

March 22, 2006

Mr. Michael R. Kansler, President
Entergy Nuclear Operations, Inc.
440 Hamilton Avenue
White Plains, NY 10601

SUBJECT: PILGRIM NUCLEAR POWER STATION RELIEF REQUEST NO. PRR-9,
(TAC NO. MC8292)

Dear Mr. Kansler:

By letter dated June 29, 2005, Entergy Nuclear Operations, Inc. (the licensee), requested relief from the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, 1998 Edition with the 2000 Addenda, Appendix VIII, Supplement 11, "Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds." The licensee proposed the use of the Electric Power Research Institute (EPRI) Performance Demonstration Initiative (PDI) program in lieu of the requirements of Section XI, Appendix VIII, Supplement 11.

The Nuclear Regulatory Commission staff has concluded that the proposed alternatives to the ASME Code requirements in PRR No. 9 are acceptable, and will provide an acceptable level of quality and safety. The results are provided in the enclosed safety evaluation. Pursuant to 10 CFR 50.55a(a)(3)(i), the proposed alternative is authorized for the Pilgrim Nuclear Power Station's fourth 10-year inservice inspection interval, which ends on June 30, 2015.

If you have any questions regarding this approval, please contact the Pilgrim Project Manager, James Shea, at 301-415-1388.

Sincerely,

/RA/

Richard J. Laufer, Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-293

Enclosure:
As stated

cc w/encl: See next page

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Pilgrim Nuclear Power Station

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST NO. PRR-9

PILGRIM NUCLEAR POWER STATION

DOCKET NO. 50-293

1.0 INTRODUCTION

By letter dated June 29, 2005, Agencywide Documents Access and Management System (accession number ML051920157), Entergy Nuclear Operations, Inc. (the licensee) submitted Relief Request No. PRR-9 requesting the Nuclear Regulatory Commission (NRC) authorization for the Pilgrim Nuclear Power Station (Pilgrim) to use proposed alternatives to the requirements of the American Society of Mechanical Engineers Boiler Pressure and Vessel Code (ASME Code), Section XI, 1998 Edition with 2000 Addenda, Supplement 11 to Appendix VIII, "Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds," that contains the qualification requirements for procedure, equipment, and personnel involved with examining dissimilar metal welds using ultrasonic techniques. In lieu of the ASME Code requirements, the licensee requested to use the dissimilar metal weld inspection criteria of the Electric Power Research Institute (EPRI) Performance Demonstration Initiative (PDI) Program. The licensee's proposed request would be applicable during Pilgrim's fourth 10-year inservice inspection (ISI) interval.

2.0 REGULATORY EVALUATION

Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(g) requires that ISI of ASME Code Class 1, 2, and 3 components be performed in accordance with Section XI of the ASME Code and applicable addenda, except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). According to 10 CFR 50.55a(a)(3), alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if an applicant demonstrates that the proposed alternatives would provide an acceptable level of quality and safety or if the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

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 ISI 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 ISI of

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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) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The ISI Code of record for the fourth 10-year inspection interval for Pilgrim is the 1998 Edition with Addenda through 2000 of the ASME Code, Section XI.

2.1 Code Requirements for Which Relief Is Requested

This request is applicable to Class 1 pressure retaining welds in piping subject to examination using procedure, personnel, and equipment qualified to ASME Code, Section XI, 1998 Edition with 2000 Addenda, Appendix VIII, Supplement 11, "Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds," criteria.

2.2 ASME Code Requirements

The Code requirements are as stated in Appendix VIII, Supplement 11 to the ASME Code, Section XI, 1998 Edition with the 2000 Addenda.

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee is requesting relief from the weld overlay requirements in the following paragraphs to Section XI, Appendix VIII, Supplement 11.

Paragraph 1.1(d)(1) requires that all base metal flaws be cracks.

Paragraph 1.1(e)(1) requires that at least 20 percent but not less than 40 percent of the flaws shall be oriented within ± 20 degrees of the axial direction.

Paragraph 1.1(e)(1) also requires that the rules of IWA-3300 shall be used to determine whether closely spaced flaws should be treated as single or multiple flaws.

Paragraph 1.1(e)(2)(a)(1) requires that a base grading unit shall include at least 3 inches of the length of the overlaid weld and the outer 25 percent of the overlaid weld and base metal on both sides.

Paragraph 1.1(e)(2)(a)(3) requires that for unflawed base grading units, at least 1 inch of unflawed overlaid weld and base metal shall exist on either side of the base grading unit.

Paragraph 1.1(e)(2)(b)(1) requires that an overlay grading unit shall include the overlay material and the base metal-to-overlay interface of at least 6 square inches. The overlay grading unit shall be rectangular, with minimum dimensions of 2 inches.

Paragraph 1.1(e)(2)(b)(2) requires that overlay fabrication grading units designed to be unflawed shall be separated by unflawed overlay material and unflawed base metal-to-overlay interface for at least 1 inch around its entire perimeter.

Paragraph 3.2(b) requires that all extensions of base metal cracking into the overlay material by at least 0.1 inch are reported as being intrusions into the overlay material.

2.3 Licensee's Proposed Alternative to Code

The proposed alternative is to use the Electric Power Research Institute (EPRI) - Performance Initiative Program (PDI) in lieu of the requirements of ASME Code, Section XI, 1998 Edition, 2000 Addenda, Appendix VIII, Supplement 11. The PDI program is described in detail in the licensee's submittal in Appendix B, relief request PRR-9, Table 1.

2.4 Licensee's Basis for Requesting Relief

The licensee states that: Paragraph 1.1(d)(1) of ASME Code, Section XI, Appendix VIII, Supplement 11 requires that all base metal flaws be cracks. As discussed in the licensee's submittal, implanting a crack requires excavation of the base material on at least one side of the flaw. While this may be satisfactory for ferritic materials, it does not produce a usable axial flaw in austenitic materials because the sound beam, which normally passes only through base material, must now travel through weld material on at least one side, producing an unrealistic flaw response. To resolve this issue, the PDI program revised this paragraph to allow use of alternative flaw mechanisms under controlled conditions. For example, the use of alternative flaws shall be limited to when the implantation of cracks precludes obtaining an effective ultrasonic response. Also, the flaws shall be semielliptical with a tip width of less than or equal to 0.002 inches and at least 70 percent of the flaws in the detection and sizing tests shall be cracks and the remainder shall be alternative flaws. The licensee has proposed to use the revised PDI in place of paragraph 1.1(d)(1) of ASME Code, Section XI, Appendix VIII, Supplement 11.

Relief is requested to allow closer spacing of flaws provided they do not interfere with detection or discrimination. The existing specimens used to date for qualifications to the Tri-party (NRC/BWROG(Boiling Water Reactor Owners Group)/EPRI) agreement have a flaw population density greater than allowed by the current Code requirements. These samples have been used successfully for all previous qualifications under the Tri-party agreement program. To facilitate their use and provide continuity from the Tri-party agreement program to Supplement 11, the PDI Program has merged the Tri-party test specimens into their weld overlay program. For example: the requirement for using IWA-3300 for proximity flaw evaluation in paragraph 1.1(e)(1) was excluded, instead indications will be sized based on their individual merits; paragraph 1.1(d)(1) includes the statement that intentional overlay fabrication flaws shall not interfere with ultrasonic detection or characterization of the base metal flaws; paragraph 1.1(e)(2)(a)(1) was modified to require that a base metal grading unit include at least 1 inch of the length of the overlaid weld, rather than 3 inches; paragraph 1.1(e)(2)(a)(3) was modified to require sufficient unflawed overlaid weld and base metal to exist on all sides of the grading unit to preclude interfering reflections from adjacent flaws, rather than the 1 inch requirement of Supplement 11; paragraph 1.1(e)(2)(b)(1) was modified to define an overlay fabrication grading unit as including the overlay material and the base metal-to-overlay interface for a length of at least 1 inch rather than the 6-square inch requirement of Supplement 11; and paragraph 1.1(e)(2)(b)(2) states that overlay fabrication grading units designed to be unflawed shall be separated by unflawed overlay material and unflawed base metal-to-overlay interface for at least 1 inch at both ends, rather than around its entire perimeter.

Additionally, the requirement for axially oriented overlay fabrication flaws in paragraph 1.1(e)(1) of ASME Code, Section XI, Appendix VIII, Supplement 11 was excluded from the proposed PDI Program as an improbable scenario. Weld overlays are typically applied using automated gas

tungsten arc welding techniques with the filler metal being applied in a circumferential direction. Because resultant fabrication induced discontinuities would also be expected to have major dimensions oriented in the circumferential direction axial overlay fabrication flaws are unrealistic.

The requirement in paragraph 3.2(b) for reporting all extensions of cracking into the overlay is omitted from the PDI Program because it is redundant to the root mean square (RMS) calculations performed in paragraph 3.2(c) and its presence adds confusion and ambiguity to depth sizing as required by paragraph 3.2(c). This also makes the weld overlay program consistent with the Supplement 2 depth sizing criteria.

3.0 TECHNICAL EVALUATION

The licensee proposed to use the program developed by PDI. The staff's evaluation of the PDI program is discussed below:

The PDI program omits the phrase "and base metal on both sides," in paragraph 1.1(e)(2)(a)(1) because some of the qualification samples included flaws on both sides of the weld. To avoid confusion, several instances of the term "cracks" or "cracking" were changed to the term "flaws" because of the use of alternative flaw mechanisms. Additionally, to avoid confusion, the overlay thickness tolerance contained in the last sentence of paragraph 1.1(b), was reworded and the phrase "and the remainder shall be alternative flaws" was added to the next to last sentence in paragraph 1.1(d)(1).

Paragraph 1.1(d)(1):

In addition to the changes for flaw locations, the PDI program determined that certain Supplement 11 requirements pertaining to location and size of cracks would be extremely difficult to achieve. In an effort to satisfy the requirements, the PDI program developed a process for fabricating flaws that exhibited crack-like reflective characteristics. Instead of all flaws being cracks, as required by Paragraph 1.1(d)(1), the PDI program weld overlay performance demonstrations contain at least 70 percent cracks with the remainder being fabricated flaws exhibiting crack-like reflective characteristics. The NRC has reviewed the flaw fabrication process, and has compared the reflective characteristics between cracks and fabricated flaws. NRC found the fabricated flaws acceptable for the application.

Paragraph 1.1(e)(1):

The ASME Code requires that at least 20 percent but not less than 40 percent of the flaws shall be oriented within ± 20 degrees of the axial direction. In the proposed PDI program, the flaws satisfy the requirement and specifies that the flaws must be in the base metal. This is a tightening of the requirements. Hence, the proposed PDI's application of flaw angles to the axial direction is acceptable.

Paragraph 1.1(e)(1):

The ASME Code also requires that the rules of IWA-3300 shall be used to determine whether closely spaced flaws should be treated as single or multiple flaws. The proposed PDI program

treats each flaw as an individual flaw and not as part of a system of closely spaced flaws. The proposed program controls the flaws going into a test specimen set such that the flaws are free of interfering reflections from adjacent flaws. In some cases, this would permit flaws to be closer together than what is allowed by IWA-3300, thus making the performance demonstration more challenging. Hence, the proposed PDI's application for closely spaced flaws is acceptable.

Paragraph 1.1(e)(2)(a)(1):

The ASME Code requires that a base grading unit shall include at least 3 inches of the length of the overlaid weld, and the base grading unit includes the outer 25 percent of the overlaid weld and base metal on both sides. The PDI program reduced the criteria to 1 inch of the length of the overlaid weld and eliminated from the grading unit the need to include both sides of the weld. The test specimens from the existing weld overlay program have flaws on both sides of the welds which prevents them from satisfying the base grading unit requirements. These test specimens have been used successfully for testing the proficiency of personnel for over 16 years. This is a more challenging test because the individual must locate the flaw on the correct side of the weld. Hence, the proposed PDI's application of the 1 inch length of the overlaid weld base grading unit and elimination from the grading unit of the need to include both sides of the weld is acceptable.

Paragraph 1.1(e)(2)(a)(3):

The ASME Code requires that for unflawed base grading units, at least 1 inch of unflawed overlaid weld and base metal shall exist on either side of the base grading unit. This is to minimize the number of false identifications of extraneous reflectors. The PDI program stipulates that unflawed overlaid weld and base metal exist on all sides of the grading unit and be free of interfering reflections from adjacent flaws, which addresses the same concerns as the Code. Hence, the proposed PDI's application of the variable flaw free area adjacent to the grading unit is acceptable.

Paragraph 1.1(e)(2)(b)(1):

The ASME Code requires that an overlay grading unit shall include the overlay material and the base metal-to-overlay interface of at least 6 square inches. The overlay grading unit shall be rectangular, with minimum dimensions of 2 inches. The PDI program reduces the base metal-to-overlay interface to at least 1 inch (in lieu of a minimum of 2 inches) and eliminates the minimum rectangular dimension. This criterion is more challenging than the Code because of the variability associated with the shape of the grading unit. Hence, the proposed PDI's application of the grading unit is acceptable.

Paragraph 1.1(e)(2)(b)(2):

ASME Code requires that overlay fabrication grading units designed to be unflawed shall be separated by unflawed overlay material and unflawed base metal-to-overlay interface for at least 1 inch around its entire perimeter. The PDI program changes the requirement of 1 inch around its perimeter to 1 inch at both ends with sufficient unflawed overlaid weld and base

metal on both sides of the overlay fabrication grading unit to preclude interfering reflections from adjacent flaws. These test specimens have been used successfully for all previous qualifications under the Tri-party (NRC/BWROG/EPRI) agreement program. Hence, the proposed PDI's application of the grading unit is acceptable.

Paragraph 3.2(b):

The ASME Code requires that all extensions of base metal cracking into the overlay material by at least 0.1 inch be reported as intrusions into the overlay material. The PDI program omits this criteria. The PDI program requires that cracks be sized to the tolerance specified in the Code, which is 0.125 inches. Since the Code tolerance is close to the 0.1 inch value of Paragraph 3.2(b), any crack extending beyond 0.1 inch into the overlay material would be identified from its dimensions. The reporting of an extension in the overlay material is redundant for performance demonstration testing. Hence, the proposed PDI's omission of highlighting a crack extending beyond 0.1 inch into the overlay material is acceptable.

4.0 CONCLUSION

Based on the above evaluation, the NRC staff has concluded that the proposed alternative to use the EPRI-PDI program requirements in lieu of Appendix VIII, Supplement 11 will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the alternative proposed in Relief Request No. PRR-9 is authorized for the fourth 10-year interval for Pilgrim. All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: P. Patnaik

Date: March 22, 2006