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

August 13, 2026

Mr. Terry J. Brown
Site Vice President
Vistra Operations Company LLC
Perry Nuclear Power Plant
Mail Stop A-PY-A290
10 Center Rd.
Perry, OH 44081-0097

SUBJECT: PERRY NUCLEAR POWER PLANT, UNIT NO. 1 - REQUEST IR-056, REVISION 4 REGARDING ALTERNATE EXAMINATIONS OF REACTOR VESSEL INTERNAL COMPONENTS (EPID L2026-LLR-0013)

Dear Mr. Brown:

By letter dated February 24, 2026 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML26063A305), as supplemented by letter dated June 11, 2026 (ML26162A481), Vistra Operations Company LLC (the licensee) requested U.S. Nuclear Regulatory Commission (NRC) review and approval of relief from certain requirements in the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," at Perry Nuclear Power Plant, Unit No. 1 (Perry).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(z)(1), the licensee requested to use the proposed alternative in Relief Request IR-056, Revision 4, on the basis that the proposed alternative will provide an acceptable level of quality and safety for the fourth inservice inspection (ISI) interval at Perry, which began on May 18, 2019, and is scheduled to expire on May 17, 2029.

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the implementation of the Boiling Water Reactor Vessel and Internals Project (BWRVIP) Inspection and Evaluation (I&E) guidelines specified in the licensee's proposed alternative will ensure the structural integrity of the reactor pressure vessel internal components with an acceptable level of quality and safety. Thus, the NRC staff authorizes the BWRVIP I&E guidelines as an alternative to the ASME Code, Section XI ISI examination criteria. Accordingly, the NRC staff concludes that the licensee has adequately addressed all the regulatory requirements set forth in 10 CFR 50.55a(z)(1).

Therefore, the NRC staff authorizes the proposed alternative in Relief Request IR 056, Revision 4, for the fourth ISI interval at Perry.

The staff's evaluation of BWRVIP-03, Revision 21; BWRVIP-38, Revision 1; BWRVIP-48, Revision 2; BWRVIP-94NP, Revision 4; and BWRVIP-180, Revision 1, for IR-056, Revision 4, at Perry does not imply or infer the NRC's approval for generic use of these reports.

All other ASME Code requirements for which relief were not specifically requested and approved in the subject request for relief remain applicable.

If you have any questions, please contact Gretchen Rivera-Capella at 301-415-5944 or via e-mail at Gretchen.Rivera-Capella@nrc.gov.

Sincerely,

ILKA BERRIOS

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Date: 2026.08.13 16:17:39 -04'00'

Ilka Berrios, Chief
Operating Reactor Licensing Branch 3
Division of Licensing Projects I
Office of Nuclear Reactor Regulation

Docket No. 50-440

Enclosure:
Safety Evaluation

cc: Listserv

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST IR-056, REVISION 4

ALTERNATIVE EXAMINATION OF REACTOR VESSEL INTERNAL COMPONENTS

PERRY NUCLEAR POWER PLANT, UNIT NO. 1

DOCKET NO. 50-440

1.0 INTRODUCTION

By letter dated February 24, 2026 (Agencywide Documents Access and Management System Accession No. ML26063A305), as supplemented by letter dated June 11, 2026 (ML26162A481), Vistra Operations Company LLC (the licensee) requested U.S. Nuclear Regulatory Commission (NRC) review and approval of relief from certain requirements in the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components,” at Perry Nuclear Power Plant, Unit No. 1 (Perry).

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2.0 REGULATORY EVALUATION

The NRC regulations in 10 CFR 50.55a(g)(4), require that ASME Code Class 1, 2, and 3 components meet the ISI requirements, except the design and access provisions, set forth in Section XI of editions and addenda of the ASME Code to the extent practical, within the limitations of design, geometry, and materials of construction of the components. The interior accessible areas, welded attachments, and the welded core support structures in the reactor pressure vessel (RPV) are categorized as ASME Code Class 1 components.

Section 50.55a(z) of 10 CFR states, in part, that alternatives to the requirements of 10 CFR 50.55a(g) may be used, when authorized by the NRC, if the licensee demonstrates: (1) the proposed alternatives would provide an acceptable level of quality and safety, 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.

3.0 TECHNICAL EVALUATION

3.1 ASME Code Components Affected

ASME Code, Section XI, Class 1, Examination Category B-N-1 and B-N-2 item numbers:

- B13.10 – Vessel Interior
- B13.20 – Vessel Interior Attachments within Beltline Region
- B13.30 – Interior Attachments beyond Beltline Region
- B13.40 – Core Support Structure

Table 1 in the submittal provides a detailed list of affected components associated with each examination item number.

3.2 Applicable Code Edition and Addenda

The applicable Code edition for the fourth ISI interval is the 2019 Edition of the ASME Code, Section XI. The original code of record for the fourth ISI interval was the 2013 Edition of the ASME Code, Section XI. By letter dated February 9, 2026 (ML26023A152), the NRC authorized the use of the 2019 Edition of the ASME Code, Section XI for the fourth ISI interval at Perry. The licensee stated that the subject relief request is to be used after implementation of the 2019 Edition of the ASME Code, Section XI.

3.3 Applicable Code Requirement

ASME Code, Section XI, Paragraph IWB-2500(a) states, in part, that: Components shall be examined and tested as specified in Table IWB-2500-1. Table IWB-2500-1 specifies, in part, the following visual examinations.

- B13.10 – Examine accessible areas of the RV [reactor vessel] interior each inspection period using a technique which meets the requirements for a VT-3 examination, as defined in paragraph IWA-2213 of the ASME Code, Section XI (B-N-1)

- B13.20 – Examine accessible interior attachment welds within the beltline region each interval using a technique which meets the requirements for a VT-1 examination as defined in paragraph IWA-2211 of the ASME Code, Section XI (B-N-2).

- B13.30 – Examine accessible interior attachment welds beyond the beltline region each interval using a technique which meets the requirements for a VT-3 examination, as defined in paragraph IWA-2213 of the ASME Code, Section XI (B-N-2).

- B13.40 – Examine accessible surfaces of the core support structures each interval using a technique which meets the requirements for a VT-3 examination, as defined in paragraph IWA-2213 of the ASME Code, Section XI (B-N-2)

3.4 Reason for Request

The licensee stated that the Boiling Water Reactor Vessel and Internals Project (BWRVIP) have developed Inspection and Evaluation (I&E) guidelines and has recommended BWR owners to identify material degradation with reactor vessel internal components. The BWRVIP guidelines focus on specific and susceptible components, specify appropriate inspection methods capable of identifying known or potential degradation mechanisms, and require re-examination at appropriate intervals. In contrast, the ASME code inspection requirements were prepared before the BWRVIP initiative and have not evolved with BWR inspection experience. The licensee explained that the scope of the BWRVIP guidelines meet or exceed that of the ASME Code and in many instances include components that are not part of the ASME Code jurisdiction.

3.5 Proposed Alternative

The licensee proposed to apply the I&E guidelines in the following BWRVIP reports to examine and evaluate the affected RPV internal components in lieu of the requirements of the ASME Code, Section XI, paragraph IWB-2500(a) and Table IWB-2500-1. The BWRVIP I&E guidelines include the examination method, examination volume, frequency, training, successive and additional examinations, flaw evaluations, and reporting.

- BWRVIP-03, “BWR Vessel and Internals Project, Reactor Pressure Vessel and Internals Examination Guidelines”
- BWRVIP-18, Revision 2-A, “BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines” (ML16302A123)
- BWRVIP-25, Revision 1-A “BWR Core Plate Inspection and Flaw Evaluation Guidelines”
- BWRVIP-26-A, “BWR Top Guide Inspection and Flaw Evaluation Guidelines”
- BWRVIP-27-A, “BWR Standby Liquid Control System/Core Plate ΔP Inspection and Flaw Evaluation Guidelines”
- BWRVIP-38, Revision 1 “BWR Shroud Support Inspection and Flaw Evaluation Guidelines”
- BWRVIP-41, Revision 4-A, “BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines” (ML18130A024)
- BWRVIP-42, Revision 1-A,” BWR Vessel and Internals Project, Low Pressure Coolant Injection (LPCI) Coupling Inspection and Flaw Evaluation Guidelines” (ML17004A256)
- BWRVIP-47-A, “BWR Lower Plenum Inspection and Flaw Evaluation Guidelines”
- BWRVIP-48, Revision 2, “Vessel ID [Internal Diameter] Attachment Weld Inspection and Flaw Evaluation Guidelines”
- BWRVIP-76, Revision 1-A, “BWR Core Shroud Inspection and Flaw Evaluation Guidelines” (ML15266A189)
- BWRVIP-94NP, Revision 4, “BWR Vessel and Internals Project Program Implementation Guide” (ML20345A248)
- BWRVIP-100, Revision 2-A, “Updated Assessment of the Fracture Toughness of Irradiated Stainless Steel for BWR Core Shrouds”
- BWRVIP-138, Revision 2-A, “Updated Jet Pump Beam Inspection and Flaw Evaluation” (ML25176A143)
- BWRVIP-180, Revision 1 “BWR Vessel and Internals Project, Access Hole Cover Inspection and Flaw Evaluation Guidelines”

- BWRVIP-183-A, “Top Guide Grid Beam Inspection and Flaw Evaluation Guidelines” (ML18078A322)

The licensee stated that if flaw evaluations are required as a result of examinations performed per BWRVIP-76-R1-A, the fracture toughness values specified in BWRVIP-100-R2-A will be used in the flaw evaluations.

3.6 Duration of the Alternative

The licensee stated that the duration of the proposed alternatives is for the fourth ISI interval, which began on May 18, 2019, and is scheduled to end on May 17, 2029.

3.7 NRC Staff Evaluation

The NRC staff organized its evaluation in four subsections. Section 3.7.1 is related to the evaluation of the BWRVIP reports used as part of IR-056, Revision 4. Section 3.7.2 is the evaluation of the specific topics presented in Section 5 of the relief request. Section 3.7.3 is the evaluation of the latest inspection results of RPV internal components at Perry. Section 3.7.4 is related to the information presented in Table 1 in the relief request.

The staff focused on three key parameters that monitor the structural integrity of the affected RPV internal components – (1) the inspection frequency (how often the components are inspected), (2) the examination method, and (3) the population of affected components that will be examined.

3.7.1 Evaluation of BWRVIP Reports

The subject submittal is an updated of IR-056, Revision 3, which the licensee submitted on January 6, 2020 (ML20006D984), which the NRC staff approved as shown in its safety evaluation (SE) dated January 29, 2021 (ML20363A006).

The NRC staff noted that the major difference between Revision 3 and Revision 4 of the relief request is the proposed use of newer versions of the following BWRVIP reports: BWRVIP-38, Revision 1; BWRVIP-48, Revision 2; BWRVIP-94NP, Revision 4; BWRVIP-100, Revision 2-A; BWRVIP-138, Revision 2-A; and BWRVIP-180, Revision 1. Of these reports, the NRC staff has approved the generic use of BWRIP-100, Revision 2-A and BWRVIP-138, Revision 2-A. The licensee is permitted to use these two NRC-approved reports at Perry in accordance with the established NRC regulations and BWRVIP protocol. Therefore, the staff approves the use of BWRIP-100, Revision 2-A and BWRVIP-138, Revision 2-A at Perry without further evaluation.

The NRC staff has not approved for generic use the following reports: BWRVIP-03; BWRVIP-38, Revision 1; BWRVIP-48, Revision 2; BWRVIP-94NP, Revision 4; and BWRVIP-180, Revision 1. As such, the staff needed to review the applicability of these reports to Perry in terms of inspection and evaluation of the affected RPV internal components as identified in Table 1 of the submittal.

BWRVIP-03

The NRC staff noted that BWRVIP-03 does not contain specific I&E guidelines for any specific RPV internal components associated with the subject relief request. Rather, BWRVIP-03, in general: (1) provides an overview of the structure of the BWRVIP for BWR plant owners, and

(2) includes guidance that establishes protocols for plant owners to follow in order to gain access to BWRVIP-owned mockups; to perform formal demonstrations of nondestructive examinations (NDE) techniques using BWRVIP mockups; and to perform their own demonstrations of NDE techniques or inspection tooling in an acceptable manner.

In its supplement dated June 11, 2026, the licensee stated that it will use BWRVIP-03, Revision 21 (dated July 15, 2024), which represents the most current industry-consensus guidance for RPV and internals examinations. The licensee stated that Revision 21 was based on the foundation of previous NRC-reviewed revisions. Revision 21 incorporates (a) lessons learned from industry operating experience since Revision 19, (b) enhanced NDE techniques and examination methodologies, (c) updated inspection frequencies and coverage requirements based on cumulative industry data, and (d) refined flaw evaluation procedures consistent with current ASME Code provisions.

The licensee stated that BWRVIP-03 is classified as "Needed" guidance per Nuclear Energy Institute (NEI) 03-08, “Guideline for the Management of Material Issues, “(ML19079A256) indicating it contains essential technical requirements for managing reactor pressure vessel and internals examinations. Revision 21 maintains the same fundamental technical basis as previous NRC-approved revisions (including Revision 19) and represents an evolution of guidance based on additional industry experience and technical advancements and it provides comprehensive examination guidelines

The NRC staff noted that BWRVIP-03, Revision 21 is the specific revision used to support IR-056, Revision 4. The staff determined that Revision 21 is based on previous NRC-reviewed revisions for the proposed alternative examination guidelines and is consistent with the NEI 0308, Revision 3 framework. The staff further determined that BWRVIP-03, Revision 21 provides sufficient guidance for NDE methods, inspection frequencies and flaw evaluation procedures. Therefore, the staff finds that the licensee may use BWRVIP-03, Revision 21, to ensure structural integrity of the reactor vessel internals for the fourth ISI interval at Perry.

BWRVIP-94, Revision 4

The NRC staff noted that BWRVIP-94, Revision 4, provides a framework for structuring and strengthening existing BWR vessel and internals programs to ensure consistent application of guidelines by BWRVIP members. Electric Power Research Institute (EPRI) revised BWRVIP-94, Revision 4, to add new guidance, clarify existing implementation guidance, and expand the guidance to discuss applicability of the BWRVIP program elements to international members and those members not governed by NEI 03-08.

The NRC staff understands that RPV internals inspection programs have been developed and implemented to satisfy the guidance of BWRVIP-94. The licensee stated that the BWRVIP Executive Committee periodically revises the BWRVIP Guidelines to address industry operating experience, including enhancements to inspection techniques, and add or adjust flaw evaluation methodologies. BWRVIP-94 states that where guidance in existing BWRVIP documents has been supplemented or revised by subsequent correspondence approved by the BWRVIP Executive Committee, the reactor vessel and internals program shall be modified to reflect the new requirements and implement the guidance within two refueling outages, unless a different schedule is specified by the BWRVIP.

The licensee stated that where the revised version of a BWRVIP inspection guideline continues to also meet the requirements of the version of the BWRVIP inspection guideline that forms the

safety basis for the NRC-authorized proposed alternative to the requirements of 10 CFR 50.55a, it may be implemented. Otherwise, the revised guidelines will only be implemented after NRC approval of the revised BWRVIP guidelines or a plant specific request for relief has been approved. The licensee further stated that any deviations from the referenced BWRVIP guidelines for the duration of the proposed alternative will be appropriately documented and communicated to the NRC, per the BWRVIP Deviation Disposition Process.

As noted above, the NRC staff approved the use of relief request IR-056, Revision 3 which uses BWRVIP-94, Revision 3 for the inspections performed during the fourth ISI interval at Perry. However, Relief Request IR-056, Revision 4 uses a newer version, BWRVIP-94, Revision 4.

The NRC staff evaluated the differences between Revision 3 and Revision 4 of BWRVIP-94 based on its review of Alternative Request RI5-02 at the Cooper Nuclear Station as shown in its SE dated March 31, 2022 (ML22045A001). The staff approved the use of BWRVIP-94, Revision 4 for the Cooper Nuclear Station based on evaluating the differences between Revision 3 and Revision 4. The staff noted that BWRVIP-94, Revision 4 provides a general framework for the inspection process for BWR plants. As such, the NRC staff finds that BWRVIP-94, Revision 4, is applicable and acceptable for plant-specific application at Perry based on its evaluation of Alternative Request RI5-02 at Cooper Nuclear Station.

BWRVIP-38, Revision 1

The licensee proposed to use BWRVIP-38, Revision 1, to inspect shroud support legs and shroud support plate as specified in Table 1 of IR-056, Revision 4.

Shroud Support Legs

The licensee will inspect shroud support legs when accessible as specified in Table 1 of IR-056, Revision 4. Specifically, Footnote Number 4 of Table 1 clarifies that "…when inspection tooling and methodologies are available, they will be utilized to establish a baseline inspection of these welds. Until such time, and as committed to in BWRVIP-47-A, Section 3.2.5, visual inspections of the lower plenum area (which includes the shroud support legs) will be performed to the extent practical when access is made available through non-routine refueling outage activities (e.g., jet pump disassembly) …"

The NRC staff approved the generic use of the original version of BWRVIP-38 (Revision 0) as shown in its SEs in letters to BWRVIP dated July 24, 2000 (ML003735498), and March 1, 2001 (ML010600211). In its SEs, the staff recognized that it is difficult to inspect the shroud support legs because they are in the lower plenum of the RPV. In its SEs, the staff concluded that if inspection tooling and methodologies are developed that allow the welds in the lower plenum accessible for examination, licensees should perform a baseline inspection. In addition, the staff specified that BWRVIP should revise the report to establish re-inspection schedule.

The NRC staff finds that there is no change in the staff's position on the inspection of shroud support legs at Perry between Revisions 0 and 1 of BWRVIP-38. Therefore, the staff finds that the proposed strategy for the inspection of the shroud support legs at Perry is acceptable.

Shroud Support Plate

The licensee proposed to examine the shroud support plate using VT-1 visual examination and ultrasonic testing (UT) consistent with BWRVIP-38, Revision 1, which the staff has not approved for generic use.

By letter dated May 7, 2025 (Package ML25134A291), EPRI submitted to the NRC for information Appendix D of BWRVIP-38, Revision 1, in lieu of the entire report. As such, the NRC staff requested the licensee to provide technical basis for the proposed inspection interval for the shroud support plate because the reinspection frequency (interval) for the shroud support plate specified in Revision 1 is longer than in Revision 0.

In its supplement dated June 11, 2026, the licensee stated that the technical basis between Revision 0 and Revision 1 is similar. However, Revision 1 considered the recirculation line break acoustic load (this load had not been considered in Revision 0) and reduced fracture toughness of the flux shielded nickel alloy weld material. The licensee stated that because of these two changes, the structural evaluations performed for Revision 1 are more conservative than those performed for Revision 0.

The NRC staff noted that the inspection interval for the shroud support plate is selected to ensure that any potential flaw can be detected by specified inspection before reaching the critical crack size. The staff further noted that inspection frequency (interval) is based on stress analysis and elastic-plastic fracture mechanics methodology. The inspection intervals for shroud support plate are derived based on crack growth rates used in the fracture mechanics calculations and when the postulated flaw would reach the calculated critical crack size.

The crack growth rate depends on the RPV water environment. For example, the crack growth rate in hydrogen water chemistry (HWC) environment is slower than the crack growth rate in normal water chemistry environment, as stated in Appendix D of BWRVIP-38, Revision 1. Appendix D states that BWRVIP-38, Revision 0, did not give credit for water chemistry mitigation when determining inspection intervals whereas BWRVIP-38, Revision 1, allows an inspection interval credit for effective water chemistry mitigation that uses HWC, noble metal chemical addition (NMCA), or Online NobleChem™ (OLNC). In its supplement dated June 11, 2026, the licensee stated that Perry uses effective HWC/NMCA/OLNC water chemistry. As such, the licensee proposed to extend inspection interval for shroud support plate as shown in Table 1 of IR-056, Revision 4.

The NRC staff finds that the inspection guidance in BWRVIP-38, Revision 1, provides reasonable assurance of structural integrity of the shroud support plate at Perry because the proposed inspection interval for the shroud support plate in Table 1 of IR-056, Revision 4, is derived based on stress corrosion cracking (SCC), effective HWC/NMCA/OLNC water chemistry, appropriate postulated flaw size, stress and fracture mechanics calculations and adequate margin. In addition, fleet inspection operating experience shows limited shroud support degradation. Therefore, the licensee may use BWRVIP-38, Revision 1, to inspect the shroud support plate at Perry.

<u>BWRVIP-48, Revision 2</u>

The licensee proposed to use BWRVIP-48, Revision 2, to inspect RPV internal components classified under Items B13.20 and B13.30 as shown in Table 1 of IR-056, Revision 4. Item B13.20 includes welds at the jet pump riser brace and the material surveillance capsule holder.

Item B13.30 includes attachment welds at brackets for the core spray piping, feedwater sparger, guide rod support, steam dryer hold down, and steam dryer support. Of these components, Table 1 of IR-056, Revision 4 shows that the licensee will inspect RPV interior, jet pump riser brace, each attachment weld of the steam dryer support and hold down bracket, feedwater sparger bracket, guide rod support bracket and surveillance sample holder bracket every 10 years. The inspection frequency and population for these components are the same as required by the ASME Code, Section XI, and therefore, the proposed inspection frequency and population for these components is acceptable. The NRC staff discussion of the attachment weld of the steam dryer support bracket is documented in SE Section 3.7.2 below.

The licensee proposed to inspect 25 percent of the welds for the core spray piping bracket and jet pump riser back bracket every 12 years based on the guidance of BWRVIP-48, Revision 2, as shown in Table 1 of IR-056, Revision 4. This proposed inspection approach deviates from the requirements of the ASME Code, Section XI, and is evaluated as follows.

The NRC staff has approved plant-specific, but not generic, use of BWRVIP-48, Revision 2, for other BWR plants. For example, by letter dated September 29, 2023 (ML23270B993), the staff approved the plant-specific use of the report as part of relief requests for Grand Gulf Nuclear Station, Unit 1 (Grand Gulf) and River Bend Station, Unit 1 (River Bend). Also, by letter dated June 18, 2024 (ML24155A004), the NRC staff approved the plant-specific use of the report for Browns Ferry Nuclear Plant, Units 1, 2 and 3 (Browns Ferry). The staff used its previous evaluations of the report for these nuclear plants and from Perry's IR-056, Revision 3, to evaluate the acceptability of BWRVIP-48, Revision 2, for IR-056, Revision 4.

The NRC staff noted that Perry, Grand Gulf, and River Bend use the same BWR Mark 3 design and are of the same vintage. The Browns Ferry reactors are of the BWR Mark 1 design which may be slightly different from Perry's BWR Mark 3 design. The staff noted that although the reactor vessel internal design may be different among BWR plants, BWRVIP-48, Revision 2, and BWRVIP-41, Revision 4A (which IR-056, Revision 4 also uses), provide consistent guidance for licensees to inspect the reactor vessel internal components using the sampling approach. These reports indicate that when periodic inspections specify that only a fraction of the population is required during the specified interval, licensees can select attachment welds based on accumulated service time since the weld was last inspected. Weld selection is rotated through the entire population before any specific weld is selected a second time. When 100 percent of the population of a component is to be inspected at an interval greater than the 10-year ISI interval specified in the ASME Code, licensees may examine the entire population at one time, or they may split the inspections over the entire interval. The NRC staff finds that the plant-specific and fleet-wide operating experience of these welds and the results of the risk assessment taken together provide appropriate technical justification for the proposed inspection of 25 percent of the weld population every 12 years for the core spray piping brackets and jet pump riser brace brackets.

The NRC staff observed that BWRVIP48, Revision 2, guidelines include more rigorous examination methods than the ASME Code, Section XI criteria for the reactor vessel internal components that are likely to be susceptible to degradation. For example, Table 1 of IR-056, Revision 4, shows that the licensee will use the enhanced VT-1 (EVT-1) visual examination method which is more rigorous than the VT-3 visual examination per the ASME Code, Section XI. The EVT-1 examination methods would enable the licensee to detect degradation earlier and more accurately than the VT-3 examination. Therefore, inspections of the welds of the core spray piping brackets and jet pump riser brace brackets will provide reasonable

assurance that any emerging degradation will be identified timely so that the licensee can take proper corrective actions to mitigate the degradation.

The NRC staff determined that Appendix G of BWRVIP48, Revision 2, provides satisfactory assessments of various degradation mechanisms such as fatigue and SCC. The report states that over 450 inspections of core spray piping bracket welds in the BWR fleet have been performed, and no cracks were found. If any detection of SCC in core spray piping welds or jet pump riser brace bracket welds were to occur in any of the units in the BWR fleet, the affected licensee would alert the industry and the staff to further evaluate the inspection frequencies in these welds based on the BWRVIP protocol. The NRC staff noted that field inspection data will be available to the fleet regularly because of different outages schedules of each BWR unit. If any SCC were to occur in the future, BWRVIP can modify the reexamination schedules of the inspected RPV internal components. Because SCC is a time-dependent phenomenon, any emerging cracks could be identified in a timely manner.

The NRC staff determines that the operating experience of these welds and the results of the qualitative risk assessment provided in BWRVIP-48, Revision 2, taken together provide appropriate technical justification for the use of BWRVIP-48, Revision 2, at Perry in lieu of the requirements of the ASME Code, Section XI. The staff finds that BWRVIP-48, Revision 2, demonstrates an acceptable level of quality and safety and provides reasonable assurance of structural integrity of the affected RPV internal components at Perry.

BWRVIP-180, Revision 1

BWRVIP-180, Revision 1, specifies inspections of access hole covers (AHCs) in the shroud support plate of BWR plants. Each shroud support plate in the reactor vessel has two AHCs located approximately 180 degrees apart, except some BWR/6 plants have only one. These access holes were used for access during construction and were subsequently closed by welding a plate in the hole. The sole function of AHCs in operating plants is to maintain a leak-tight barrier between the annulus and lower plenum.

BWRVIP-180, Revision 1, states that the failure of the AHC cover welds during normal operation would result in bypass of core flow to the annulus and would result in a detectable power-flow mismatch. The mismatch would be detected by the plant operator, and the plant would be brought to a safe shutdown condition. The report concluded that there was no safety concern related to AHC failure. BWRVIP-180, Revision 1, was revised to incorporate all AHC configurations, address recirculation line break acoustic loads, and address flux-shielded weld material.

The report has (1) considered different types of AHC designs and the degradation mechanisms that influence cracking susceptibility, (2) reviewed the results of field inspections and cracking history, (3) performed stress analysis for all AHC configurations in use in currently operating plants, and (4) evaluated the structural implications of AHC cracking. Based on the stress analysis, the report specifies inspection methods and frequencies for normal water chemistry, hydrogen water chemistry, noble metal chemical addition, and on-line noble metal chemistry environments. The period between inspections depends on the type of prior inspection and the water chemistry. If an indication is detected, the report provides the guidance for the flaw evaluation and leakage rate calculation to derive acceptable flaw sizes and the period of operation before subsequent inspection or repair is required.

The NRC staff determined that Perry is categorized as a Group 7 plant as shown in Table 2-1 of BWRVIP-180, Revision 1. Table 6-3 of BWRVIP-180, Revision 1, specifies the reinspection frequency of the AHC with respect to the water chemistry used in Perry RPV. The staff noted that Table 1 of IR-056, Revision 4, does not specify the inspection of AHC welds; however, the relief request includes the report as part of the proposed alternative as shown above. Therefore, the inspection guidance per the report will monitor the condition of the AHC welds and is acceptable.

The NRC staff determined that (1) the reinspection frequency of the AHC welds is based on flaw evaluation using linear-elastic and elastic-plastic fracture mechanics method, (2) the inspection, flaw evaluation, and leakage rate calculation guidance provided in the is acceptable to disposition the degradation mechanisms affecting the report AHC at Perry. The staff determined that the analyses performed in the report demonstrate adequate structural integrity of the AHC and that the AHC will be adequately maintained during the fourth ISI interval at Perry. Therefore, the NRC staff finds that the licensee may use BWRVIP-180, Revision 1, for the inspection of the AHC at Perry.

3.7.2 Evaluation of Specific Topics in IR-056, Revision 4

Furnace-sensitized stainless steel and Alloy 182 welds

The NRC staff noted that furnace-sensitized stainless steel vessel attachment welds are inspected as required by the ASME Code and BWRVIP applicable guidelines. The licensee stated that it has not determined the sensitization status of the steam dryer and the feedwater support brackets, and as such, they are assumed to be furnace-sensitized (i.e., assuming a worse condition). The NRC staff noted that furnace-sensitized stainless steel is susceptible to Intergranular Stress Corrosion Cracking (IGSCC). As shown in Table 1 of IR-056, Revision 4, the licensee proposed to examine steam dryer and the feedwater support brackets in accordance with the ASME Code, Section XI, Table IWB-2500-1 and BWRVIP-48, Revision 2. Specifically, the staff noted that the licensee will perform EVT-1 visual examination for feedwater sparger bracket attachment welds and steam dryer support bracket attachment welds each 10-year interval, as shown in Table 1 of IR-056, Revision 4. The NRC staff finds that the EVT-1 visual examination is a more rigorous inspection than ASME Code required VT-3 visual examination and the inspection frequency is consistent with ASME Code, Section XI. Therefore, the staff determined that the inspection for the furnace-sensitized stainless steel components at Perry is acceptable.

The NRC staff noted that nickel-based Alloy 182 weld is susceptible to IGSCC based on operating experience. The licensee stated that Perry RPV has no Alloy 182 welds under Examination Category B-N-1. However, the shroud support (weld H9), shroud support legs (weld H12), and AHC as part of Examination Category B-N-2 do have Alloy 182 welds. The shroud support and shroud support leg inspections are specified in BWRVIP-38, Revision 1, and the AHC inspection is specified in BWRVIP-180, Revision 1. The licensee stated that no additional augmented inspections are performed on the Alloy 182 welds outside of that defined in BWRVIP-38 and BWRVIP-180. The licensee reported that it has not identified cracking in the Alloy 182 welds at Perry. The NRC staff determined that BWRVIP-38, Revision 1, and BWRVIP-180, Revision 1, provide sufficient inspection guidance for shroud support, shroud support leg, and the AHC as discussed above. Therefore, the staff finds that the licensee has satisfactorily addressed the inspection of Alloy 182 welds in the RPV internal components at Perry.

Feedwater nozzle and control rod drive return line nozzle

For the feedwater nozzle attached to the RPV, the licensee stated that it has implemented the NRC-recommended inspections in NUREG-0619, “BWR Feedwater Nozzle and Control Rod Drive [CRD] Return Line Nozzle Cracking: Resolution of Generic Technical Activity A-10 (Technical Report)” (ML19351E437), in both the ASME Code ISI and BWRVIP programs as augmented inspections. The licensee stated that regarding the ASME Code ISI program, the requirements are limited to the six feedwater nozzle inner radii. The licensee examined the feedwater sparger flow holes and welds in the tees and arms of the feedwater sparger per NUREG-0619. In addition, the licensee examined reactor vessel attachment welds based on the requirements of BWRVIP-48, Revision 2. The NRC staff determined that the licensee has addressed the inspection of the feedwater nozzle satisfactorily because the inspection is based on NUREG-0619 and BWRVIP-48, Revision 2.

According to the licensee, the CRD return line at Perry has been cut and capped and, therefore, is not subject to examinations. As such, the NRC staff finds it acceptable that the CRD return line has been removed from service and therefore is not required to be inspected.

Reactor Vessel Water Chemistry

The licensee stated that it uses the General Electric OLNC process as the current means of NMCA at Perry. This process replaced the previous NobleChem process and is used in conjunction with HWC to mitigate IGSCC in the reactor internals. According to the licensee, IGSCC is considered mitigated when the local electrochemical corrosion potential (ECP) is reduced below -230 millivolts (mV) standard hydrogen electrode (SHE).

The NRC staff noted that several of the BWRVIPs that are used in IR-056, Revision 4 (e.g. BWRVIP-48, Revision 2, Table G-10, Note 1), require implementation of an effective HWC program. An effective HWC program is defined as when RPV water chemistry meets the criteria specified in BWRVIP-62, “BWR Vessel and Internals Project, Technical Basis for Inspection Relief for BWR Internal Components with Hydrogen Injection.” The staff further noted that BWRVIP-62, Revision 2 (Revision 2 is the latest version), discusses the same acceptance criteria for an effective HWC program as BWRVIP-62-A, both of which include other criteria than just the ECP.

In its supplement dated June 11, 2026 (ML26162A481), the licensee responded that Perry performs all required analyses to meet the monitoring requirements of a BWRVIP-62, Revision 2, Category 3a plant (i.e., NMCA or OLNC plant with ECP measurement) and to claim credit for an effective OLNC environment at the location of welds or components of interest, as discussed below.

The NRC staff noted that HWC availability is defined in Section 4.6.1 of BWRVIP-62-A. The licensee presented data showing that HWC availability at Perry during the past five operating cycles has satisfied the required acceptance values. Therefore, the staff determined that Perry has met the requirements for HWC availability.

The licensee provided a graph showing that the measured hydrogen and oxygen molar ratios at Perry are greater than the required (proprietary) value as specified in BWRVIP-62. The molar ratio is limited at certain value to ensure that dissolved hydrogen is maintained to mitigate IGSCC. The NRC staff determined that Perry has satisfied the hydrogen and oxygen molar ratio criterion.

The licensee stated that it applies OLNC every 11 to 16 months, starting in October 2008. The licensee provided dates of the OLNC application. The staff determined that the licensee has periodically applied OLNC and satisfied the OLNC application criterion.

The licensee stated that it uses the in-vessel coupons to obtain data on noble metal loading during refueling outages. The licensee provided the data on the noble metal deposition demonstrating that the noble metal loadings at Perry have exceeded the required noble metal loading value (proprietary). The NRC staff determined that Perry has satisfied the noble metal loading criterion.

The licensee stated that it has installed a Mitigation Monitoring System (MMS) at Perry to monitor ECP. The MMS system contains two ECP electrodes: a self-sealing iron-iron oxide electrode and a platinum electrode. Both electrodes at Perry are functional and were available for the last ramping test in October 2025. The NRC staff determined that Perry has satisfied the ECP electrode criterion.

The licensee stated that at least two benchmarked secondary parameters are available at Perry. The licensee measures either feedwater hydrogen flow rate or concentration feedwater hydrogen flow rate continuously at Perry. Feedwater hydrogen concentration is calculated from the hydrogen injection rate and total feedwater flow rate. Feedwater measured hydrogen concentration is periodically obtained by grab samples. Both secondary parameters are available. The licensee monitors hydrogen and oxygen molar ratio and excess dissolved hydrogen from the radiolysis model. The model produces data at various locations in the system at various concentrations of feedwater hydrogen. The licensee stated that excess dissolved hydrogen at the location of interest and the total oxidants can be used to calculate a predicted molar ratio. The NRC staff determined that Perry has satisfied the criterion of having two secondary parameters to monitor water chemistry.

The licensee stated that it completed a hydrogen ramp test in January 2016 and again in October 2025. The ten-year frequency as specified in BWRVIP-62 has been met. The next scheduled ramp test is in 2034 or after a power uprate greater than 5 percent, whichever comes first. According to the licensee, October 2025 ramp test results were like those of the 2016 test and confirmed that the BWR Vessel Internal Application (BWRVIA) model is slightly conservative for Perry. The NRC staff determined that Perry has satisfied the criterion of performing periodic hydrogen ramping test.

The licensee stated that the BWRVIA radiolysis model is run at the beginning of each operating cycle using bounding reactor chemistry conditions with cycle-specific inputs to validate that the established hydrogen injection rate is adequate to maintain the 4:1 molar ratio required for mitigation. Results from the BWRVIA radiolysis model runs for each cycle are documented in the Perry action tracking software. According to the licensee, to validate the assumptions made when the BWRVIA model was initially run, the cases are re-run using actual plant chemistry data when each state point is reached to ensure mitigation is being maintained. The NRC staff determined that Perry uses the BWRVIA model to monitor the water chemistry to ensure proper molar ratio. Therefore, Perry has satisfied the BWRVIA radiolysis model criterion.

The NRC staff noted that HWC/NMCA/OLNC methodology implemented at Perry has complied with the staff's conditions addressed in the NRC's SE for BWRVIP62A (ML19178A130). The staff determined that the licensee adequately demonstrated that it implemented an effective HWC/NMCA/OLNC method as part of chemical mitigation at Perry. The staff also noted that absence of any IGSCC occurrence in Alloy 182 welds confirms the effectiveness of chemical

mitigation at Perry. Therefore, the NRC staff concluded that the effective HWC/NMCA/OLNC methodology will provide reasonable assurance that chemical mitigation is achieved in minimizing the IGSCC in RPV internal components at Perry.

3.7.3 Inspection Results of the Reactor Internal Components

By letter dated October 31, 2024 (ML24297A566), the BWRVIP organization submitted for information, the report that contains results of inspections performed in 2023 in domestic BWR plants, “EPRI - BWR Vessel and Internals Project, Vessel Internals Inspection Summaries for 2023 Outages.” This report provides the inspection methods used, the inspection frequency to date, corrective actions, and the results of the inspections of RPV internal components during the spring 2023 refueling outage. The report contains the results of inspections performed at Perry.

The NRC staff noted that Perry identified new indications at the two core shroud vibration instrumentations VIB-E-SHD 150 and VIB-G-SHD 315; gaps and wears at various jet pump restrainer brackets; wear and deformation on the core shroud head bolts. Perry did not detect indications in other internal components such as core spray piping welds, top guide, and low pressure coolant injection welds.

Based on its review of these inspection summaries for Perry, the NRC staff determined that the licensee has adequately (1) identified the weld flaws; (2) has appropriately taken corrective actions to ensure that the structural integrity of the component is maintained (i.e., proper repair, if necessary, or flaw evaluation with proper engineering justification); and (3) complied with scope expansion of inspections and subsequent inspections per the applicable BWRVIP reports.

The NRC staff noted that no cracking was observed in the H9 and H12 Alloy 182 core shroud support welds. As such, the staff determined that the structural integrity of the core shroud support welds is maintained.

The NRC staff further noted that the licensee implemented ISI and augmented inspection programs for feedwater nozzles that are consistent with the NUREG0619 program. Therefore, the staff concludes that implementation of inspections addressed in the NUREG0619 program provides adequate assurance that any active degradation in feedwater nozzles will be detected in a timely manner, which allows the licensee to take corrective actions at Perry.

The licensee compared ASME Code, Section XI, Examination Category B-N-1 and B-N-2 requirements to BWRVIP guidance requirements. The licensee provided specific examples comparing the inspection requirements of the ASME Code, Section XI, Item Numbers B13.10, B13.20, B13.30, and B13.40 in Table IWB-2500-1, to the inspection requirements in the BWRVIP documents, including inspection methods. Furthermore, the licensee provided specific examples of how the I&E guidelines from various BWRVIP reports compare to the ASME Code requirements with respect to inspection scope, examination method, and frequency.

The NRC staff reviewed the licensee’s evaluation of the differences in the inspection criteria between the ASME Code, Section XI, Examination Category BN1 and BN2 requirements with the relevant BWRVIP I&E guidelines for the various RPV internal components. The staff noted that the rigor of the inspection methods recommended in the BWRVIP I&E guidelines may provide more accurate results than the requirements of the ASME Code, Section XI, Table IWB-2500-1. For example, some of the components (e.g., core shroud welds) are inspected using

UT, which is superior to a VT-3 examination as required by the ASME Code, Section XI. Due to UT examinations, through-thickness defects can be discovered, and corrective action can be taken in timely manner. Additionally, better resolution of the indications using UT would be beneficial in assessing flaw evaluation. Therefore, the NRC staff concludes that the implementation of BWRVIP inspection guidelines in lieu of ASME Code, Section XI inspections would be more effective in monitoring the degradation in RPV internal components that are susceptible to IGSCC.

3.7.4 Table 1 of the Submittal

The NRC staff compared the inspection of components in Table 1 of IR-056, Revision 4, with the components in Table 1 in IR-056, Revision 3, in terms of frequency, inspection method, and inspected population. The staff did not evaluate those components in Table 1 of IR-056, Revision 4, that have the same inspection frequency, inspection method, and inspected population as those in Table 1 of IR-056, Revision 3. This is because the staff had previously approved the inspection of those components in IR-056, Revision 3, for the fourth ISI interval, as discussed in its SE dated January 29, 2021. Instead, the staff evaluated the inspection of those components in Table 1 of IR-056, Revision 4, whose inspection frequency, method, or population are different from that of Table 1 of IR-056, Revision 3 (e.g., shroud support plate and core spray bracket). The differences are based on the use of new version of BWRVIP reports such as BWRVIP-38, Revision 1, and BWRVIP-48, Revision 2.

The NRC staff determined that the inspection frequency, inspection method and population for the affected components in Table 1 of IR-056, Revision 4, are acceptable. Therefore, the staff finds that the inspection of all components in Table 1 of IR-056, Revision 4, is acceptable for use.

3.7.5 Technical Evaluation Summary

Based on the above considerations, the NRC staff finds that the implementation of the BWRVIP I&E guidelines specified in the licensee's proposed alternative will ensure the structural integrity of the RPV internal components with an acceptable level of quality and safety. Thus, the NRC staff authorizes the BWRVIP I&E guidelines as an alternative to the ASME Code, Section XI ISI examination criteria. In the event the licensee decides to take exceptions to or deviations from the authorized alternative, the licensee must revise and resubmit its request for authorization to use the proposed alternative under 10 CFR 50.55a(z)(1).

4.0 ENVIRONMENTAL CONSIDERATION

This authorized alternative relates to 10 CFR 50.55a action. The NRC staff finds that the action does not have a significant effect on the human environment and that special circumstances are not present that would preclude reliance on the categorical exclusion. Accordingly, this action meets the eligibility criteria for categorical exclusion set forth in paragraph (a)(16) of 10 CFR 51.22, "Categorical exclusions." Pursuant to 10 CFR 51.22, no environmental impact statement or environmental assessment need be prepared in connection with the action.

5.0 CONCLUSION

As set forth above, the NRC staff finds that the proposed alternative described in RR IR-056, Revision 4, provides an acceptable level of quality and safety. Accordingly, the NRC staff

concludes that the licensee has adequately addressed all the regulatory requirements set forth in 10 CFR 50.55a(z)(1). Therefore, the NRC staff authorizes the proposed alternative in RR IR056, Revision 4, for the fourth ISI interval at Perry, which began on May 18, 2019, and is scheduled to end on May 17, 2029.

The staff's evaluation of BWRVIP-03, Revision 21; BWRVIP-38, Revision 1; BWRVIP-48, Revision 2; BWRVIP-94NP, Revision 4; and BWRVIP-180, Revision 1, for IR-056, Revision 4, at Perry does not imply or infer the NRC's approval for generic use of these reports.

All other ASME Code requirements for which relief were not specifically requested and approved in the subject request for relief remain applicable.

Date: August 13, 2026

SUBJECT: PERRY NUCLEAR POWER PLANT, UNIT NO. 1 - REQUEST IR-056, REVISION 4 REGARDING ALTERNATE EXAMINATIONS OF REACTOR VESSEL INTERNAL COMPONENTS (EPID L2026-LLR-0013) DATED AUGUST 13, 2026

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