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

March 6, 2018

Vice President, Operations
Entergy Nuclear Operations, Inc.
Indian Point Energy Center
450 Broadway, GSB
P.O. Box 249
Buchanan, NY 10511-0249

SUBJECT: INDIAN POINT NUCLEAR GENERATING UNIT NO. 2 – SAFETY EVALUATION FOR RELIEF REQUEST IP2-ISI-RR-05 ALTERNATIVE EXAMINATION VOLUME REQUIRED BY ASME CODE CASE N-729-4 (EPID L-2017-LLR-0157)

Dear Sir or Madam:

By letter dated December 20, 2017 (Agencywide Documents Access and Management System Accession No. ML17362A038), Entergy Nuclear Operations, Inc. (the licensee) submitted Relief Request IP2-ISI-RR-05 to the U.S. Nuclear Regulatory Commission (NRC). Entergy Nuclear Operations, Inc. requested to implement a proposed alternative to the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g)(6)(ii)(D), which mandates the use of the American Society of Mechanical Engineers (ASME) Code Case N-729-4, "Alternative Examination Requirements for PWR [Pressurized-Water Reactor] Vessel Upper Heads With Nozzles Having Pressure-Retaining Partial-Penetration Welds," with conditions. The request pertains to the volumetric and/or surface examinations of reactor vessel upper head nozzles, most of which are used to house control rod drive mechanisms of the PWR vessel at Indian Point Nuclear Generating Unit No. 2 (Indian Point 2). Specifically, pursuant to 10 CFR 50.55a(z)(2), the licensee requested to use the proposed alternative in Relief Request IP2-ISI-RR-05 on the basis that complying with the specified requirement would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety.

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC staff authorizes the proposed alternative for the fifth 10-year inservice inspection interval at Indian Point 2, which began on June 1, 2016, and is scheduled to end on May 31, 2026.

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

If you have any questions concerning this matter, please contact the Indian Point 2 Project Manager, Mr. Richard Guzman, at (301) 415-1030 or Richard.Guzman@nrc.gov.

Sincerely,

James G. Danna, Chief
Plant Licensing Branch 1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-247

Enclosure:
Safety Evaluation

cc: Listserv

UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO RELIEF REQUEST IP2-ISI-RR-05

REGARDING ASME CODE CASE N-729-4

ENTERGY NUCLEAR OPERATIONS, INC.

INDIAN POINT NUCLEAR GENERATING UNIT NO. 2

DOCKET NO. 50-247

1.0 INTRODUCTION

By letter dated December 20, 2017 (Agencywide Documents Access and Management System Accession No. ML17362A038), Entergy Nuclear Operations, Inc. (the licensee) submitted Relief Request IP2-ISI-RR-05 for U.S. Nuclear Regulatory Commission (NRC) review and approval. The licensee requested to implement a proposed alternative to the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g)(6)(ii)(D), which mandates the use of the American Society of Mechanical Engineers (ASME) Code Case N-729-4, "Alternative Examination Requirements for PWR [Pressurized-Water Reactor] Vessel Upper Heads With Nozzles Having Pressure-Retaining Partial-Penetration Welds," with conditions. The request pertains to the volumetric and/or surface examinations of reactor vessel upper head nozzles, most of which are used to house control rod drive mechanisms of the PWR vessel at Indian Point Nuclear Generating Unit No. 2 (Indian Point 2).

Specifically, pursuant to 10 CFR 50.55a(z)(2), the licensee requested to use the proposed alternative in Relief Request IP2-ISI-RR-05 on the basis that complying with the specified requirement would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety.

2.0 REGULATORY EVALUATION

In accordance with 10 CFR 50.55a(z)(2), the licensee proposed to use an alternative to the requirements of 10 CFR 50.55a(g)(6)(ii)(D), which mandate the use of ASME Code Case N-729-4, with conditions.

In accordance with 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components, including supports, must meet the requirements, except the design and access provisions and the preservice examination requirements set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry and materials of construction of the components.

As stated in 10 CFR 50.55a(z), alternatives to the requirements of paragraph (g) of 10 CFR 50.55a may be used when authorized by the NRC if the licensee demonstrates that (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.

Based on the above, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request, and the NRC to authorize, the alternative requested by the licensee.

3.0 TECHNICAL EVALUATION

3.1. ASME Code Components

ASME Code Class: 1
Code Item Number: B4.20 of Table 1 of ASME Code Case N-729-4
Description: ASME Code Case N-729-4 – examination volume for all reactor pressure vessel head penetration nozzles

3.2. Applicable Code Edition and Addenda

The Code of Record for the fifth 10-year inservice inspection (ISI) interval for Indian Point 2 is the 2007 Edition/2008 Addenda. For the components under consideration, ISI is governed by 10 CFR 50.55a(g)(6)(ii)(D), which mandates the use of ASME Code Case N-729-4, with conditions.

3.3. Inspection Requirements for the Component under Consideration

The requirements of 10 CFR 50.55a(g)(6)(ii)(D)(3) stipulate that the licensee perform a volumetric and/or surface examination of essentially 100 percent of the required volume, or equivalent surfaces of the nozzle tube, as identified by Figure 2 of ASME Code Case N-729-4. Figure 2 identifies the required volume of the tube to be inspected, a distance "a" above the highest point of the root of the J-groove weld to a distance "a" below the lowest point of the toe of the J-groove weld. Distance "a" is equal to 1.5 inches for incidence angle less than or equal to 30 degrees to the horizontal plane, or 1.0 inch for incidence angle greater than 30 degrees to the horizontal plane.

3.4. Proposed Alternative

The licensee proposed to perform a volumetric inspection of each penetration nozzle from a distance "a" above the J-groove weld and the minimum required ultrasonic test (UT) coverage below the J-groove weld as defined in Table 1 below.

Table 1: Minimum Inspection Coverage Requirement

Nozzle Penetration No.	**Nozzle Angle of Incidence (degrees}**	**Minimum Required UT Coverage Below J-groove Weld with >2 Effective Full Power Years by Crack Growth Evaluation (inches)**	**Time, Effective Full Power Years to Reach the Lowest Point of the Toe of the J-groove Weld (year)**
1 through 25	0 to 23.3	0.55	4.6
26 through 69	24.8 to 38.6	0.45	4.4
70 through 81	44.3	0.25	8.4
82 through 89	45.4	0.25	6.8
90 through 97	48.7	0.18	5.0

3.5. Licensee's Technical Basis

The licensee provided a basis for the adequacy of the proposed alternative based on three components: (1) a finite element stress analysis of the nozzles near the J-groove weld; (2) a postulation of an initial flaw size and crack growth rate based on the stress analysis; and (3) a proposal for an alternate inspection area such that the postulated crack is not expected to grow sufficiently to reach the toe of the J-groove weld prior to the next inspection, which is scheduled for the next refueling outage in 2 years.

As indicated by the licensee, surface examination techniques are an available option to meet the current regulatory requirements. However, radiation dose rates under the head near the J-groove weld areas are expected to be in the 3 to 5 roentgen equivalent man (rem)/hour (hr) range. Additionally, the area under the head is posted as a locked high radiation area and high contamination area. Performance of a surface exam is considered a hardship as a result of the high radiation exposure.

The licensee stated that, in all cases, the inspection requirements of Figure 2 of the Code Case for inspection above the J-groove could be met. Based on the stress analysis and crack growth rate predictions, the licensee proposed minimum UT inspection coverage requirements. These values are contained in Table 1 above. The licensee also confirmed that the proposed UT inspection area for each of the nozzles is at least as large as the required inspection area as listed in the table.

3.6 Duration of Proposed Alternative

The licensee requested relief for the fifth 10-year ISI Interval, which is currently scheduled to end on May 31, 2026.

3.7 NRC Staff Evaluation

The NRC staff finds that the inspection requirements found in 10 CFR 50.55a(g)(6)(ii)(D)(3) are the appropriate inspection requirements for the components identified in the licensee's relief request.

The NRC staff reviewed the licensee's basis for requesting relief from the inspection requirements for these components. The NRC staff finds that satisfactory UT inspection of the threaded regions at the lower ends of the penetration nozzles is unlikely. The NRC staff also finds that the distance between the toe of the J-groove welds and the top of the threaded region of the nozzle is, in some cases, less than the inspection distance required by Figure 2 of Code Case N-729-4. The NRC staff also finds that, although surface examination of the components is an acceptable option, the length of time required to perform the inspection, in combination with the projected dose rate (3 to 5 rem/hr), would result in a significant radiation exposure to the individuals performing the inspection.

The NRC staff reviewed the basis upon which the licensee's proposed alternative inspection area is based. This basis relies upon stress analyses and crack growth projections to predict that a crack, which lies outside the proposed inspection area in one inspection, cannot reasonably be expected to grow to the toe of the J-groove weld prior to the next scheduled

inspection. Cracks in the nozzle material below the J-groove weld are not part of the pressure boundary of the reactor coolant system and only pose a loose parts condition.

The NRC staff reviewed the minimum inspection coverage. The NRC staff noted that the end of the required inspection area lies at the postulated location of the crack. Based on the values reported in Table 1 above, this point is either 0.18, 0.25, 0.45, or 0.55 inches below the toe of the J-groove weld. The licensee's flaw analysis predicted the length of time required for the postulated crack to grow from the uninspected area to the toe of the J-groove weld. These projections are reported in Table 1 as the time and effective full power year to reach the toe of the J-groove weld. The NRC staff performed a series of independent flaw evaluations and determined that an inspection area of 0.18, 0.25, 0.45, or 0.55 inches, respectively, is adequate because, in all instances, the time required for the postulated crack to grow the necessary distance to reach the toe of the J-groove weld exceeds the time interval between inspections.

The NRC staff reviewed the licensee's proposal to determine whether the specified requirement created a hardship. The NRC staff noted that meeting the specified requirement through the use of internal UT inspection is not possible for all penetrations. The NRC staff also noted that the specified requirement could be met through the use of a manual surface exam, but that the length of time required to perform the inspection, in combination with the projected dose rate (3 to 5 rem/hr), would result in a significant radiation exposure to the inspector. The NRC staff considers this to be a hardship.

Given that the licensee's flaw analysis demonstrates that a hypothetical flaw in the area of missed coverage will not grow into the reactor coolant pressure boundary during the period of operation between required inspections, the NRC staff finds that the licensee has demonstrated that the proposed alternative provides reasonable assurance of structural integrity and of public health and safety. Additionally, given the hardship described above, the NRC staff finds that compliance with the specified requirement would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety. Therefore, the NRC staff finds a sufficient basis to authorize relief under 10 CFR 50.55a(z)(2).

4.0 CONCLUSION

As set forth above, the NRC staff determined that the proposed alternative, Relief Request IP2-ISI-RR-05, provides reasonable assurance of structural and leaktightness of the subject component and that complying with the specified requirement would result in hardship or unusual difficulty, without a compensating increase in the level of quality or safety. Accordingly, the staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, pursuant to 10 CFR 50.55a(z)(2), the NRC staff authorizes the use of Relief Request IP2-ISI-RR-05 at Indian Point 2 for the fifth 10-year ISI interval, which started on June 1, 2016, and is scheduled to end May 31, 2026.

All other requirements for which relief was not specifically requested and approved in this relief request remain applicable, including the third party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: J. Collins

Date: March 6, 2018

SUBJECT: INDIAN POINT NUCLEAR GENERATING UNIT NO. 2 – SAFETY EVALUATION FOR RELIEF REQUEST IP2-ISI-RR-05 ALTERNATIVE EXAMINATION VOLUME REQUIRED BY ASME CODE CASE N-729-4 (EPID L-2017-LLR-0157) DATED MARCH 6, 2018

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