

March 21, 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-11,
(TAC NO. MC8294)

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 I, Subparagraph I-2110(b). The licensee proposed to use Electric Power Research Institute (EPRI) Performance Demonstration Initiative (PDI) qualified procedure to perform ultrasonic testing of the reactor pressure vessel Shell-to-Flange weld.

The Nuclear Regulatory Commission staff has concluded that the proposed alternatives to the ASME Code requirements in PRR No. 11 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-11

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 request for relief number PRR-11 requesting the Nuclear Regulatory Commission (NRC) authorization for the Pilgrim Nuclear Power Station (Pilgrim) to use a Performance Demonstration Initiative (PDI) qualified procedure to complete the ultrasonic testing (UT) of the Reactor Pressure Vessel (RPV) shell-to-flange weld in accordance with American Society of Mechanical Engineer's Boiler and Pressure Vessel Code (ASME Code) Section XI, 1998 Edition with Addenda through 2000, Appendix VIII, Supplements 4 and 6 as amended by *Federal Register Notice* (FRN) 67 FR 187, dated September 26, 2002. The relief request relates to certain examination requirements for the Class 1, Examination Category B-A, Item No. B1.30, pressure vessel circumferential shell-to-flange weld at Pilgrim during the fourth 10-year inservice inspection (ISI) interval required to be performed in accordance with ASME Code, Section XI, 1998 Edition with the 2000 Addenda, Appendix I, Subparagraph I-2110(b).

2.0 REGULATORY EVALUATION

The ISI of the ASME Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). 10 CFR 50.55a(a)(3) states in part that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that: (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.

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 (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 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,

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subject to the limitations and modifications listed therein. The fourth 10-year ISI interval for Pilgrim extends from July 1, 2005, through June 30, 2015. The ISI Code of record for the fourth 10-year ISI interval for Pilgrim is the 1998 Edition through the 2000 Addenda of the ASME Code, Section XI. The components (including supports) may meet the requirements set forth in subsequent editions and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b) subject to the limitations and modifications listed therein and subject to NRC approval.

2.1 Components for Which Relief is Requested

The RPV shell-to-flange weld, includes the following component/weld numbers:

RPV-SF-0-120, RPV-SF-120-240, and RPV-SF-240-360.

2.2 Code Requirements

ASME Code, Section XI, 1998 Edition with Addenda through 2000, Appendix I, Subparagraph I-2110(b) requires that ultrasonic examination of RPV shell-to-flange welds be conducted in accordance with Article 4 of ASME Code, Section V, supplemented by the requirements of Table I-2000-1. In addition, Regulatory Guide (RG) 1.150, Revision 1, "Ultrasonic Testing of Reactor Vessel Welds During Pre-service and Inservice Examinations," serves as regulatory guidance for the UT examination of RPV welds

2.3 Licensee's Proposed Alternative to Code

The licensee proposes to use a PDI qualified procedure to complete the UT of the RPV shell-to-flange weld in accordance with ASME Code, Section XI, 1998 Edition with Addenda through 2000, Appendix VIII, Supplements 4 and 6 as amended by 67 FR 187, dated September 26, 2002.

2.4 Licensee's Basis for Requesting Relief

Appendix VIII to the ASME Code was developed to ensure the effectiveness of UT examinations within the nuclear industry by means of a rigorous item-specific performance demonstration. The performance demonstration is conducted on an RPV mockup containing flaws of various sizes and locations. The demonstration establishes the capability of equipment, procedures, and personnel to find flaws that could be detrimental to the integrity of the RPV.

Although Appendix VIII is not a requirement for this weld, the qualification process to Appendix VIII criteria demonstrates that the examination and evaluation techniques are equal or surpass the requirements of Appendix I, Subparagraph 2110(b) of ASME Code, Section V, Article 4, and the guidance in RG 1.150.

A comparison between the ASME Code, Section V, Article 4 based on UT methods and the procedures developed to satisfy the PDI and Appendix VIII can be best described as a comparison between a compliance-based procedure (ASME Code, Section V, Article 4) and a results-based procedure (PDI/Appendix VIII). ASME Code, Section V, Article 4 procedures use an amplitude-based technique and a known reflector. The proposed alternate UT method was established independently from the acceptance standards for flaw size found in ASME Code, Section XI.

A PDI-qualified sizing method is considered more accurate than the method used in ASME Code, Section V, Article 4. The proposed alternate UT examination technique provides an acceptable level of quality and examination repeatability as compared to the Article 4 requirements.

Pilgrim will obtain the examination vendor's Performance Demonstration Qualification Sheet (PDQS), which will attest that the procedure is in compliance with the detection and sizing tolerance requirements of Appendix VIII. The PDI qualification method is based on a group of samples, which validate the acceptable flaw sizes in ASME Code, Section XI. The sensitivity necessary to detect these flaws is considered to be equal to or better than the sensitivity obtained through ASME Code, Section V, Article 4, because the sensitivity necessary to detect implanted cracks is generally better than that necessary to calibrate on a machined notch.

The examination and sizing procedures for all potential qualified examination vendors use echo-dynamic motion and tip diffraction characteristics of the flaw instead of the amplitude characteristics required by ASME Code, Section V, Article 4. The search units are required to interrogate the same examination volume as depicted by ASME Code, Section XI, Figure IWB-2500-4 for the shell-to-flange weld joint.

Procedures used for satisfying the requirements of ASME Code, Section V, Article 4 for the UT examination of the RPV shell-to-flange weld has not undergone such a rigorous demonstration or received the same qualifications as a PDI qualified procedure.

The Pilgrim RPV shell-to-flange geometry compares very favorably with the geometry of the PDI qualification specimens. The inside diameter surface (the scan surface) of the shell-to-flange weld and adjacent base material is theoretically a cylinder; there is no taper associated with this joint on the RPV inside diameter at Pilgrim. The shell base material thickness (excluding clad) is 5 5/16 inches. The flange thickness (excluding clad) within the extremity of the required examination volume is 10 5/8 inches. Pilgrim will require that the vendor's PDQS bound this thickness range. It is expected that an examination will be able to be performed from both the shell and the flange sides of the weld.

The shell-to-flange weld was examined radiographically and ultrasonically as part of the RPV fabrication. During the second 10-year ISI interval this weld was re-examined. In 1996, the weld was examined by remote automated inspection per 10 CFR 50.55a(g) during the first period of the third 10-year ISI interval. This last examination was conducted in accordance with Appendix VIII using PDI-demonstrated procedures, even though Appendix VIII was not mandatory at the time.

If Pilgrim were to conduct examination of the RPV shell-to-flange weld in accordance with ASME Code, Section V, Article 4 and RG 1.150, it is expected that the examination would be performed using manual techniques from the vessel outside diameter inside the drywell at the top of the bio-shield wall, and also from the vessel flange mating surface in the reactor refueling cavity. The use of Appendix VIII Supplements 4 and 6 for examination of this weld using remote automated inspection tooling is expected to significantly reduce personnel radiation exposure.

Compliance with the proposed alternatives described above will provide an adequate level of quality and safety for examination of the affected welds, and will not adversely impact the health and safety of the public.

3.0 NRC STAFF EVALUATION

The ASME Code requires that ultrasonic examinations of shell-to-flange welds in vessels greater than 2 inches in thickness be conducted in accordance with Article 4 of ASME Code, Section V, as supplemented by the requirements in Table I-2000-1. ASME Code, Section V, Article 4, provides a prescriptive-based process for qualifying UT procedures and the scanning requirements for performing the examinations. The prescriptive-based UT uses detailed criteria for setting up and calibrating equipment, calculating coverage, and detecting indications. The capability of a prescriptive-based UT examination is demonstrated with calibration blocks made from representative material containing holes and notches. Performance-based UT requires that detailed criteria be used for performance demonstration tests. The results are performed on representative mock-ups containing flaws similar to those found in operating plants. The performance-based tests demonstrate the effectiveness of UT personnel and procedures.

In lieu of Article 4 of ASME Code, Section V, as supplemented by the requirements in Table I-2000-1, the licensee proposed performing UT examinations of the subject weld in accordance with the performance-based criteria listed in the 1998 Edition through the 2000 Addenda, of the ASME Code, Appendix VIII, Supplements 4 and 6, as amended by 10 CFR 50.55a. These performance-based methods are currently required by 10 CFR 50.55a for examination of RPV shell welds when scanning from the vessel shell surface. These performance-based examinations are performed with the scanning requirements for Supplements 4 and 6 that are provided in 10 CFR 50.55a(b)(2)(xv)(G), and the scanning volume identified in ASME Code, Section XI, Figure IWB-2500-4.

The procedures, equipment, and personnel qualified to Appendix VIII through the PDI program have shown a high probability of flaw detection, and have increased the reliability of examinations of weld configurations within the scope of the PDI program. Therefore, the proposed alternative provides an acceptable level of quality and safety.

4.0 CONCLUSION

Based on the above evaluation, the NRC staff concludes that the licensee's proposed alternative (PRR-11, Revision 0) to use the PDI qualified procedure to complete the UT of the RPV shell-to-flange weld in accordance with ASME Code, Section XI, 1998 Edition, though the 2000 Addenda, Appendix VIII Supplements 4 and 6 as amended by 10 CFR 50.55a will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the proposed alternative is authorized for the fourth 10-year ISI interval at 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: Andrea Keim

Date: March 21, 2006