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

March 14, 2016

Vice President, Operations
Entergy Nuclear Operations, Inc.
Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043-9530

SUBJECT: PALISADES NUCLEAR PLANT – RELIEF REQUEST NUMBER RR 4-24 – PROPOSED ALTERNATIVE, USE OF ALTERNATE ASME CODE CASE N-770-1 BASELINE EXAMINATION (CAC NO. MF6755)

Dear Sir or Madam:

By letter dated September 26, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15269A035), as supplemented by letter dated September 27, 2015 (ADAMS Accession No. ML15270A004), Entergy Nuclear Operations, Inc. (ENO, the licensee) requested relief from the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Code Case N-770-1, as conditioned by Title 10 of the *Code of Federal Regulations,* Part 50 (10 CFR 50) Paragraph 55a(g)(6)(ii)(F) at the Palisades Nuclear Plant (PNP). The licensee proposed an alternative to defer performing full volumetric coverage examinations of eight cold leg welds and to perform enhanced leakage monitoring until the next refueling outage (1R25).

Specifically, pursuant to 10 CFR 50.55a(z)(2), the licensee proposed the alternative on the basis that complying with the essentially 100 percent coverage requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the coverage obtained during refueling outage 1R24 is acceptable and that Relief Request RR 4-24 provides reasonable assurance of the structural integrity of the branch connections to the cold leg piping until the next refueling outage. Further, while leakage may occur, the licensee's action as outlined in the proposed alternative of this relief request will ensure that the leakage will be promptly identified, and as such, the staff concludes the effects of any such leakage would be minimal on other plant components. The NRC staff concludes complying with the essentially 100 percent volumetric requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, during a conference call on September 28, 2015 (ADAMS Accession No. ML15272A065), the NRC staff verbally authorized the use of the licensee's proposed alternative at PNP, effective until the end of the next refueling outage, planned for spring 2017.

The NRC staff notes that all other ASME Code requirements for which relief was not specifically requested and approved in the subject request for relief remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

If you have any questions, please contact the PNP Project Manager, Jennivine Rankin at (301) 415-1530.

Sincerely,

David J. Wrona, Chief
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-255

Enclosure:
Staff Evaluation of Relief Request RR 4-24

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UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FOR RELIEF REQUEST 4-24

USE OF ALTERNATE ASME CODE CASE N-770-1 BASELINE EXAMINATION

PALISADES NUCLEAR PLANT

ENTERGY NUCLEAR OPERATIONS, INC

DOCKET NO. 50-255

1.0 INTRODUCTION

By letter dated September 26, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15269A035), as supplemented by letter dated September 27, 2015 (ADAMS Accession No. ML15270A004), Entergy Nuclear Operations, Inc. (ENO, the licensee) requested relief from the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Code Case N-770-1, as conditioned by Title 10 of the *Code of Federal Regulations,* Part 50 (10 CFR 50) Paragraph 55a(g)(6)(ii)(F) at the Palisades Nuclear Plant (PNP). The licensee proposed an alternative to defer performing full volumetric coverage examinations of eight cold leg welds and to perform enhanced leakage monitoring until the next refueling outage (1R25).

Specifically, pursuant to 10 CFR 50.55a(z)(2), the licensee proposed the alternative on the basis that complying with the essentially 100 percent coverage requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. During a conference call on September 28, 2015 (ADAMS Accession No. ML15272A065), the U.S. Nuclear Regulatory Commission (NRC) staff verbally authorized the use of the proposed alternative at PNP, effective until the end of the next refueling outage, planned for spring 2017.

2.0 REGULATORY EVALUATION

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 pre-service 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. However, 10 CFR 50.55a(z) states, in part, that alternatives to the requirements of paragraph (g) 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.

Enclosure

Based on analysis of the regulatory requirements, the NRC staff concludes that regulatory authority exists to authorize the proposed alternative pursuant to 10 CFR 50.55a(z)(2).

3.0 TECHNICAL EVALUATION

3.1 The Licensee's Relief Request

Code Requirements

The requirements for inspecting the subject welds are described in ASME Code Case N-770-1 "Alternative Examination Requirements and Acceptance Standards for Class 1 PWR Piping and Vessel Nozzle Butt Welds Fabricated with UNS N06082 or UNS W86182 Weld Filler Material With or Without Application of Listed Mitigation Activities Section XI, Division 1"

ASME Code Case N-770-1 is incorporated by reference in 10 CFR 50.55a(a)(1)(iii)(C) and required for use in 10 CFR 50.55a(g)(6)(ii)(F).

Components Affected

The welds covered under RR 4-24 are eight Class 1 Pressurized Water Reactor (PWR) pressure retaining Dissimilar Metal Piping and Vessel Nozzle Butt Welds containing Alloy 82/182. The eight cold leg welds are covered under ASME Code Case N-770-1, Inspection Item B, "Unmitigated butt weld at Cold Leg operating temperature (-2410) ≥ 525°F (274°C) and < 580°F (304°C)."

Additionally, one hot leg weld, PCS-42-RCL-1H-3/2, was examined during the same refueling outage. The hot leg weld inspection was able to achieve 100 percent coverage. No relief is required for weld PCS-42-RCL-1H-3/2.

Table 1: Branch Connections Covered in RR 4-24

Branch Connection Description	Weld Identification	Axial Flaw Coverage	Circumferential Flaw Coverage	Weld Location
2 inch Cold Leg Charging Nozzle	PCS-30-RCL-1A-11/2	0%	100%	P-50A Discharge Leg
2 inch Cold Leg Drain Nozzle	PCS-30-RCL-1A-5/2	0%	50% (approx.)	P-50A Suction Leg
3 inch Cold Leg Pressurizer Spray Nozzle	PCS-30-RCL-1B-10/3	0%	100%	P-50B Discharge Leg
2 inch Cold Leg Drain Nozzle	PCS-30-RCL-1B-5/2	0%	50% (approx.)	P-50B Suction Leg
2 inch Cold Leg Charging Nozzle	PCS-30-RCL-2A-11/2	0%	100%	P-50C Discharge Leg
3 inch Cold Leg Pressurizer Spray Nozzle	PCS-30-RCL-2A-11/3	0%	100%	P-50C Discharge Leg

2 inch Cold Leg Drain Nozzle	PCS-30-RCL-2A-5/2	0%	50% (approx.)	P-50C Suction Leg
2 inch Cold Leg Drain and Letdown Nozzle	PCS-30-RCL-2B-5/2	0%	50% (approx.)	P-50D Suction Leg

Code of Record

The applicable code of record for the fourth 10-year inservice inspections interval is the ASME Section XI, 2001 Edition through 2003 Addenda. The applicable code of record for the fifth 10-year inservice inspection interval is the ASME Section XI, 2007 Edition with the 2008 Addenda.

Reason for Relief Request

By letter dated September 26, 2015, the licensee provide the following reason for the proposed alternative:

> The welds listed in [Table 1 above] did not satisfy the exam coverage required by ASME Code Case N-770-1, as conditioned by 10 CFR 50.55a(g)(6)(ii)(F).
>
> The relevant conditions for this request for alternative are ASME Section XI Code Case N-770-1, and 10 CFR 50.55a(g)(6)(ii)(F) items (3) and (4), which address performing the required baseline examination and attaining the required examination coverage.
>
> 10 CFR 50.55a(g)(6)(ii)(F)(3) requires that Inspection Item B receives a baseline examination by the end of the first refueling outage after January 20, 2012.
>
> 10 CFR 50.55a(g)(6)(ii)(F)(4) provides the following exception to ASME Code Case N-770-1, "the axial examination coverage requirements of Paragraph-2500(c) may not be considered to be satisfied unless essentially 100 percent coverage is achieved."
>
> Relief is requested from Code Case N-770-1, -2500, Examination Requirements, as conditioned by 10 CFR 50.55a(g)(6)(ii)(F)(3) and 10 CFR 50.55a(g)(6)(ii)(F)(4) that essentially 100% coverage must be achieved of the inspection volume for the baseline and future required volumetric examinations.
>
> Coverage requirements could not be attained for these welds because the contour of the weld along the periphery of the branch connection nozzles is different than the weld contour in the branch connection nozzle mockup used for qualification of the examination technique in the PDI [Performance Demonstration Initiative] program (see Figure 1 in Attachment 2 [of the submittal dated September 26, 2015]). The piping fabricator applied additional weld, making a taper transition weld instead of following the contour of the pipe outside diameter.
>
> Four cold leg welds have an additional physical obstruction affecting the ability to achieve coverage requirements. There is a concrete pipe whip restraint in close

proximity to each of the cold legs that limits placement and travel of the encoded phased array scanner and probe (see Figure 2 in Attachment 2 [of submittal dated September 26, 2015]). This obstruction prevents the automated scanner from rotating 360 degrees around the weld. The ultrasonic probe rotates slightly greater than 180 degrees. Along the 50 percent of these four welds that were examined (180° of the 360° periphery), 100 percent of the code-required weld volume could be obtained in this direction and no circumferential flaws were identified in the scanned areas.

Hardship

By letter dated September 26, 2015, the licensee states the following when describing the associated hardship with performing the required examinations:

> Due to the location of the welds, and the time duration required to [physically modify the weld contours (via grinding or machining) to allow for 100 percent inspection coverage], the personnel dose incurred would be significant. It is estimated, based on dose rate measurements taken in the vicinity of the welds, that personnel radiological exposure would be approximately 41 Rem for the eight welds (see Table 3 in Attachment 1 [of submittal dated September 26, 2015]). This is based on an estimated 20 man hours of manual grinding per weld, two hours for surface examination of each weld, walkdowns, and mobilization and demobilization of equipment. In addition, prior to actual start of work in the field, mockups would need to be fabricated for training purposes in order to ensure that personnel are capable of providing the required weld profile, performing the task without violating minimum wall tolerances with the efficiencies needed to minimize dose.

By letter dated September 27, 2015, the licensee explained that developing and qualifying a new examination procedure capable of accommodating the weld taper and physical restrictions would likely take at least one year, based on the previous development and qualification process for the procedure used in the 1R24 inspection.

Proposed Alternative

By letter dated September 26, 2015, the licensee proposed performing the following actions in lieu of performing the inspections with 100 percent coverage:

1) Perform periodic system leakage tests in accordance with ASME Section XI Examination Category B-P, Table IWB-2500-1.

2) Perform a volumetric examination, using ASME Code, Section XI, Appendix VIII, Supplement 10 qualified procedures, equipment and personnel, on each of the eight subject welds of this alternative during the next scheduled refueling outage (1R25).

3) Until the next scheduled refueling outage, if unidentified primary coolant system (PCS) leakage increases by 0.15 gpm above the WCAP-16465NP baseline mean, and is sustained for 72 hours, ENO will take action to be in

Mode 3 within 6 hours and Mode 5 within 36 hours, and perform bare metal visual examinations of the eight subject welds of this alternative, unless it can be confirmed that the leakage is not from these welds.

Entergy will perform appropriate actions to meet ASME Section XI Code Case N-770-1 baseline examinations for those dissimilar metal welds not meeting the examination coverage requirements during the 2015 refueling outage prior to startup from the planned spring 2017 refueling outage.

Basis for Use

By letter dated September 26, 2015, the licensee provided the following basis for using the proposed alternative:

The PDI qualified encoded phased array UT [ultrasonic testing] technique was able to achieve the volumetric coverage requirements on the one hot leg weld examination performed during the current refueling outage on September 22, 2015. Examination of the two inch hot leg drain nozzle (weld identification number PCS-42-RCL-1H-3/2) was completed with 100% coverage with no axial or circumferential flaws identified.

The operating temperature of a component is a primary factor influencing the initiation of Primary Water Stress Corrosion Cracking (PWSCC). Research by the Electric Power Research Institute (EPRI) (Reference 10 [of the submittal dated September 26, 2015]) indicates that the difference in the operating temperature between hot leg locations and cold leg locations is sufficient to significantly influence the time to initiation of PWSCC, with the susceptibility increasing with temperature. The research reports PWSCC is least likely to occur in cold leg temperature penetrations. The hot leg temperature is approximately 583° F whereas the cold leg temperature is approximately 537° F. This means there is a lower probability of crack initiation, and a slower crack growth [rate, in] cold leg locations.

The encoded phased array UT technique that was PDI qualified for use on each of the eight cold leg welds was applied to the extent practicable while still remaining within its qualification requirements. However, due to the cold leg weld contours and concrete pipe whip restraint obstructions, no coverage was possible for axial flaw scans and only limited examination coverages were possible for circumferential flaw scans.

Because the hot leg weld is a higher operating temperature location, it is a more likely location for PWSCC to occur than in one of the cold leg welds. Since no weld flaws were identified in the hot leg weld, it is less likely that a PWSCC-induced flaw is present in the portions of the cold leg welds that could not be examined during this current outage.

[The licensee] used a finite element analysis (FEA) approach to evaluate postulated flaws in the cold leg nozzles. These models were used to perform weld residual stress evaluations and calculations of stress intensity factors in the

DM [dissimilar metal] welds. Utilizing these new stress intensity factor distributions for postulated circumferential and axial flaws in the DM welds, crack growth due to PWSCC was evaluated for the cold leg configuration. Crack growth durations were then plotted on charts to show the service life of the cold leg configuration based on crack growth from an assumed initial flaw depth of 0.025 inch. It should be noted that PWSCC was the only crack growth mechanism considered in this evaluation (i.e., PWSCC growth of a postulated axial and circumferential flaw in the weld).

Using the FEA approach, the time for an initial 0.025-inch deep flaw to grow to 75% through-wall is 64.5 years for the bounding axial flaw (77 years to go 95% through-wall) and 55.6 years for the circumferential flaw (66.2 years to go 95% through-wall).

Duration of Proposed Alternative

The duration of the proposed alternative for the welds with limited coverage is until the next refueling outage, planned for the spring of 2017.

3.2 Staff Evaluation

The licensee is proposing, pursuant to 10 CFR 50.55a(z)(2), to defer obtaining full volumetric coverage on the basis that complying with the essentially 100 percent coverage requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The licensee performed ultrasonic inspections of nine dissimilar metal butt welds joining branch connections to piping but was not able to obtain 100 percent coverage on eight of the welds. For the eight cold leg welds, the inspections for axial flaws was not possible due to the presence of a weld taper on the cold leg welds that prevents the search units from examining the required inspection volume. On four of the welds, the inspection coverage for circumferential flaws was restricted to approximately 50 percent by the presence of concrete pipe whip restraints. In total, this provides approximately 75 percent coverage for circumferential flaws of all cold leg weld total inspection volume. No evidence of PWSCC was found in these inspections. Additionally, a qualified volumetric inspection of a hot leg butt weld joining a branch connection to a pipe was completed with greater than 90 percent coverage and no surface connected flaws were found.

To improve the inspection coverage for axial flaws in the eight cold leg welds, the licensee would need to machine or manually grind the welds flat, to allow the ultrasonic search units to examine the required inspection volume. Obtaining full coverage for the circumferential flaw inspections would require modifying or removing the concrete pipe whip restraints. Modifying the welds to allow full axial scan coverage would take considerable time and an estimated 41 Rem of dose to the workers. Alternately, the licensee proposed that deferral of the inspection for one refueling outage would permit the modification of inspection procedures and/or the development of an automated machining method to reconfigure the welds. The NRC reviewed the hardship claim by the licensee and finds that the amount of dose required to achieve the required coverage during this refueling outage constitutes a hardship.

The NRC staff also assessed the licensee's safety basis to extend the required inspections one cycle of operation. The NRC staff finds the licensee flaw evaluations to be non-conservative in some respects. Based on both licensee evaluations and independent NRC evaluations the NRC staff finds that the potential for leakage during the next operating cycle cannot be completely excluded. However, the NRC also finds that loss of structural integrity of the subject welds will not occur without the occurrence of detectable leakage prior to loss of structural integrity. If leakage should occur from the weld locations, the licensee's enhanced leakage monitoring will ensure that the leakage will be promptly identified, and as such, the NRC staff concludes the effects of any such leakage would be minimal on other plant components. Therefore, given that the licensee's proposed alternative includes enhanced leakage monitoring, the NRC staff finds that the licensee has demonstrated reasonable assurance that the structural integrity of the subject welds will be maintained during the next cycle of operation.

4.0 CONCLUSION

As set forth above, the NRC staff has determined that the coverage obtained during refueling outage 1R24 is acceptable and that Relief Request RR 4-24 provides reasonable assurance of the structural integrity of the branch connections to the cold leg piping until the next refueling outage. The staff concludes that complying with the essentially 100 percent volumetric coverage requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and 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, the NRC authorizes the use of Relief Request 4-24 until the end of the next refueling outage (1R25), scheduled for spring 2017.

The NRC staff notes that all other ASME Code requirements for which relief was not specifically requested and approved in the subject request for relief remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: Stephen Cumblidge, NRR/DE

Date of Issuance: March 14, 2016

If you have any questions, please contact the PNP Project Manager, Jennivine Rankin at (301) 415-1530.

Sincerely,

/RA/

David J. Wrona, Chief
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-255

Enclosure:
Staff Evaluation of Relief Request RR 4-24

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