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

February 17, 2009

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 - RELIEF REQUEST (RR) NO. RR-CRV-75 FOR VOLUMETRIC EXAMINATION OF WELDS (TAC NO. MD8416)

Dear Sir or Madam:

By letter dated March 26, 2008, as supplemented on December 12, 2008, and January 20, 2009, Entergy Nuclear Operations, Inc. (the licensee) submitted Relief Request No. RR CRV-75 to the Nuclear Regulatory Commission (NRC) on volumetric examination of welds applicable to Indian Point Nuclear Generating Unit No. 2 (IP2) for the third 10-year inservice inspection (ISI) interval. The licensee determined that conformance with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) requirement of essentially 100% coverage of weld volume was impractical for IP2 in certain locations. The NRC staff finds that the licensee's determination of impracticality for RR CRV-75, Parts A and C, is acceptable, pursuant to Title 10 of the *Code of Federal Regulations*, Section 50.55a(g)(6)(i), as evaluated in the enclosed safety evaluation. RR CRV-75, Part B, was withdrawn by the licensee.

If you have any questions regarding this approval, please contact the Indian Point Project Manager, John Boska, at (301) 415-2901.

Sincerely,

Mark G. Kowal, Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-247

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv

UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF RR-CRV-75

ENTERGY NUCLEAR OPERATIONS, INC.

INDIAN POINT NUCLEAR GENERATING UNIT NO. 2

DOCKET NO. 50-247

1.0 INTRODUCTION

By letter dated March 26, 2008, Agencywide Documents Access and Management System (ADAMS) accession number ML080920717, as supplemented on December 12, 2008, ADAMS accession number ML083510668, and January 20, 2009, ADAMS accession number ML090400576, Entergy Nuclear Operations, Inc. (the licensee) submitted Relief Request No. RR CRV-75 to the Nuclear Regulatory Commission (NRC) on volumetric examination of welds applicable to Indian Point Nuclear Generating Unit No. 2 (IP2) for the third 10-year inservice inspection (ISI) interval. The licensee determined that conformance with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) requirement of essentially 100% coverage of weld volume was impractical for IP2 in certain locations.

2.0 REGULATORY REQUIREMENTS

As specified in Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g), inservice inspection of nuclear power plant components shall be performed in accordance with the requirements of ASME Code, Section XI, except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Pursuant to 10 CFR 50.55a(a)(3), alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. As stated in 10 CFR 50.55a(g)(5)(iii), if the licensee has determined that conformance with certain Code requirements is impractical for its facility, the licensee shall notify the Commission and submit information to support the determinations.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall 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. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) twelve months prior to the start of the 120-month interval,

subject to the limitations and modifications listed in paragraph (b) of that section. The ISI Code of Record for the third 10-year ISI interval for IP2 was the 1989 Edition of the ASME Code, Section XI. The third 10-year ISI interval for IP2 started on July 1, 1994, and ended March 1, 2007.

3.0 TECHNICAL EVALUATION

The information provided by the licensee in support of the requests for relief from, and alternatives to, ASME Code requirements has been evaluated and the bases for disposition are documented below. For clarity, the licensee's requests and alternatives have been evaluated in several parts according to ASME Code Examination Category.

3.1 Request for Relief RR-CRV-75, Part A, ASME Code, Section XI, Table IWB-2500-1 Examination Category B-A, Items B1.22 and B1.40, Pressure Retaining Welds in Reactor Vessel

ASME Code Requirement

ASME Code, Section XI, Table IWB-2500-1, Examination Category B-A, Item B1.22 requires essentially 100 percent volumetric examination, as defined by ASME Code, Section XI, Figure IWB-2500-3, of the "accessible length" of meridional head welds on the reactor pressure vessel (RPV). In addition, ASME Code, Section XI, Item B1.40 requires essentially 100 percent volumetric and surface examination, as defined by IWB-2500-5, of RPV head-to-flange welds. "Essentially 100%", as clarified by ASME Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 Welds," is greater than 90 percent coverage of the exarnination volume, or surface area, as applicable. ASME Code Case N-460 has been approved for use by the NRC in Regulatory Guide 1.147, Revision 15, "Inservice Inspection Code Case Acceptability" (RG 1.147).

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required 100 percent volumetric examination of ASME Code, Class 1 RPV closure head meridional Welds RVHM-2, -4, and -6, and head-to-flange Weld RVHC-2.

Licensee's Basis for Relief Request

The licensee stated that meridional welds RVHM-2, RVHM-4, and RVHM-6 exam coverages are obstructed by the control rod drive mechanism penetrations, the RPV head shroud, and the flange contour. Examinations of these meridional welds were conducted to inspect as much as reasonably practical. These exams were limited by geometry or access.

The [RPV] Flange-to-Head circumfernal weld [Weld RVHC-2] has limited accessibility due to the contour of the flange head and the interference of the lifting lug.

Licensee's Proposed Alternative Examination

None. The licensee did not propose any alternatives to the ASME Code requirements; however, the licensee examined the subject welds to the extent practical.

Licensee's Response to RAI

The licensee stated that approximately 25 inches up on RPV meridional welds RVHM-2, -4, and -6, there is a taper where the RPV upper head goes from a machined surface to a rough as-rolled surface. This taper is around the entire head, not just at the weld locations, and is located directly below the head shroud. At this point, the thickness of the RPV head transitions from approximately 7.5 inches thick to approximately 8.4 inches thick and the head surface becomes very rough.

In accordance with 10 CFR 50.55a(b)(2)(xv)(G) and the Performance Demonstration Initiative (PDI) for examination of RPV circumferential and longitudinal welds, the clad-to-base metal interface, including a minimum of 15 percent thickness (measured from the clad-to-base metal interface), shall be examined from four orthogonal directions (i.e., two parallel and two perpendicular). The remainder of the examination volume is considered fully examined if coverage is obtained in four orthogonal directions, or alternatively, a minimum of one parallel and one perpendicular direction using personnel qualified for single-side access examination in accordance with ASME Code, Section XI, Appendix VIII, Supplement 6.

For welds RVHM-2, -4, and -6 the following descriptions of weld coverage apply.

1. Approximately 4 inches of the meridional welds adjacent to the flange weld exceeded the ASME Code, Section XI, Appendix VIII qualified thickness range and coverage was not credited for this volume. Although coverage for this volume was not credited, the volume was examined and no indications were detected.

2. The accessible length of the meridional welds (approximately 21 inches) was scanned perpendicular to the weld in two directions and 100 percent coverage was achieved. The perpendicular scans would detect flaws parallel to the weld. These perpendicular scans would detect the most likely indications.

3. Due to the flange at the bottom of the weld and the taper 25 inches up the weld, the inner 15 percent was only scanned in three directions. 100 percent coverage was obtained in the two perpendicular scans and 100 percent coverage was obtained in one parallel scan. Less than 1 percent coverage was obtained in the second parallel scan.

4. Using one-sided qualified personnel as allowed by PDI (see the first part of this response), >90 percent of the upper 85 percent of the weld was covered in one direction perpendicular to the weld and one direction parallel to the weld.

In conclusion, although <1 percent of the inner 15 percent was scanned in all four directions, 100 percent of the inner 15 percent was scanned in three directions (two perpendicular and one parallel) and the perpendicular scans, which are the most critical scans because they detect indications parallel to the weld, achieved 100 percent coverage. Additionally, the upper 85 percent of the weld was inspected in one direction perpendicular to the weld and one direction parallel to the weld using one-sided qualified personnel as allowed by PDI (see the first part of this response). The inspection of the upper 85 percent of the weld achieved >90 percent coverage. The inspections performed and coverage achieved provides high confidence that if degradation was present, it would be detected. Phased array technology was not considered

for use in performing these examinations because this technology was not fully qualified for this application at the time that the examinations were performed.

Staff Evaluation

The ASME Code requires essentially 100 percent volumetric examination of the accessible length of the subject ASME Code, Class 1 RPV upper closure head welds. However, the geometry of the welds, along with interference from appurtenances such as the head flange and control rod drive housings located in close proximity to these welds, limit access for full volumetric examination. To gain access for examination, the RPV would require design modifications. Imposing this ASME Code requirement would create a burden on the licensee; therefore, the ASME Code-required 100 percent volumetric examinations are impractical.

As shown on the sketches and technical descriptions[1] included in the licensee's submittals, examinations of the subject welds have been performed to the extent practical with the licensee obtaining aggregate volumetric coverage of approximately 85 percent on RPV Closure Head Meridional Welds RVHM-2, RVHM-4, & RVHM-6, and from 78 percent to 84 percent (depending on coverage calculations) on RPV Closure Head-to-Flange Weld RVHC-2.

In the case of RPV Meridional Welds RVHM-2, RVHM-4, & RVHM-6, examinations of the accessible length are impacted by a thickness transition region, which produces an outside diameter taper around the entire circumference of the head, just below the area of the control rod drive housings. These welds bisect the tapered region which causes ultrasonic scanning limitations. In addition, at the lower end of these welds, the RPV head-to-flange transition region impacts scanning of these welds. However, the licensee obtained 100 percent volumetric coverage in two perpendicular scans and one parallel scan of the inner 15 percent of these welds, and greater than 90 percent coverage of the upper 85 percent of the welds in one parallel and one perpendicular direction.

For weld RVHC-2, an upper head-to-flange weld, aggregate volumetric coverage of approximately 78 percent to 84 percent was obtained due to the outside surface transition which limited scanning to the head side of the weld only.

The licensee has shown that it is impractical to meet the ASME Code-required 100 percent volumetric examination coverage for the subject welds due to their design and proximity to RPV appurtenances. Based on the substantial volumetric examination coverage obtained, it is reasonable to conclude that if service-induced degradation were occurring, evidence of it would have been detected by the examinations that were performed. In addition, the examinations performed to the extent practical provide reasonable assurance of structural integrity of the subject welds.

3.2 Request for Relief RR-CRV-75, Part B, ASME Code, Section XI, Table IWB-2500-1 Examination Category B-D, Item B3.120, Nozzle Inside Radius Sections

This request for relief for volumetric examination of the inside radius sections for pressurizer nozzles PZRN-1 (spray nozzle) and PZRN-6 (surge nozzle) was withdrawn by the licensee by letter dated January 20, 2009. The NRC staff notes that this examination was not performed in

[1] Sketches and technical descriptions provided by the licensee are not included in this report.

the third 10-year ISI interval as required, and should be performed at the first available opportunity.

3.3 Request for Relief RR-CRV-75, Part C, ASME Code, Section XI, Table IWB-2500-1, Examination Category R-A, Item R1.20, Risk-Informed Piping Examinations

ASME Code Requirement

The examination requirements for the subject piping welds at IP2 are governed by a Risk-Informed Inservice Inspection (RI-ISI) program that was approved by the NRC in a safety evaluation (SE) dated March 19, 2004 (ML040860006). The RI-ISI program was developed in accordance with Electric Power Research Institute (EPRI) Topical Report TR-112657, Rev. B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure" (January 2000)[2]. As part of the NRC-approved program, the licensee has implemented inspection requirements listed in ASME Code Case N-578-1[3], Risk-Informed Requirements for ASME Code, Class 1, 2 or 3 Piping, Method B, with more detailed provisions contained in TR-112657. The topical report includes a provision for requesting relief from volumetric examinations if 100% of the required volumes cannot be examined.

Table 1 of ASME Code Case N-578-1 assigns the Examination Category R-A, Item R1.20, to piping inspection elements not subject to a known damage mechanism. This table requires 100 percent of the examination location volume, as described in Figures IWB-2500-8, 9, 10, or 11, as applicable, including an additional ½-inch of base metal adjacent to the ASME Code volume, be completed for selected ASME Code, Class 1 circumferential piping welds. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, Revision 15, states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10 percent, i.e., greater than 90 percent examination coverage is obtained.

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from 100 percent volumetric examination of Class 1 RPV nozzle safe end-to pipe Welds RCC-21-1, RCC-22-1, RCC-23-1, and RCC-24-1.

Licensee's Basis for Relief Request

The licensee stated that ultrasonic detection scans for the primary nozzle safe-end to pipe/elbow welds were examined from the inside diameter (ID) surface using 70 degree L-wave transducers applied four-directionally. Axial scans were performed at a 0.25 inch increment and the circumferential scans were conducted at a 0.080 inch incremental distance. This exam interrogated the inner 1/3 thickness volume. The safe-end to nozzle welds (RCC-21 -1, RCC-22-1, RCC-23-1, & RCC-24-1) had limitations due to the tapered area of the weld overlay on the ID. Eddy current techniques were also employed to examine the inner surfaces of the dissimilar

[2] EPRI Topical Report TR-112657, Rev. B-A is not included in this SE.

[3] ASME Code N-578 is not approved for general use in RG 1.147, Revision 15; however, some licensees base their RI-ISI alternative inspection program on portions of ASME Code Case N-578 for item identification in which their plant specific RI-ISI program is approved under 10 CFR 50.55a(a)(3)(i).

metal and pipe/elbow welds and the adjacent examination volumes where ID geometry presents a limitation to the detection of axial flaws as defined in the Performance Demonstration Qualification Summary for the qualified Appendix VIII technique. As a result, all areas of limitations were fully examined by the supplemental eddy current techniques with no recordable indications.

Licensee's Proposed Alternative Examination

None. The licensee did not propose any alternatives to the ASME Code requirements; however, the licensee did examine the subject welds to the extent practical.

Staff Evaluation

The examination requirements for the subject piping welds at IP2 are governed by a RI-ISI program that was approved by the NRC in an SE dated March 19, 2004. This program assigns RI-ISI Program, Examination Category R-A, Item R1.20 to piping elements not subject to a known damage mechanism, and requires inspection of 100 percent of the examination location volume for ASME Code, Class 1 circumferential piping welds. However, a tapered overlay on the inside diameter of the subject safe end-to-piping welds limits volumetric examinations. In order to meet the RI-ISI program volumetric coverage requirements, these components would have to be redesigned and modified. Therefore, 100 percent volumetric examination is impractical for the subject safe end-to-piping welds.

Examinations of the subject nozzle safe end-to-pipe welds were performed from the ID surface using remote techniques deployed in conjunction with automated RPV shell and nozzle weld examinations. Entergy has determined that certain IP2 welds had ultrasonic examination coverage limitations of less than 100 percent of the ASME Code-required weld and adjacent material volume(s). The limitations encountered during the ultrasonic examinations on the subject welds were caused by an area of ID surface overlay (on-lay), deposited during the initial fabrication of the plant. These overlays have a slight taper which limits full scanning of the required volumes from the inside diameter. However, as shown on the sketches and technical descriptions[4] included in the licensee's submittal, examinations of the subject safe end-to-piping welds have been completed to the extent practical with aggregate volumetric coverage of approximately 89 percent of the ASME Code-required volumes.

Ultrasonic personnel, procedures and equipment qualified through the industry's PDI were employed, including shear wave and refracted longitudinal wave (L-wave), as applicable, techniques from the accessible sides of these welds. The L-wave method is capable of detecting planar ID surface-breaking flaws on the far-side of wrought stainless steel welds. Recent studies[5,6] recommend the use of both shear and L-waves to obtain the best detection results, with minimum false calls, in austenitic welds. In addition, to augment the ultrasonic

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[4] Sketches and technical descriptions provided by the licensee are not included in this report.

[5] F.V. Ammirato, X. Edelmann, and S.M. Walker, "Examination of Dissimilar Metal Welds in BWR Nozzle-to-Safe End Joints", 8th International Conference on NDE in the Nuclear Industry, ASM International, 1987.

[6] P. Lemaitre, T.D. Koble, and S.R. Doctor, "PISC III Capability Study on Wrought-to-Wrought Austenitic Steel Welds: Evaluation at the Level of Procedures and Techniques", Effectiveness of Nondestructive Examination Systems and Performance Demonstration, PVP-Volume 317, NDE-Volume 14, ASME, 1995.

examinations, the licensee applied eddy current (ET) surface methods to detect any ID-connected flaws that might be present. No recordable flaw indications were observed during these examinations.

The licensee has shown that it is impractical to meet the ASME Code-required 100 percent volumetric examination coverage for the subject piping welds due to their design and ultrasonic access restrictions caused by ID surface overlays. Based on the significant level of ultrasonic coverage obtained for the subject welds, and considering the licensee's performance of ET techniques used to augment these examinations, it is reasonable to conclude that if significant service-induced degradation were occurring, evidence of it would have been detected by the examinations that were performed. In addition, the examinations performed provide reasonable assurance of structural integrity of the subject welds.

4.0 CONCLUSION

The NRC staff has reviewed the licensee's submittal and concludes that ASME Code examination coverage requirements are impractical for the subject welds listed in Request for Relief RR-CRV-75, Parts A and C. Further, based on the volumetric and/or surface coverage obtained, it is reasonable to conclude that, if significant service-induced degradation were occurring, evidence of it would have been detected by the examinations that were performed. In addition, the NRC staff concludes that the examinations performed provide reasonable assurance of structural integrity of the subject welds. Therefore, for the items in Request for Relief RR-CRV-75, Parts A and C, relief is granted, pursuant to 10 CFR 50.55a(g)(6)(i), for the third ISI interval at IP2.

The NRC staff has determined that granting Request for Relief No. RR-CRV-75, Parts A and C pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property, or the common defense and security, and is otherwise in the public interest given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in the subject requests for relief remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributors: T. McLellan
D. Naujock

Date: February 17, 2009

February 17, 2009

Vice President, Operations
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SUBJECT: INDIAN POINT NUCLEAR GENERATING UNIT NO. 2 - RELIEF REQUEST (RR) NO. RR-CRV-75 FOR VOLUMETRIC EXAMINATION OF WELDS (TAC NO. MD8416)

Dear Sir or Madam:

By letter dated March 26, 2008, as supplemented on December 12, 2008, and January 20, 2009, Entergy Nuclear Operations, Inc. (the licensee) submitted Relief Request No. RR CRV-75 to the Nuclear Regulatory Commission (NRC) on volumetric examination of welds applicable to Indian Point Nuclear Generating Unit No. 2 (IP2) for the third 10-year inservice inspection (ISI) interval. The licensee determined that conformance with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) requirement of essentially 100% coverage of weld volume was impractical for IP2 in certain locations. The NRC staff finds that the licensee's determination of impracticality for RR CRV-75, Parts A and C, is acceptable, pursuant to Title 10 of the *Code of Federal Regulations*, Section 50.55a(g)(6)(i), as evaluated in the enclosed safety evaluation. RR CRV-75, Part B, was withdrawn by the licensee.

If you have any questions regarding this approval, please contact the Indian Point Project Manager, John Boska, at (301) 415-2901.

Sincerely,

/RA/

Mark G. Kowal, Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-247
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