



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

September 27, 2023

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: DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3 – PROPOSED
ALTERNATIVE REQUEST RV-03 ASSOCIATED WITH THE SIXTH 10-YEAR
INSERVICE TESTING INTERVAL (EPID L-2022-LLR-0076)

Dear Mr. Rhoades:

By letter dated November 1, 2022 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML22305A578), Constellation Energy Generation, LLC (the licensee) submitted alternative request RV-03 to the U.S. Nuclear Regulatory Commission (NRC). The alternative request proposed an alternative to the testing requirements of American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code section ISTC-3630(a) for use during the sixth 10-year inservice testing (IST) interval program at Dresden Nuclear Power Station (DNPS) Units 2 and 3.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), 50.55a(z)(1), the licensee requested to implement proposed alternative request RV-03 for the 16 valves (listed in Attachment 2 of the licensee's submittal) at DNPS, Units 2 and 3, on the basis that the proposed alternative will provide an acceptable level of quality and safety.

The NRC staff has reviewed the subject alternative request and concluded, as set forth in the enclosed safety evaluation, that the proposed alternative request RV-03 will implement performance-based leak testing intervals for the specified 16 pressure-indicating valves at DNPS for the sixth 10-year IST interval program and provide an acceptable level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed the regulatory requirements set forth in 10 CFR 50.55a(z)(1) and the staff authorizes the use of alternative request RV-03 for the sixth 10-year IST interval program at DNPS, Units 2 and 3, which will begin on November 1, 2023, and is scheduled to end on October 31, 2033.

All other ASME OM Code requirements as incorporated by reference in 10 CFR 50.55a for which an alternative was not specifically requested and approved remain applicable.

D. Rhoades

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If you have any questions on this action, please contact the NRC Project Manager Surinder Arora at 301-415-1421 or via e-mail at Surinder.Arora@nrc.gov.

Sincerely,

Jeffrey A. Whited, Chief
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-237 and 50-249

Enclosure:
Safety Evaluation

cc: Listserv



UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ALTERNATIVE REQUEST RV-03

SIXTH 10-YEAR INSERVICE TESTING INTERVAL PROGRAM

CONSTELLATION ENERGY GENERATION, LLC

DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3

DOCKET NUMBERS 50-237 AND 50-249

EPID NO. L-2022-LLR-0076

1.0 INTRODUCTION

By a letter dated November 1, 2022 (Agencywide Documents and Access Management System (ADAMS) Accession No. ML22305A578), Constellation Energy Generation LLC (CEG, the licensee) submitted alternative request RV-03 to the U.S. Nuclear Regulatory Commission (NRC) for the 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) during the sixth 10-year IST interval program at Dresden Nuclear Power Station (DNPS), Units 2 and 3.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee requested to implement the proposed alternative request RV-03 for the 16 gate and check valves listed in Attachment 2 of the licensee's submittal at DNPS, Units 2 and 3, on the basis that the proposed alternative will provide an acceptable level of quality and safety.

The DNPS, Units 2 and 3, sixth 10-year IST interval program will start on November 1, 2023, and is scheduled to end on October 31, 2033.

2.0 REGULATORY EVALUATION

The NRC regulations in 10 CFR 50.55a(f)(4), "Inservice testing standards requirement for operating units," state, in part, 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 50.55a(z), "Alternatives to codes and standards requirements," state that alternatives to the requirements of 10 CFR 50.55a(b) through (h) or portions thereof may be used when authorized by the Director, Office of Nuclear Reactor Regulation. A

proposed alternative must be submitted and authorized prior to implementation. The applicant or licensee must demonstrate that:

- (1) Acceptable level of quality and safety. The proposed alternative would provide an acceptable level of quality and safety; or
- (2) Hardship without a compensating increase in quality and safety. Compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

3.0 TECHNICAL EVALUATION

The information provided by the licensee in support of the request for an alternative to IST requirements in the ASME OM Code, as incorporated by reference in 10 CFR 50.55a, has been evaluated and the bases for disposition are documented in this safety evaluation (SE).

3.1 Licensee's Alternative Request RV-03

Applicable Code Edition

The applicable Code of Record for the sixth 10-year IST interval program at DNPS, Units 2 and 3, is the 2017 Edition of ASME OM Code as incorporated by reference in 10 CFR 50.55a.

ASME Code Components Affected

In its submittal, the licensee proposed alternative testing for the following 16 containment isolation valves (CIVs) and pressure-isolation valves (PIVs) listed in table 1 below:

Table 1

Valve ID	Valve Type	CIV/PIV or Both	System	Code Class	Category
2(3)-1501-22A-MO	Gate	Both	Low Pressure Coolant Injection (LPCI)	1	A
2(3)-1501-22B-MO	Gate	Both	LPCI	1	A
2(3)-1501-25A-MO	Check	Both	LPCI	1	A/C
2(3)-1501-25B-MO	Check	Both	LPCI	1	A/C
2(3)-1402-9A	Check	PIV	Core Spray (CS)	1	A/C
2(3)-1402-9B	Check	PIV	CS	1	A/C
2(3)-1402-25A-MO	Gate	Both	CS	1	A
2(3)-1402-25B-MO	Gate	Both	CS	1	A

Applicable Code Requirement

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-3522, "Category C Check Valves," subparagraph (a), states, in part:

During operation at power, each check valve shall be exercised or examined in a manner that verifies obturator travel by using the methods in ISTC-5221.

Each check valve exercise test shall include open and close tests.

- ASME OM Code, subsection ISTC, paragraph ISTC-3522, subparagraph (c), states:

If exercising is not practicable during operation at power and cold shutdowns, it shall be performed during refueling outages [RFOs].

- ASME OM Code, subsection ISTC, 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 [are] within acceptable limits. Valve closure before seat leakage testing shall be by using the valve operator with no additional closing force applied.

- ASME OM Code, subsection ISTC, paragraph ISTC-3630, subparagraph (a), "Frequency," states:

Tests shall be conducted at least once every 2 yr [years].

Reason for Request

The NRC staff summarizes the licensee's reason for its request provided in its submittal dated November 1, 2022, as follows:

Pursuant to 10 CFR 50.55a(z)(1), the licensee is proposing an alternative to the testing requirements of ASME OM Code, subsection ISTC, paragraph ISTC-3630(a), for the affected components on the basis that the alternative testing would provide an acceptable level of quality and safety.

ASME OM Code, subsection ISTC, paragraph ISTC-3630(a), requires that leakage rate testing for PIVs be performed at least once every 2 years. PIVs are not specifically included in the scope for performance-based testing for 10 CFR part 50, appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," option B, "Performance-Based Requirements." These motor-operated and check valve PIVs are in some cases CIVs but are not within the appendix J scope because the LPCI valves are considered water-sealed, and the CS system is not exposed to containment atmosphere. Table RV-03-1 in Attachment 2 of the licensee's submittal provides details regarding current and proposed testing requirements and test frequencies for these PIVs.

The concept behind the 10 CFR part 50, appendix J, option B, alternative for CIVs is that licensees are allowed to adopt cost effective methods for complying with NRC regulatory requirements. Nuclear Energy Institute (NEI) report NEI 94-01 (ML112920567), "Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J," describes the risk-informed basis for extended test intervals under 10 CFR part 50, appendix J, option B. Using that approach, valves that have demonstrated good performance by the successful completion of two consecutive leak rate tests for two consecutive cycles may have increased test intervals. If the component does not fail

within two operating cycles, further failures appear to be governed by the random failure rate of the component. NEI 94-01 presents the results of a comprehensive risk analysis, including the statement that “the risk impact associated with increasing [leak rate] test intervals are negligible (less than 0.1 % of total risk).”

The PIVs identified in alternative request RV-03 are installed in water applications. The PIV testing is performed with water pressurized to pressures lower than the function maximum pressure differential. The observed leakage is adjusted to the function maximum pressure differential value in accordance with ASME OM Code, subsection ISTC, paragraph ISTC-3630(b), *Differential Test Pressure*, item (4).

The licensee’s request is intended to provide for performance-based scheduling of PIV tests at DNPS. The reason for proposing this alternative request is dose reduction in keeping with industry as low as reasonably achievable radiation dose principles. The licensee used recent historical data to identify that PIV testing alone incurs a total dose of approximately 600 millirem (rem) each RFO. Assuming the affected PIVs continue to remain classified as good performers, the extended test intervals would provide for a savings of approximately 1.2 rem over a 4 and one-half year period (i.e., a bounding timeframe encompassing two RFOs). In addition, this request aids the station in the implementation of a division-based outage schedule.

NUREG-0933, “Resolution of Generic Safety Issues,” Issue 105, “Interfacing Systems LOCA [loss-of-coolant accident] at LWRs [light-water reactors],” discussed the need for PIV leak rate testing based primarily on three pre-1980 historical failures of applicable valves industry-wide. These failures involved human errors in either operations or maintenance. None of these failures involved inservice equipment degradation. The performance of PIV leak rate testing provides assurance of acceptable seat leakage with the valve in a closed condition.

Power-operated valves are routinely full stroke tested in accordance with the ASME OM Code to ensure their functional capabilities. Typical PIV testing does not identify functional problems, which might inhibit the valve’s ability to reposition from open to closed.

For check valves, functional testing is accomplished in accordance with ASME OM Code, subsection ISTC, paragraph ISTC-3522. The functional testing of certain PIV check valves is monitored through a condition monitoring plan in accordance with ASME OM Code, subsection ISTC, paragraph ISTC-5222, “Condition-Monitoring Program,” and Mandatory Appendix II, “Check Valve Condition Monitoring Program.” Performance of the separate 2-year PIV leak rate testing does not contribute additional assurance of functional capability; it only determines the seat tightness of the closed valves.

The functional capability of check valves 2(3)-1501-25A/B is demonstrated by the opening and closing of the valves each RFO using internal magnetic position indication, which is directly coupled to the valve disk and is completely enclosed. This test is separate and distinct from the PIV testing; therefore, there is no need for a condition monitoring plan for these valves.

The functional capability of the 2(3)-1402-9A/B check valves is verified through periodic testing. The valves’ open function is verified by mechanically exercising the valve to the open position. The frequency is one division each RFO in accordance with the check

valve condition monitoring plan. The close function is verified during the performance of the PIV seat leakage pressure test where valve closure function is verified by the capability to build pressure against the valve disk. The intent of the condition monitoring plan is solely to align the open and close test frequencies to the same frequency as the PIV seat leakage pressure test. It is not intended to extend check valve testing to once every 10 years. By use of a condition monitoring plan, the check valve closure and opening test, based on performance, would be verified concurrently with the PIV seat leakage test.

At DNPS, the functional tests for motor-operated PIVs are performed on a 2-year frequency in accordance with ASME OM Code, Mandatory Appendix III, "Preservice and Inservice Testing of Active Electric Motor-Operated Valve Assemblies in Water-Cooled Reactor Nuclear Power Plants."

The licensee asserts that the above tests provide reasonable assurance of the operational readiness of the PIVs within the scope of this request.

Licensee's Proposed Alternative

The licensee proposes to perform PIV testing at intervals ranging from every 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. The licensee will establish conservative controls such that if any valve fails either PIV test, the test interval for both tests will be reduced consistent with appendix J, option B, requirement until good performance is re-established.

The licensee stated that the primary basis for this proposed alternative is the historically good performance of the PIVs. Tables 1 through 4 in enclosure RV-03-1, "Leakage History of DNPS, Units 2 and 3 PIVs," to the licensee's submittal dated November 1, 2022, provides the leakage history for the 16 subject PIVs for five consecutive RFO test performances.

The NEI 94-01, Revision 3-A, was not the sole basis for the licensee's request because NEI 94-01, Revision 3-A, does not address seat leakage testing with water. The licensee cited NEI 94-01 as an approach similar to the requested alternative method.

The licensee stated that the extension of test intervals proposed will be consistent with the guidance provided in 10 CFR part 50, appendix J, Type C, leak rate tests, as detailed in NEI 94-01, Revision 3-A, paragraph 10.2.3.2, "Extended Test Interval," which states:

Test intervals for Type C valves may be increased based upon completion of two consecutive periodic as-found Type C tests where the result of each test is within a licensee's allowable administrative limits. Elapsed time between the first and last tests in a series of consecutive passing tests used to determine performance shall be 24 months or the nominal test interval (e.g., refueling cycle) for the valve prior to implementing Option B to Appendix J. Intervals for Type C testing may be increased to a specific value in a range of frequencies from 30 months up to a maximum of 75 months. Test intervals for Type C valves should be determined by a licensee in accordance with Section 11.0.

Additional justification for this proposed alternative, provided by the licensee, is as follows:

- Separate functional testing of motor-operated valve (MOV) is performed in accordance with the ASME OM Code.

- Low likelihood of valve mispositioning during power operations (e.g., procedure, interlocks)
- Relief valves in the low-pressure piping relief valves may not provide Intersystem Loss of Coolant Accident (ISLOCA) mitigation for inadvertent PIV mispositioning, but their relief capacity can accommodate conservative PIV seat leakage rates.
- Operators are highly trained to recognize symptoms of the presence of an ISLOCA (i.e., alarms that identify high-pressure to low-pressure leakage), and to take appropriate actions.

Therefore, the licensee asserts that the proposed alternative to perform PIV testing at the specified intervals will continue to provide assurance of the PIV's operational readiness and provides an acceptable level of quality and safety pursuant to 10 CFR 50.55a(z)(1).

3.2 NRC Staff Evaluation

In its submittal dated November 1, 2022, for alternative request RV-03, the licensee proposed an alternative to the requirements in ASME OM Code, 2017 Edition, subsection ISTC, paragraph ISTC-3630(a), for 16 PIVs for the sixth 10-year IST interval program at DNPS. Specifically, the licensee proposes to functionally test and verify the leakage rate of the 16 PIVs using a 10 CFR, part 50, appendix J, option B, performance-based schedule. The licensee submitted and the NRC authorized alternative request RV-03 for these 16 PIVs for the fifth 10-year IST interval program (ML15174A303). In its submittal describing alternative request RV-03 for the sixth 10-year IST interval program, the licensee provided the current seat leakage testing schedule for these 16 PIVs being implemented during the fifth 10-year IST interval program. Using alternative request RV-03, the PIVs demonstrating good performance for two consecutive cycles may have their test interval extended to every third RFO in lieu of the RFO or 2-year interval specified in ISTC-3630(a). Any PIV leakage test failure requires the leakage testing for the component to return to the initial interval of every RFO or 2 years until good performance can again be established.

The PIVs are defined as two valves in series within the reactor coolant pressure boundary that separate the high pressure reactor coolant system from an attached lower pressure system. The failure of a PIV could result in an over-pressurization event which could lead to a system rupture and possible release of fission products to the environment. This type of failure event was analyzed in NUREG/CR-5928, "Inter System Loss of Coolant Accident (ISLOCA) Research Program" (ML072430731-non-public). The purpose of NUREG/CR-5928 was to quantify the risk associated with an ISLOCA event. NUREG/CR-5928 analyzed a boiling-water reactor (BWR) and pressurized-water reactor designs. The conclusion of the analysis resulted in an ISLOCA not being a risk concern for BWR designs, such as the BWRs at DNPS.

The NRC regulations in 10 CFR, part 50, appendix J, option B, allow the establishment of a performance-based leakage test program. Guidance for implementation of acceptable leakage rate test methods, procedures, and analyses is provided in Regulatory Guide (RG) 1.163, "Performance-Based Containment Leak-Test Program" (ML003740058). RG 1.163 accepts NEI 94-01, Revision 0, "Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J," dated July 26, 1995, with the limitation that Type C component test intervals cannot extend greater than 60 months. The current version of NEI 94-01 is Revision 3-A, which allows Type C CIV test intervals to be extended to 75 months with a permissible extension for non-routine emergent conditions of 9 months (84 months total).

As specified in the SE (ML121030286 and ML12226A546), incorporated in NEI 94-01, Revision 3-A, the NRC staff finds the guidance in NEI 94-01, Revision 3-A, to be acceptable, with the following conditions:

- 1) NEI 94-01, Revision 3, is requesting that the allowable extended interval for Type C local leakage-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., BWR 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.

The DNPS licensee is currently applying alternative request RV-03 for leak testing the 16 PIVs within the scope of this alternative request as described in the November 1, 2022, submittal. The licensee has demonstrated that these PIVs have a history of good performance for five consecutive RFOs as shown in tables 1 through 4 in enclosure RV-03-1 to the licensee's submittal dated November 1, 2022. The licensee reports that the performance of leakage testing for the 16 PIVs places a burden on test personnel being exposed to radiation. Extending the leakage test interval based on good performance is a logical progression for a performance-based approach.

Based on the information described above for the 16 PIVs within the scope of the licensee's alternative request RV-03 at DNPS, Units 2 and 3, the NRC staff finds that (1) these PIVs have demonstrated good historical performance; (2) no current concerns with the performance of these PIVs have been identified; (3) periodic maintenance activities are not modified by this request; (4) the alternative request allows a performance-based approach for leak testing of these 16 PIVs such that PIVs that have demonstrated good performance for two consecutive cycles may have their test interval extended up to 75 months, with a permissible extension (for non-routine emergent conditions) of 9 months (84 months total); and (5) any PIV leakage test failure would require the component to be returned to the initial ASME OM Code interval until good performance can again be established. Therefore, the NRC staff finds that alternative request RV-03 will implement performance-based leak testing intervals for the PIVs within the scope of this request at DNPS, Units 2 and 3, that will provide an acceptable level of quality and safety that satisfies 10 CFR 50.55a(z)(1).

4.0 CONCLUSION

As described above, the NRC staff finds that the licensee's proposal described in alternative request RV-03 will implement performance-based leak testing intervals for the specified 16 PIVs at DNPS for the sixth 10-year IST interval program that will provide an acceptable level of quality and safety. 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 use of alternative request RV-03 for the sixth 10-year IST interval program at DNPS, Units 2 and 3, which is scheduled to start on November 1, 2023, and scheduled to end on October 31, 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 Contributors: Gurjendra Bedi, NRR/DEX/EMIB
Thomas Scarbrough, NRR/DEX/EMIB

Dated: September 27, 2023

SUBJECT: DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3 – PROPOSED ALTERNATIVE REQUEST RV-03 ASSOCIATED WITH THE SIXTH 10-YEAR INSERVICE TESTING INTERVAL (EPID L-2022-LLR-0076) DATED SEPTEMBER 27, 2023

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