOV valve grouping. Where valve-specific dynamic testing was not performed and the PPM was not used, the staff accepted grouping of MOVs that were dynamic tested at the plant to apply the plant-specific test information to an MOV in the group.

4) The use of valve test data from other plants or research programs. The NRC ranks this as the least-preferred approach (with the most margin required) because the licensee would have minimal information regarding the tested valve and its history.

GL 96-05 superseded GL 89-10 and requested that each licensee establish a program, or ensure the effectiveness of its current program, to verify on a periodic basis that safety-related MOVs continue to be capable of performing their safety functions within the current licensing basis of the facility. The program should ensure that changes in required performance resulting from degradation (such as those caused by age) can be properly identified and accounted for.

In response to GL 96-05, the nuclear industry joined together to form the JOG MOV periodic verification program. The JOG program consisted of three elements: (1) an "interim" MOV periodic verification program for licensees to use in response to GL 96-05 during development of a long-term program; (2) a 5-year MOV dynamic diagnostic test program; and (3) a long-term MOV periodic diagnostic test program to be based on the information from the dynamic testing program. The JOG effort was intended to answer the valve degradation question as it pertained to valve configuration, design, and system application. The JOG test program was not intended to provide data to the industry for the purpose of justifying valve performance. The final JOG program plan consisted of periodic diagnostic test program that is based on risk and margin. The NRC staff approved the JOG final program plan, with conditions, in a safety evaluation (SE) dated September 25, 2006 (ADAMS Accession No. ML061280315).

The ASME OM Code establishes the requirements for preservice and inservice testing and examination of certain components to assess their operational readiness in light-water reactor nuclear power plants. These requirements apply to pumps and valves that are required to perform a specific function in shutting down a reactor to the safe shutdown condition, in maintaining the safe shutdown condition, or in mitigating the consequences of an accident. The ASME OM Code also applies to pressure relief devices and dynamic restraints.

Prior to the development of Mandatory Appendix III, the ASME OM Code testing for MOVs consisted of:

1) Valve exercising to include quarterly stroke time testing
2) Valve obturator movement verification during the exercise test
3) Valve leakage testing (only if the valve has a leakage limit requirement)
4) Remote position indication verification

In the past, these required tests were considered to be adequate to assess MOV operational readiness. However, over the course of several years of operating experience and testing, it was determined that quarterly stroke time testing of MOVs was not an adequate indicator of valve degradation. As an alternative to MOV stroke-time testing, ASME developed Code Case OMN-1 to allow periodic exercising and diagnostic testing in assessing operational readiness of active MOVs in lieu of quarterly stroke-time testing. ASME provided additional guidance by developing Code Case OMN-11, "Risk-Informed Testing for Motor-Operated Valves," for MOVs in the IST program that are determined to have a high safety significance. The NRC staff has reviewed and accepted these Code Cases with certain conditions as noted in Regulatory Guide (RG) 1.192, "Operation and Maintenance Code Case Acceptability ASME OM Code," (ADAMS Accession No. ML19128A261), which is incorporated by reference in 10 CFR 50.55a. ASME merged these two Code Cases into an updated version of Code Case OMN-1 published in the 2006 Addenda of the ASME OM Code. This updated OMN-1 Code Case was later adopted into the 2009 Edition of ASME OM Code as Mandatory Appendix III. The NRC conditions for use of Mandatory Appendix III are specified in 10 CFR 50.55a(b)(3)(ii).

Most licensees of operating nuclear power plants committed to follow the JOG MOV Periodic Verification Program as part of their response to GL 96-05. The NRC staff reviewed each licensee's GL 96-05 program and risk methodology (including implementation of the JOG program) and prepared an SE describing its review of each of those programs with conditions. As noted in the August 2, 1999, SE (ADAMS Accession No. ML15113A733), ONS Units 1, 2, and 3 committed to the Westinghouse Owners Group (WOG) risk method V-EC-1658-A (Revision 2), which was approved by NRC staff on April 14, 1998 (ADAMS Accession No. ML20248H636).

Licensees of operating nuclear power plants must meet the requirements of 10 CFR 50.55a(b)(3)(ii) to follow the ASME OM Code requirements and have an MOV program that periodically verifies that MOVs will continue to perform their safety function. The NRC staff considers the JOG program plan and Mandatory Appendix III to meet 10 CFR 50.55a(b)(3)(ii) with conditions. Both programs are similar but have differences such as:

1) The JOG program incorporates risk into its MOV diagnostic testing schedule, but Mandatory Appendix III does not require the implementation of a risk-informed program. Applying risk in Mandatory Appendix III relaxes valve grouping requirements which allows for more flexible testing.
2) The JOG program has specific test intervals based on risk and margin. High risk MOVs have shorter test intervals dependent on margin with a maximum test interval of 6 years for high margin and 2 years for low margin. Mandatory Appendix III relies on the plant MOV engineer to set the correct test interval not to exceed 10 years based on specific MOV diagnostic test data. High risk valves can be justified to extend the test interval to 10 years.
3) The licensee's implementation of the JOG program is a commitment, whereas the implementation of Mandatory Appendix III is a regulatory requirement.
4) The JOG program applies to valve performance, and the licensee is responsible for justifying the periodic verification of the actuator performance.

ASME developed Code Case OMN-26 to reduce the amount of programmatic changes for licensees incorporating Mandatory Appendix III for the first time when the licensees update their IST program plans. Code Case OMN-26 aligns those portions of Mandatory Appendix III to follow the JOG approach of the test interval being based on both margin and risk that has been successfully implemented for the last 20 years. In some instances, Code Case OMN-26 is more restrictive in that certain valves (without periodic design-basis testing) are not allowed to have test intervals up to the 10-year interval allowed in Mandatory Appendix III. On the other hand, Code Case OMN-26 will allow certain valves to have test intervals based on their risk and margin that are beyond the 10-year interval in Appendix III. The NRC staff considers the extensions of the test intervals in Code Case OMN-26 to be reasonable based on many years of successful test data in implementing the JOG program by nuclear power plant licensees.

Another improvement in Code Case OMN-26 is that for high-risk valves with very high margins that are successfully stroked at least once per operating cycle under full design pressure and flow, the test interval may be extended to 12 years. Similarly, the diagnostic test interval for low-risk valves with very high margins and that are successfully stroked at least once per operating cycle under full design pressure and flow, the test interval may be extended to 16 years. Essentially, each successful stroke under full design pressure and flow is a reasonable demonstration of an MOV being operationally ready to perform its safety function without diagnostic test equipment.

The NRC staff has determined that the licensee's proposed alternative to implement Code Case OMN-26, in its entirety as described in the licensee's letters dated July 29, 2021, and August 19, 2021, at ONS Units 1, 2 and 3, provides an acceptable level of quality and safety for the sixth 10-year IST program interval, which is currently scheduled to commence on July 1, 2022, and end on June 30, 2032.

4.0 CONCLUSION

As described above, the NRC staff concludes that proposed Alternative Request ON-MOV-OMN-26 to implement ASME OM Code Case OMN-26 in its entirety, as described in the licensee's letters dated July 29, 2021, and August 19, 2021, provides an acceptable level of quality and safety for ONS, Units 1, 2, and 3. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1).

Therefore, the NRC staff authorizes proposed Alternative Request ON-MOV-OMN-26 for the implementation of ASME OM Code Case OMN-26 for the sixth 10-year IST program interval for ONS Units 1, 2, and 3.

All other ASME OM Code requirements for which relief or an alternative was not specifically requested and approved in the subject request remain applicable.

Principal Contributor: Michael Farnan, NRR

Date: December 20, 2021

SUBJECT: OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3 – PROPOSED ALTERNATIVE TO IMPLEMENT ASME CODE CASE OMN-26 (EPID L-2021-LLR-0053) DATED DECEMBER 20, 2021

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