Entergy

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William J. Riggs
Director, Nuclear Assessment

October 8, 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)-36,

Alternative Contingency Repair Plan for Generic Letter 88-01, Reactor Pressure Vessel Nozzle-to-End Cap Weld, Using ASME Code Cases N-638 and N-504-2 with Exceptions - Revision 1.

REFERENCES:

1. Entergy Letter No. 2.03.114, Pilgrim Relief Request - 36, Alternative Contingency Repair Plan for Generic Letter 88-01, Reactor Pressure Vessel Nozzle-to-End Cap Weld, Using ASME Code Cases N-638 and N-504-2 with Exceptions - Revision 0, dated October 1, 2003.

2. Entergy Letter No. 2.03.116, Response to NRC Request for Additional Information, dated October 3, 2003.

LETTER NUMBER: 2.03.120

Dear Sir or Madam:

This letter requests NRC approval of Pilgrim Relief Request (PRR) No. 36, in support of the current outage to complete an In-service Inspection repair plan within the scope of Generic Letter 88-01 and BWRVIP-75. This letter replaces the referenced Entergy Letter 2.03.114, dated October 1, 2003 and provides additional information.

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This relief request applies to the existing reactor pressure vessel (RPV) nozzle-to-end cap weld 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 RPV capped N10 nozzle austenitic to ferritic weld.

During an inspection of the Drywell, a flaw was discovered in the capped N10 nozzle-to-end cap weld. This flaw requires a repair in place. Pilgrim is proceeding with the attached repair plan.

This repair plan includes use of ASME Code Cases N-638 and Code Case N-504-2. NRC has authorized the use of Code Case N-638 and N-504-2 in Regulatory Guide 1.147, Rev. 13. The Staff has approved exceptions from Code Case N-504-1 (an earlier version of N-504-2) and Code Case N-638, 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 1989 Edition, 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. Therefore, this proposed alternative satisfies the requirements of 10CFR50.55a(a)(3)(i).

Review and approval of the repair plan alternative is requested 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,

William J. Riggs

Attachments: Pilgrim Relief Request No. 36 (5 pages)

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ATTACHMENT TO ENTERGY LETTER 2.03.120

Proposed Alternative for the Repair of
Reactor Pressure Vessel Nozzle-to-End Cap Weld
Pilgrim Relief Request (PRR-36)

A. COMPONENT IDENTIFICATION

A full structural weld overlay repair is proposed for the weldment associated with the austenitic to ferritic-capped N10 RPV nozzle weld.

This weld falls within the scope of GL 88-01 and BWRVIP-75.

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 F-No. 43 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 known commercially as Alloy 152

B EXAMINATION AND REPAIR REQUIREMENTS

Weld overlay will be designed consistent with the requirements of NUREG-0313, Revision 2 (which was implemented by Generic Letter 88-01), ASME Code Cases N-504-2, N-638, 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. This procedure will make use of UNS W86152 SMAW electrodes consistent with the requirements of ASME Section IX. 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 52/152.

Welding Wire Material

The conditions which initiated the cracking of the N10 nozzle was interdendritic stress corrosion cracking (IDSCC) at the inside diameter of the N10 nozzle due to geometric discontinuities and residual repair weld stresses in an oxidizing environment. A consumable welding wire highly resistant to intergranular stress corrosion cracking (IGSCC) and IDSCC will be used for the overlay material. (Note: IGSCC and IDSCC refer to essentially the same phenomenon in the base metal and weld material respectively. For the purpose of this request they are synonymous.) 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 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. Alloy 152 welding wire may be used for seal welding activities.

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-504-2 and Generic Letter 88-01 and BWRVIP-75. The specific thickness and length will be computed according to guidance provided in ASME Section XI, Code Case N-504-2 and ASME Section XI, Paragraph IWB-3640, 1989 Edition. The overlay will completely cover the indication location and the Inconel 182 weld deposit butter 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 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.

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. The weld overlay will be examined in accordance with PRR-38, using the industry developed PDI procedure. Additional information concerning the examinations can be found in Entergy Letter dated October 3, 2003, "Response to NRC Request for Additional Information".

Unusual Difficulty in Meeting Specified Requirements

Since the IGSCC flaw begins on the inner surface (inside diameter), the Code repair would require removal of the flaw. This would require replacement of the CRD cap. A second repair option would require grinding out the flaw. This is not considered prudent, as it would result in the repaired area being susceptible to IGSCC. Replacement of the cap would require draining down the vessel to a level below the affected nozzle to allow the following:

- Machining of the nozzle to remove the Inconel 182 weld butter and ID cladding.
- Preheat of the nozzle prior to welding.
- Actual welding of the replacement cap to the CRD vessel nozzle.
- Final Post weld heat treatment

This code repair would take several days. This would extend the outage duration. In addition, if the vessel were drained to a level below the affected nozzle there would be a significant increase in person-rem exposure for the craft labor installing the new cap via the code repair.

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. 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 the overlay,

although sealing of the flaw may be performed without a water backing. The weld overlay will be completed with water on the inside surface of the nozzle and end cap. This approach (i.e., no vessel drain down) shortens outage duration and reduces 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-504-2, "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-504-2 for Applicability to Nickel-Based Austenitic Steel

Code Case N-504-2 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-504-2 Paragraph (b)

Code Case N-504-2 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-504-2 Paragraph (e)

Code Case N-504-2 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-504-2 Paragraph (h)

Code Case N-504-2 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.

Use of Code Case N-638 Applicability

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

D. BASIS FOR THE ALTERNATIVE

Clarification of Code Case N-504-2 for Applicability to Nickel-Based Austenitic Steel

The weldment being addressed is austenitic material having a mechanical behavior

similar to austenitic stainless steel. The weldment is designed to be highly resistant to IGSCC and is compatible with the existing weldment and base metal materials. Accordingly, this alternative provides an acceptable level of quality and safety. Therefore, Code Case N-504-2 should be interpreted to apply equally to both materials.

Exception from Code Case N-504-2 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 stress corrosion cracking 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%. Alloy 52 with its high chromium content provides a high level of resistance to IGSCC consistent with the requirements of the code case. Therefore, this alternative provides an acceptable level of quality and safety.

Exception from Code Case N-504-2 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 weld of 300 series stainless steel that require delta ferrite to develop corrosion resistance. Weld of Alloy 52 and Alloy 152 are 100% austenitic and contain no delta ferrite due to the high nickel composition (approximately 60% Ni and low iron content). Alloy 52 with its high chromium content provides a high level of resistance to hot cracking and IGSCC consistent with the purpose for the delta ferrite requirements for stainless steels of the code case. Therefore, this alternative provides an acceptable level of quality and safety.

Exception from Code Case N-504-2 Paragraph (h)

In lieu of the hydrostatic pressure test requirements defined in Code Case N-504-2, the required pressure test shall be performed in accordance with the Third Interval ISI Program and Plan and Code Case N-416-2 with the exception that the volumetric examination performed shall be an ultrasonic examination of the weld overlay. These alternative requirements are sufficient to demonstrate that the overlay is of adequate quality to ensure the pressure boundary integrity. Accordingly, this alternative provides an acceptable level of quality and safety.

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. Use of Code Case N-638 has been accepted in Regulatory Guide 1.147 Revision 13 as providing an acceptable level of quality and safety.

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-504-2. Weld overlays have been used in the nuclear industry as an acceptable method to repair flawed weld. The use of overlay filler material that provides excellent resistance to IGSCC provides an effective barrier to crack extension.

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-504-2 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-end cap weld for the scheduled outage and for the remaining service life of this weld. Re-inspection will be per BWRVIP-75 Guidelines.