



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

September 29, 2022

Mr. David P. Rhoades  
Senior Vice President  
Constellation Energy Generation, LLC  
President and Chief Nuclear Officer  
Constellation Nuclear  
4300 Winfield Road  
Warrenville, IL 60555

SUBJECT: QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2 – PROPOSED  
ALTERNATIVE TO THE REQUIREMENTS OF THE ASME OM CODE  
(EPID L-2022-LLR-0014)

Dear Mr. Rhoades:

By letter dated February 17, 2022 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML22048B569), Constellation Energy Generation, LLC, (the licensee) submitted an alternative request to the U.S. Nuclear Regulatory Commission (NRC) to the requirements of the American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code), associated with valve inservice testing (IST) at Quad Cities Nuclear Power Station, Units 1 and 2 (QCNPS).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50 Section 55a, paragraph (z), subparagraph (1) (10 CFR 50.55a(z)(1)), to implement alternative request RV-03 for the frequency of the testing of certain pressure isolation valves at QCNPS on the basis that the proposed alternative provides an acceptable level of quality and safety. Although the licensee referred to this submittal as a “relief” request, this submittal represents an alternative request in accordance with 10 CFR 50.55a(z)(1).

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the proposed alternative request RV-03 to establish performance-based leak testing intervals for valves at QCNPS within the scope of this request will provide an acceptable level of quality and safety where those valves have demonstrated successful leak test performance during the two most recent periodic leak tests. Accordingly, the NRC staff concludes 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 RV-03 for the sixth 10-year IST interval at QCNPS, which will begin on February 18, 2023, and is scheduled to end on February 17, 2033.

All other ASME OM Code requirements as incorporated by reference in 10 CFR 50.55a for which relief or an alternative was not specifically requested, and granted or authorized (as appropriate), in the subject request remain applicable.

D. Rhoades

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If you have any questions, please contact the Project Manager, Robert Kuntz at 301-415-3733 or via e-mail at [Robert.Kuntz@nrc.gov](mailto:Robert.Kuntz@nrc.gov).

Sincerely,

Nancy L. Salgado, Chief  
Plant Licensing Branch III  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-254 and 50-265

Enclosure:  
Safety Evaluation

cc: Listserv



UNITED STATES  
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO

ALTERNATIVE REQUEST RV-03

CONSTELLATION ENERGY GENERATION, LLC

QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2

DOCKET NOS. 50-254 AND 50-265

1.0 INTRODUCTION

By letter dated February 17, 2022 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML22048B569), Constellation Energy Generation, LLC (the licensee) submitted alternative request RV-03 to the U.S. Nuclear Regulatory Commission (NRC) for use of an alternative to specific inservice testing (IST) requirements in the 2017 Edition of the American Society of Mechanical Engineers (ASME) Operation and Maintenance of Nuclear Power Plants, Division 1, OM Code: Section IST (OM Code) at the Quad Cities Nuclear Power Station, Units 1 and 2 (QCNPS) for the sixth 10-year IST interval.

Specifically, RV-03 request an alternative for the frequency of the testing of certain pressure isolation valves (PIVs) at QCNPS pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50 Section 55a, paragraph (z), subparagraph (1) (10 CFR 50.55a(z)(1)), on the basis that the proposed alternative provides an acceptable level of quality and safety. Although the licensee referred to this submittal as a "relief" request, this submittal represents an alternative request in accordance with 10 CFR 50.55a(z)(1).

The QCNPS sixth 10-year IST interval will begin on February 18, 2023, and is scheduled to end on February 17, 2033.

2.0 REGULATORY EVALUATION

The regulations in 10 CFR 50.55a(f)(4), "Inservice testing standards requirement for operating plants," state that throughout the service life of a boiling or pressurized water-cooled nuclear power facility, pumps and valves that are within the scope of the ASME OM Code must meet the IST requirements (except design and access provisions) set forth in the ASME OM Code and addenda that become effective subsequent to editions and addenda specified in 10 CFR 50.55a(f)(2) and (3) and that are incorporated by reference in 10 CFR 50.55a(a)(1)(iv), to the

extent practical within the limitations of design, geometry, and materials of construction of the components.

The NRC regulations in 10 CFR Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," specify requirements for containment isolation valve (CIV) leakage tests.

In proposing an alternative to IST requirements in the applicable edition or addenda of the ASME OM Code as incorporated by reference in 10 CFR 50.55a, a licensee must demonstrate that (1) the proposed alternative provides an acceptable level of quality and safety in accordance with 10 CFR 50.55a(z)(1), or (2) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety in accordance with 10 CFR 50.55a(z)(2).

The IST requirements in the ASME OM Code (2017 Edition), as incorporated by reference in 10 CFR 50.55a, related to this alternative request are as follows:

ASME OM Code, Subsection ISTC, "Inservice Testing of Valves in Light-Water Reactor Nuclear Power Plants," paragraph ISTC-3630, "Leakage Rate for Other Than Containment Isolation Valves," states:

Category A valves with a leakage requirement not based on an Owner's 10 CFR 50, Appendix J program, shall be tested to verify their seat leakages within acceptable limits. Valve closure before seat leakage testing shall be by using the valve operator with no additional closing force applied.

Subparagraph (a), "Frequency," in paragraph ISTC-3630 states:

Tests shall be conducted at least once every 2 years.

ASME OM Code, Section ISTC, paragraph ISTC-3630, subparagraph (b), states in part that the valve seat test shall be made with the pressure differential in the same direction as when the valve is performing its function with specific exceptions. ASME OM Code, Section ISTC, paragraph ISTC-3620, "Containment Isolation Valves," states in part that CIVs with a leakage rate requirement based on an Appendix J program commitment shall be tested in accordance with the Owner's 10 CFR Part 50, Appendix J program. ASME OM Code, Section ISTC, paragraph ISTC-3620, also states that CIVs with a leakage requirement based on other functions shall be tested in accordance with paragraph ISTC-3630.

Guidance for implementation of acceptable leakage rate test methods, procedures, and analyses for 10 CFR Part 50, Appendix J, Option B, is provided in Regulatory Guide (RG) 1.163 "Performance-Based Containment Leak-Test Program" (ML003740058). RG 1.163 endorses Nuclear Energy Institute (NEI) 94-01, "Industry Guideline for Implementing Performance-Based Option of 10 CFR 50 Appendix J," Revision 0, dated July 26, 1995, with the limitation that the Type C component test intervals cannot extend greater than 60 months. Revision 3-A to NEI 94-01 allows the Type C containment isolation valve test intervals to be extended to 75 months with a permissible extension for non-routine emergent conditions of 9 months (84 months total). In a safety evaluation dated June 8, 2012 (ML121030286) and the corresponding approval letter dated December 6, 2012 (ML12226A546), the NRC staff determined that the guidance in NEI 94-01, Revision 3-A, is acceptable with the following conditions:

1. NEI 94-01, Revision 3, is requesting that the allowable extended interval for Type C local leak rate tests (LLRTs) be increased to 75 months, with a permissible extension (for non-routine emergent conditions) of nine months (84 months total). The staff is allowing the extended interval for Type C LLRTs be increased to 75 months with the requirement that a licensee's post-outage report include the margin between the Type B and Type C leakage rate summation and its regulatory limit. In addition, a corrective action plan shall be developed to restore the margin to an acceptable level. The staff is also allowing the non-routine emergent extension out to 84 months as applied to Type C valves at a site, with some exceptions that must be detailed in NEI 94-01, Revision 3. At no time shall an extension be allowed for Type C valves that are restricted categorically (e.g., boiling water reactor main steam isolation valves), and those valves with a history of leakage, or any valves held to either a less than maximum interval or to the base refueling cycle interval. Only nonroutine emergent conditions allow an extension to 84 months.
  
2. The basis for acceptability of extending the integrated leak rate testing (ILRT) interval out to once per 15 years was the enhanced and robust primary containment inspection program and the local leakage rate testing of penetrations. Most of the primary containment leakage experienced has been attributed to penetration leakage and penetrations are thought to be the most likely location of most containment leakage at any time. The containment leakage condition monitoring regime involves a portion of the penetrations being tested each refueling outage, nearly all LLRTs being performed during plant outages. For the purposes of assessing and monitoring or trending overall containment leakage potential, the as-found minimum pathway leakage rates for the just tested penetrations are summed with the as-left minimum pathway leakage rates for penetrations tested during the previous 1 or 2 or even 3 refueling outages. Type C tests involve valves which, in the aggregate, will show increasing leakage potential due to normal wear and tear, some predictable and some not so predictable. Routine and appropriate maintenance may extend this increasing leakage potential. Allowing for longer intervals between LLRTs means that more leakage rate test results from farther back in time are summed with fewer just tested penetrations and that total used to assess the current containment leakage potential. This leads to the possibility that the LLRT totals calculated understate the actual leakage potential of the penetrations. Given the required margin included with the performance criterion and the considerable extra margin most plants consistently show with their testing, any understatement of the LLRT total using a 5-year test frequency is thought to be conservatively accounted for. Extending the LLRT intervals beyond 5 years to a 75-month interval should be similarly conservative provided an estimate is made of the potential understatement and its acceptability determined as part of the trending specified in NEI 94-01, Revision 3, Section 12.1. When routinely scheduling any LLRT valve interval beyond 60-months and up to 75-months, the primary containment leakage rate testing program trending or monitoring must include an estimate of the amount of understatement in the Type B & C total, and must be included in a licensee's post-outage report. The report must include the reasoning and

determination of the acceptability of the extension, demonstrating that the LLRT totals calculated represent the actual leakage potential of the penetrations.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Alternative Request RV-03

##### 3.1.1 Applicable Code Edition

The applicable OM Code of Record for the sixth 10-year IST interval at QCNPS is the 2017 Edition of ASME OM Code as incorporated by reference in 10 CFR 50.55a.

##### 3.1.2 ASME Code Components Affected

The components affected by the alternative request are provided on page 1 of 10 of "10 CFR 50.55a Relief Request: RV-03" included in the Attachment to the February 17, 2022, letter under item 1, "ASME Code Components Affected."

##### 3.1.3 Reason for Request

Alternative request RV-03 describes the reason for the request pursuant to 10 CFR 50.55a(z)(1) to implement an alternative to certain testing requirements of ASME OM Code, Subsection ISTC, paragraph ISTC-3630(a) for specific valves on the basis that the alternative testing would provide an acceptable level of quality and safety. The alternative references Technical Specification (TS) 5.5.12, "Primary Containment Leakage Rate Testing Program," which requires the establishment of a leakage rate testing program in accordance with the guidelines contained in NEI 94-01, Revision 3-A, dated July 2012, and the conditions and limitations specified in NEI 94-01, Revision 2-A, dated October 2008. The request states that the alternative is intended to provide for performance-based scheduling of PIV tests at QCNPS to maintain radiation exposure of plant personnel as low as reasonably achievable.

##### 3.1.4 Licensee's Proposed Alternative and Basis for Use

Alternative request RV-03 proposes to perform PIV testing at intervals ranging from every refueling outage to every third refueling outage. The specific interval for each valve would be a function of its performance, and would be established in a manner consistent with the CIV process under 10 CFR Part 50, Appendix J, Option B, "Performance-Based Requirements." The licensee states that a conservative control will be established such that if any valve fails its PIV test, the test interval will be reduced consistent with Option B requirements until good performance is reestablished.

The request states that the primary basis for the proposed alternative is the historically good performance of the PIVs at QCNPS. Tables RV-03-1 through RV-03-5 in the submittal summarize test data that demonstrate acceptable historical PIV performance for the Residual Heat Removal and Core Spray Systems. The submittal reports that the only recorded seat leakage failures of the PIVs at QCNPS were determined to be the result of the test methodology, and not due to any physical condition of the valves. In addition to NEI 94-01, the licensee states that bases for this request include (a) the performance of separate functional testing of motor-operated valve PIVs and condition monitoring of check valve PIVs per the ASME OM Code; (b) the low likelihood of valve mispositioning during power operations (e.g.,

procedures and interlocks); (c) the presences of relief valves in the low pressure (LP) piping, which might not provide inner-system loss of coolant accident mitigation for inadvertent PIV mispositioning, but their relief capacity can accommodate conservative PIV seat leakage rates; and (d) the presence of alarms that identify high pressure to LP leakage such that reactor operators can take appropriate action.

Based on this information, the request asserts that the proposed alternative to perform PIV testing at the specified performance-based intervals will continue to provide assurance of PIV operational readiness, and will provide an acceptable level of quality and safety pursuant to 10 CFR 50.55a(z)(1).

### 3.2 NRC Staff Evaluation

Alternative request RV-03 proposes to perform the valve seat leakage testing at intervals ranging from every refueling outage (RFO) to every third RFO. The specific interval for each valve would be a function of its performance, and would be established in a manner consistent with the CIV process under 10 CFR Part 50, Appendix J, Option B. If any valve fails its PIV test, the test interval will be reduced consistent with Option B requirements until good performance is reestablished.

Alternative request RV-03, Tables RV-03-1 through RV-03-5, summarize test data that demonstrate good historical performance of the PIVs within the scope of the request at QCNPS. The tables provide leakage test results indicating little or no measurable leakage for some valves within the scope of the request as far back as 2006 at QCNPS. The request states that the only recorded seat leakage failures of PIVs at QCNPS were the result of the test methodology and not due to a physical condition of the valves. In addition, the licensee performs functional tests and/or performance indicator activities for each PIV within the scope of this request to ensure their functional capabilities in accordance with ASME OM Code as incorporated by reference in 10 CFR 50.55a.

Based on good valve performance history and functional tests and/or performance indicator activities for the PIVs, the NRC staff finds that the performance-based leak testing interval approach proposed in alternative request RV-03 for the PIVs within the scope of this request at QCNPS will provide an acceptable level of quality and safety as required by 10 CFR 50.55a(z)(1) where those valves have demonstrated successful leak test performance during the two most recent periodic leak tests.

### 4.0 CONCLUSION

As indicated above, the NRC staff finds that the proposed alternative request RV-03 to establish performance-based leak testing intervals for valves at QCNPS within the scope of this request will provide an acceptable level of quality and safety where those valves have demonstrated successful leak test performance during the two most recent periodic leak tests. Accordingly, the NRC staff concludes 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 RV-03 for the sixth 10-Year IST interval at QCNPS, which will begin on February 18, 2023, and is scheduled to end on February 17, 2033.

All other ASME OM Code requirements as incorporated by reference in 10 CFR 50.55a for which relief or an alternative was not specifically requested, and granted or authorized (as appropriate), in the subject request remain applicable.

Principal Contributor:           K. Hsu, NRR  
  T. Scarbrough, NRR

Date: September 29, 2022

SUBJECT: QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2 – PROPOSED ALTERNATIVE TO THE REQUIREMENTS OF THE ASME OM CODE (EPID L-2022-LLR-0014) DATED SEPTEMBER 29, 2022

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