Entergy

Entergy Nuclear Operations, Inc.
Pilgrim Station
600 Rocky Hill Road
Plymouth, MA 02360

William J. Riggs
Director, Nuclear Assessment

April 28, 2003

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
Docket No. 50-293
License No. DPR-35

Pilgrim Relief Request (PRR)-31,

Alternative Contingency Repair Plan for Generic Letter 88-01, Reactor Pressure Vessel Nozzle-to-Safe-End Welds, using ASME Code Cases N-638, 2142-1, 2143-1, and N-504-1

LETTER NUMBER: 2.03.066

Dear Sir or Madam:

This letter requests NRC approval of Pilgrim Relief Request (PRR) No. 31, in support of refueling outage (RFO)-14 to complete an In-service Inspection repair plan within the scope of Generic Letter 88-01.

This relief request applies to the existing reactor pressure vessel (RPV) nozzle-to-safe-end welds as an alternative to 10CFR50.55a(c)(3). This relief is requested under the provisions of 10CFR50.55a(a)(3)(i), in that the proposed alternative would provide an acceptable level of quality and safety. The repair plan uses a weld overlay repair method that represents an alternative to "American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code," Section XI Code repair.

This relief request applies to the austenitic to ferritic RPV nozzle-to-safe-end welds for RFO-14 and the remainder of the Third In-service Inspection interval.

The weldment associated with the RPV nozzle-to-safe-end welds are being inspected during RFO-14 to satisfy the requirements of Generic Letter 88-01, "NRC Position on IGSCC in BWR, Austenitic Stainless Steel Piping" and Appendix VIII of ASME Section XI. Although previous inspections of these RPV nozzle-to-safe-end welds identified no indication(s) and Pilgrim has implemented hydrogen water chemistry, the materials in these weldments are susceptible to IGSCC. Based on industry experience with IGSCC susceptible materials, Pilgrim has developed a contingency repair plan for repair of the RPV nozzle-to-safe-end welds, should unacceptable indication(s) be detected.

A047

The repair plan includes use of ASME Code Cases N-638, 2142-1, 2143-1 and partial use of Code Case N-504-1, in that exceptions are taken from Code Case N-504-1. The American Society of Mechanical Engineers has approved these Code Cases and, additionally, NRC has authorized the use of Code Case N-504-1 in Regulatory Guide 1.147. The Code Case N-638 is included in the approved list of Draft Regulatory Guide DG-1091, dated December 2001. The Staff has approved exceptions from Code Case N-504-1, which are similar to Pilgrim's request contained in the Attachment, for James A Fitzpatrick (TAC No. MB0252, dated October 26, 2000), Duane Arnold Energy Center (NRC Staff's letter dated November 19, 1999), and for the Nine Mile Point Unit 2 plant (NRC Staff's letter dated March 30, 2000). The repair plan presented in the Attachment is an alternative to the ASME Code, Section XI, pursuant to the requirements of 10CFR50.55a(c)(3), and was recently approved by the NRC for use at Fitzpatrick (TAC No. MB0252).

Based on the evaluations contained in the Attachment, Pilgrim has concluded that this alternative provides an acceptable level of quality and safety and that strict adherence to the specified requirements would result in unusual difficulty without a compensating increase in the level of quality and safety. Therefore, this proposed contingency alternative satisfies the requirements of 10CFR50.55a(a)(3)(i).

Review and approval of the proposed contingency repair alternative is requested by May 7, 2003 to support Pilgrim restart.

If you have any questions regarding the information contained in this letter, please contact Mr. Bryan Ford (508) 830-8403.

Sincerely,

for William J. Riggs

Attachments: Pilgrim Relief Request No. 31 (5 pages)

cc: Mr. Travis Tate, Project Manager
Office of Nuclear Reactor Regulation
Mail Stop: 0-8B-1
U. S. Nuclear Regulatory Commission
1 White Flint North
11555 Rockville Pike
Rockville, MD 20852

U.S. NRC, Region 1
475 Allendale Road
King of Prussia, PA 19406

Senior Resident Inspector
Pilgrim Nuclear Power Station

ATTACHMENT TO ENTERGY LETTER 2.03.066

Proposed Alternative for the Contingency Repair of Reactor Pressure Vessel Nozzle-to-Safe-End welds Pilgrim Relief Request (PRR-31)

A. COMPONENT IDENTIFICATION

A full structural weld overlay repair is proposed, if needed, for the weldment associated with the austenitic to ferritic RPV nozzle-to-safe-end welds.

These RPV nozzle-to-safe-end welds fall within the scope of GL 88-01.

The weld overlay material for the proposed repair is as follows:

For machine (GTAW) welding, the weld material is ASME Section II, Part C, SFA 5-14 Filler Wire ER NiCrFe-7 UNS NO6052 0.035" diameter F-No. 43 supplemented by Code Case 2142-1, and known commercially as Alloy 52.

For manual (SMAW) welding, the weld material is ASME Section II, Part C, SFA 5-11 Weld Electrode E NiCrFe-7 UNS W86152 0.125" diameter, supplemented by Code Case 2143-1, and known commercially as Alloy 152

B EXAMINATION AND REPAIR REQUIREMENTS

Weld overlays will be designed consistent with the requirements of NUREG-0313, Revision 2 (which was implemented by Generic Letter 88-01), ASME Code Case N-504-1, and ASME, Section XI, Paragraph IWB-3640.

Welder Qualification and Welding Procedures

All welders and welding procedures will be qualified in accordance with ASME Section IX and any special requirements from Section XI or applicable code cases. A manual shielded metal arc weld (SMAW) procedure will be qualified to facilitate localized repairs and to provide a seal weld, prior to depositing the overlay, should the defect be near through-wall or through-wall and leaking. This procedure will make use of UNS W86152 SMAW electrodes consistent with the requirements of ASME Section IX, Code Case 2143-1, "F-Number Grouping for Ni-Cr-Fe, Classification UNS W86152 Welding Electrode." The repair activities will be performed by qualified personnel from Welding Services Incorporated (WSI) and shall be in accordance with WSI's Nuclear Repair (NR) Certificate of Authorization. The repairs will be performed in accordance with WSI Welding Procedure Specification for welding Alloy 52.

Welding Wire Material

A consumable welding wire highly resistant to intergranular stress corrosion cracking (IGSCC) will be used for the overlay material. This material, designated UNS N06052 is a nickel-based weld filler material, commonly referred to as Alloy 52, and will be applied using the gas tungsten arc welding (GTAW) process. Alloy 52 is identified in Code Case 2142-1 as F-No. 43 Grouping for Ni-Cr-Fe, classification UNS N06052 Filler Metal. Alloy 52 contains about 30% chromium that imparts excellent corrosion resistance to this material.

Weld Overlay Design

The weld overlay will extend around the full circumference of the nozzle weldment location in accordance with NUREG-0313, Revision 2, Code Case N-504-1 and Generic Letter 88-01. The specific thickness and length will be computed according to guidance provided in ASME Section XI, Code Case N-504-1 and ASME Section XI, Paragraph IWB-3640, 1989 Edition. The overlay will completely cover the indication locations and the Inconel 182 weld deposit with the highly corrosion resistant Alloy 52 material. In order to accomplish this objective, it may be necessary to weld on the low alloy steel (LAS) nozzle material. A temper bead welding approach will be used for this purpose according to provisions of recently approved ASME Code Case N-638. This code case provides for machine gas tungsten-arc welding (GTAW) temper bead weld repairs to P No. 3 nozzle materials (SA 508 Cl. 2) at ambient temperature. The temper bead approach was selected because temper bead welding supplants the requirement for post weld heat treatment (PWHT) of heat-affected zones in welded LAS material. Also, temper bead welding techniques produce excellent toughness and ductility in heat affected zones of welded LAS materials, and results in compressive residual stresses, which inhibit IGSCC.

Examination Requirements

The repair, PSI and ISI examination of the weld overlay repair will be performed in accordance with the ISI Program and Plan along with of NUREG-0313, Revision 2, Generic Letter 88-01, and approved plant procedures as specified by the ISI Repair/Replacement Program.

Unusual Difficulty in Meeting Specified Requirements

An alternative repair method with a more corrosion resistant material would require draining the reactor vessel. In addition, preheat and post weld heat treatment are required for welding on nozzle material by ASME Section III, Subparagraph NB4622.7. These requirements are highly impractical without draining the reactor vessel, and may distort the P3 components involved. To drain the vessel requires a full-core offload of the fuel, which would add several days to the outage critical path, resulting into additional shielding for any work in the drywell, which increases radiation exposure to Pilgrim personnel. If the vessel is drained, the radiation dose rates in the nozzle area would increase significantly, resulting in increased personnel exposure. Therefore, consistent with ALARA practices and prudent outage scheduling and utilization of outage personnel, there is no vessel drain down planned for this repair. The weld overlays will be completed with water on the inside surface of the nozzles and safe-ends. This approach (i.e., no vessel drain down) minimizes fuel movement, thereby enhancing nuclear safety, while shortening outage duration and reducing radiation exposure to personnel.

The alternative, as described below, provides an acceptable level of quality and safety while neither draining the reactor vessel nor applying preheat and post weld heat treatments. Therefore, the alternative alleviates the impracticality of following certain code requirements for this repair activity.

C. ALTERNATIVE TO REPAIR REQUIREMENTS

The repair will utilize ASME Code Case N-504-1, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping," and Code Case N-638, "Similar and

Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique," with the following exceptions and clarifications.

Clarification of Code Case N-504-1 for Applicability to Nickel-Based Austenitic Steel

Code Case N-504-1 was prepared specifically for austenitic stainless steel material. An alternate application to nickel-based austenitic materials (i.e., Alloy 52) is requested due to the specific configuration of the nickel-based austenitic weldment.

Exception from Code Case N-504-1 Paragraph (b)

Code Case N-504-1 paragraph (b) requires that the reinforcement weld metal shall be low carbon (0.035 % maximum) austenitic stainless steel. In this application, a nickel-based filler is required and Alloy 52 has been selected in place of low carbon austenitic stainless steel.

Exception from Code Case N-504-1 Paragraph (e)

Code Case N-504-1 paragraph (e) requires as-deposited delta ferrite measurements of at least 7.5 for the weld reinforcement. These measurements have no meaning for nickel-based materials and will not be performed for this overlay.

Exception from Code Case N-504-1 Paragraph (h)

Code Case N-504-1 paragraph (h) requires a system hydrostatic test of completed repairs if the repaired flaw penetrated the original pressure boundary or if there is any observed indication of the flaw penetrating the pressure boundary during repairs. A system leak test of completed repairs will be used in lieu of a hydrostatic test in the unlikely event of such through wall penetration.

Use of Code Case N-638 Applicability

Code Case N-638 shall be applied to the nozzle material.

Use of Code Case 2142-1

Code Case 2142-1, "F-Number Grouping for Ni-Cr-Fe, Classification UNS N06052 Filler Metal," may be used.

Use of Code Case 2143-1

Code Case 2143-1, "F-Number Grouping for Ni-Cr-Fe, Classification UNS W86152 Welding Electrode," may be used to make localized repairs.

D. BASIS FOR THE ALTERNATIVE

Clarification of Code Case N-504-1 for Applicability to Nickel-Based Austenitic Steel

The weldment being addressed is austenitic material having a mechanical behavior similar to austenitic stainless steel. Accordingly, this alternative provides an acceptable level of quality and safety. Therefore, Code Case N-504-1 should be interpreted to apply equally to both materials.

Exception from Code Case N-504-1 Paragraph (b)

A consumable welding wire highly resistant to IGSCC was selected for the overlay material. This material, designated UNS N06052 is a nickel-based alloy weld filler material, commonly referred to as Alloy 52, and will be applied using the gas tungsten arc welding (GTAW) process. Alloy 52 contains about 30% chromium that imparts excellent corrosion resistance to this material. By comparison, Alloy 82, is identified as an IGSCC resistant material in NUREG 0313 Revision 2 and contains about 18 to 22% chromium while Alloy 182 has a nominal chromium composition of 13 to 17%.

Exception from Code Case N-504-1 Paragraph (e)

The composition of nickel-based Alloy 52 is such that delta ferrite is not formed during welding. Ferrite measurement requirements were developed for welds of 300 series stainless steel that require delta ferrite to develop corrosion resistance. Welds of Alloy 52 and Alloy 152 are 100% austenitic and contain no delta ferrite due to the high nickel composition (approximately 60% Ni).

Exception from Code Case N-504-1 Paragraph (h)

In lieu of the hydrostatic pressure test requirements defined in Code Case N-504-1, the required pressure test shall be performed in accordance with the Third Interval ISI Program and Plan, approved Pilgrim Relief Request, which invokes Code Case N-416-1 (TAC No. M91513, dated March 10, 1995).

Use of Code Case N-638 Applicability

Code Case N-638 was developed for temper bead applications to similar and dissimilar metals. It permits the use of machine gas tungsten arc welding (GTAW) at ambient temperature without the use of preheat or PWHT on Class 1, 2, and 3 components.

Temper bead welding methodology is not new. Numerous applications over the past decade have demonstrated the acceptability of temper bead technology in nuclear environments. Temper bead welding achieves heat affected zone (HAZ) tempering and grain refinement without subsequent post weld heat treatment (PWHT). Excellent HAZ toughness and ductility are produced.

A 48-hour post weld hold prior to acceptance inspection is required by Code Case N-638 and will be done to assure that no delayed cracking has occurred.

Use of Code Case 2142-1

Code Case 2142-1, "F-Number Grouping for Ni-Cr-Fe, Classification UNS N06052 Filler Metal," may be used. The composition of these alloys produces a material that possesses excellent resistance to IGSCC mechanisms. Because the chromium content is nominally 30%, the corrosion resistance will be superior to any of the materials to which it is being applied. In addition, the welding filler material is compatible with any of the substrate materials.

Use of Code Case 2143-1

Code Case 2143-1, "F-Number Grouping for Ni-Cr-Fe, Classification UNS W86152 Welding Electrode," may be used. The composition of these alloys produces a material that possesses excellent resistance to IGSCC mechanisms. Because the chromium content is nominally 30%, the corrosion resistance will be superior to any of the materials to which it is being applied. In addition, the welding filler material is compatible with any of the substrate materials.

E. CONCLUSION

Weld overlays involve the application of weld metal circumferentially over and in the vicinity of the flawed weld to restore ASME Section XI margins as required by ASME Code Case N-504-1. Weld overlays have been used in the nuclear industry as an acceptable method to repair flawed welds. The use of overlay filler material that provides excellent resistance to IGSCC develops an effective barrier to crack extension by corrosion processes.

The design of the overlay for RPV nozzle weldment uses methods that are standard in the industry for size determination of pipe-to-pipe overlays. There are no new or different approaches used in these overlay designs that would be considered first of a kind or inconsistent with previous approaches. The overlay is designed as a full structural overlay in accordance with the recommendation of NUREG-0313, Revision 2, which was forwarded by Generic Letter 88-01 and by Code Case N-504-1 and by ASME Section XI Paragraph IWB-3640.

Temper bead techniques, as defined by Code Case N-638, will produce a tough corrosion resistant overlay deposit that meets or exceeds all code requirements for the weld overlay.

Pilgrim concludes that the contingency repair plan is justified and presents an acceptable level of quality and safety to satisfy the requirements of 10CFR50.55a(a)(3)(i). Similar proposed alternatives to the requirements of 10CFR50.55a(c)(3) have been previously approved by the NRC for James A Fitzpatrick (TAC No. MB0252, dated October 26, 2000), Duane Arnold Energy Center (NRC Staff's letter dated November 19, 1999), and Nine Mile Point Unit 2 plant (NRC Staff's letter dated March 30, 2000).

F. DURATION OF THE PROPOSED ALTERNATIVE

The proposed alternative applies to the repairs of RPV nozzle-to-safe-end welds for RFO-14 and the remainder of the Third In-service Inspection interval.