April 12, 2005

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

SUBJECT: PILGRIM NUCLEAR POWER STATION - PILGRIM RELIEF REQUEST PRR-39 ALTERNATIVE CONTINGENCY REPAIR PLAN FOR REACTOR PRESSURE VESSEL NOZZLE SAFE-END AND DISSIMILAR METAL PIPING WELDS USING ASME CODE CASES N-638 AND N-504-2 WITH EXCEPTIONS (TAC NO. MC2496)

Dear Mr. Kansler:

By letter dated March 15, 2004, as supplemented by letters dated October 12, 2004, and March 16, 2005, Entergy Nuclear Operations, Inc. (Entergy) requested relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, pertaining to flaw removal, heat treatment, and nondestructive examination at the Pilgrim Nuclear Power Station (PNPS). Specifically, Entergy requested that the Nuclear Regulatory Commission (NRC) review and approve Pilgrim Relief Request (PRR) No. 39, “Alternative Contingency Repair Plan for Reactor Pressure Vessel Nozzle Safe-end and Dissimilar Metal Piping Welds.”

The proposed PRR uses the weld overlay method based on the methodology of the ASME Code, Section XI, 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 [gas tungsten arc weld] Temper Bead Technique." PRR-39 is related to the repair of reactor pressure vessel nozzle safe-end welds and dissimilar metal piping welds in the core spray and recirculation systems.

The NRC staff has reviewed the proposed alternatives. The results of this review are provided in the enclosed safety evaluation. The NRC staff has concluded that the proposed alternatives to ASME Code requirements provided in PRR-39 provide reasonable assurance of structural integrity, and an acceptable level of quality and safety. Therefore, pursuant to Title 10 of the *Code of Federal Regulations*, Section 50.55a(a)(3)(i), the NRC staff authorizes the use of ASME Code Case N-504-2, as modified, and the use of ASME Code Case N-638, to perform weld overlay repairs at PNPS for the third 10-year inservice inspection interval.

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.

If you have any questions regarding this approval, please contact the PNPS Project Manager, John Boska, at 301-415-2901.

Sincerely,

/RA by Victor Nerses for/

Darrell J. Roberts, Chief, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Reactor Regulation

Docket No. 50-293

Enclosure: As stated

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST FOR REPAIR OF SAFE-END AND DISSIMILAR WELDS

OF REACTOR VESSEL NOZZLES

ENTERGY NUCLEAR OPERATIONS, INC

PILGRIM NUCLEAR POWER STATION

DOCKET NO. 50-293

1.0 INTRODUCTION

By letter dated March 15, 2004, as supplemented by letters dated October 12, 2004, and March 16, 2005, Entergy Nuclear Operations, Inc. (Entergy) requested relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, pertaining to flaw removal, heat treatment, and nondestructive examination (NDE) at the Pilgrim Nuclear Power Station (PNPS). Specifically, Entergy requested that the Nuclear Regulatory Commission (NRC or the Commission) review and approve Pilgrim Relief Request (PRR) No. 39, “Alternative Contingency Repair Plan for Reactor Pressure Vessel Nozzle Safe-End and Dissimilar Metal Piping Welds.”

The proposed PRR uses the weld overlay method based on the methodology of the ASME Code, Section XI, 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 [gas tungsten arc weld] Temper Bead Technique." PRR-39 is related to the repair of reactor pressure vessel nozzle safe-end welds and dissimilar metal piping welds in the core spray and recirculation systems.

2.0 REGULATORY EVALUATION

The inservice inspection (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) Section 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Section 50.55a(a)(3) of 10 CFR states, in part, that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if Entergy 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) will meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in 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. The regulations require that inservice examinations of components and system pressure tests conducted during the first 10-year ISI 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 PNPS's third 10-year ISI interval, which began on July 1, 1995, and ends on June 30, 2005, is the 1989 Edition of the ASME Code, Section XI.

3.0 LICENSEE'S PROPOSED ALTERNATIVE

3.1 Components for Which Relief is Requested

Entergy proposed a full structural weld overlay repair for the austenitic reactor vessel nozzle safe-end and dissimilar metal piping welds in the core spray and recirculation systems as shown in the table below. This request is applicable for the welds which fall within the scope of Generic Letter (GL) 88-01, "NRC Position on IGSCC [intergranular stress-corrosion cracking] in BWR [boiling-water reactor] Austenitic Stainless Steel Piping," and BWRVIP-75, "BWR Vessel and Internals Project Technical Basis for Revisions to GL 88-01 Inspection Schedules."

WELD IDENTIFICATION	DESCRIPTION	SYSTEM
14-A-1	Safe-End to Nozzle	Core Spray
14-B-1	Safe-End to Nozzle	Core Spray
2R-N1B-1	Safe-End to Nozzle	Recirculation
2R-N2D-1	Safe-End to Nozzle	Recirculation
2R-N2E-1	Safe-End to Nozzle	Recirculation
2R-N2F-1	Safe-End to Nozzle	Recirculation
2R-N2G-1	Safe-End to Nozzle	Recirculation
2R-N2J-1	Safe-End to Nozzle	Recirculation
14-A-3	Pipe to Reducer	Core Spray
14-B-3	Pipe to Reducer	Core Spray
14-A-10A	Valve to Pipe	Core Spray
14-B-10A	Valve to Pipe	Core Spray

3.2 Code Requirements for which Relief is Requested

Entergy will design the weld overlay consistent with the requirements of NUREG-0313 which was implemented by GL 88-01; ASME Code Section XI, Code Cases N–504-2 and N–638; and ASME Code Section XI, Paragraph IWB-3640. Entergy will follow the examination and acceptance criteria in accordance with ASME Code Section III, 1992 Edition, subsection NB for class 1 components; ASME Code Section XI, 1989 Edition; and ASME Code Cases N–504-2 and N–638.

3.3 Welder Qualification and Welding Procedures

Entergy stated that all welders and welding procedures will be qualified in accordance with ASME Code Section XI, and any special requirements from Section XI or applicable code cases. If necessary, a manual shielded metal arc weld procedure will be qualified to facilitate localized repairs and to provide a seal weld, prior to depositing the overlay. This procedure uses UNS W86152 shielded metal arc weld electrodes consistent with the requirements of ASME Code Section XI. Personnel qualified in accordance with the welding procedure specification for welding Alloy 52/152 will perform the repair activities.

3.4 Welding Wire Material

Entergy stated that for machine GTAW, the weld material is ASME Code Section II, Part C, SFA 5-14 Filler Wire ER Nickel-Chromium-Iron-7 UNS N06052 F-No. 43, known commercially as Alloy 52. This weld material is resistant to IGSCC. Alloy 52 contains about 30% chromium and is corrosion resistant.

For manual shielded metal arc weld welding, the weld material is ASME Code Section II, Part C, SFA 5-11 Weld Electrode E Nickel-Chromium-Iron-7 UNS W86152, known commercially as Alloy 152.

3.5 Weld Overlay Design

Entergy stated that the weld overlay will extend around the full circumference of the weldment location in accordance with NUREG-0313, ASME Code Case N–504-2, GL 88-01, and BWRVIP-75. The overlay will be performed using a standard overlay design as described in NUREG-0313, Section 4.4.1. This design assumes a crack completely through the pipe wall for 360 degrees in circumferential extent. The calculation methods for design of the overlay will be in accordance with NUREG-0313, Section 4.1. The specific thickness and length will be computed according to ASME Code Section XI, Code Case N–504-2, and ASME Code Section XI, Paragraph IWB-3640, 1989 Edition.

The overlay will completely cover any indication location and the existing Inconel 182 weld deposit butter with the corrosion-resistant Alloy 52 material. In order to accomplish this objective, it is necessary to weld on the low alloy steel 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 requirements for weld repair using machine GTAW based on the temper bead process of P No. 3 nozzle materials (SA 508, Class 2) at ambient temperature. Entergy selected the temper bead approach because temper bead welding supplants the

requirement for post-weld heat treatment of heat-affected zones in welded low alloy steel material.

ASME Code Case N–638, paragraph 1(a), limits the maximum finished surface area of the weld overlay repair to 100 square inches. The overlay repair (design and fabrication) on large diameter (13 and 29-inch outside diameter) recirculation nozzle safe-end welds would exceed the 100 square-inch limit and requires NRC approval for a maximum finished weld repair surface area up to 300 square inches on the basis of analysis in Electric Power Research Institute (EPRI) Technical Report 1003616, "Additional Evaluations to Extend Repair Limits for Pressure Vessels and Nozzles", dated March 2004. Susquehanna Station has used the EPRI Report as justification for recent nozzle weld overlay repairs. If the weld overlay necessary for a nozzle exceeds 300 square inches, additional relief will be requested.

3.6 Examination Requirements

Entergy stated that the repair, preservice inspection, and ISI examinations of the weld overlay repair will be performed in accordance with the ISI program and plan along with NUREG-0313, GL 88-01, and plant procedures as specified by its Inservice Inspection Repair/Replacement Program. The weld overlay will be examined using the industry-developed performance demonstration initiative (PDI) procedure, which the staff approved in PNPS PRR-38 on February 26, 2004.

Entergy will perform system leakage testing as allowed by ASME Code Case N–416-2 with the additional condition that hold times specified in IWA-5213(d) be observed, in lieu of the system hydrostatic test required by ASME Code Case N–504-2. This complies with Regulatory Guide (RG) 1.147, Revision 13, relative to the NRC's conditional acceptance of Code Case N–416-2. Entergy will perform the VT-2 visual inspection with the insulation removed from the locations where the proposed weld overlays are performed. This will allow a 10-minute hold before the VT-2 visual inspection is performed.

The examinations and acceptance criteria will follow ASME Code Section III, 1992 Edition, Subsection NB for Class 1 Components; ASME Code Section XI, 1989 Edition; and ASME Code Cases N–504-2 and N–638. Entergy proposed the following examinations for the weld overlay:

EXAMINATION DESCRIPTION	METHOD	TECHNIQUE	REFERENCE
Weld overlay surface area preparation exam	Penetrant Test (PT)	Visible Dye	N–504-2
First two weld overlay layers surface exam	PT	Visible Dye	N–504-2
First two weld overlay layers thickness measurements	Ultrasonic Test (UT) or Mechanical	0° Longitudinal UT or Mechanical Height Measurement	N–504-2
Completed overlay or thickness measurements	UT or Mechanical	0° Longitudinal UT or Mechanical Height Measurement	N–504-2
Surface exam of final overlay surface and adjacent band within 1.5t (7/8" band) of weld overlay. This also serves as preservice surface examination of completed overlay.	PT	Visible Dye	NB-5350 IWB-3514 N–638 N–504-2
Volumetric exam of final overlay and adjacent band within 1.5t (7/8" band) of weld overlay. This also serves as preservice volumetric examination of completed overlay.	UT	PDI Procedure	ASME Code 1995, Section XI Appendix VIII; ASME Code 1989 Section XI
Preservice baseline exam of final overlay outer 25% of the underlying pipe wall to identify the original flaws.	UT	PDI Procedure	N–504-2

The acceptance criteria for the volumetric examinations shall be ASME Code Section XI Paragraph IWB-3514, "Standards for Examination Category B-F, Pressure Retaining Dissimilar Metal Welds, and Examination Category B-J, Pressure Retaining Welds in Piping".

Entergy noted that the curvatures of reactor nozzles require an exception to the ultrasonic inspection requirement for a 1.5t (7/8-inch band) adjacent band volumetric examination at the end of the overlay on the nozzle end. The liquid penetrant examination of this surface will constitute the acceptance testing for the overlay deposit. Thickness will be characterized at four azimuths representing each of the four pipe quadrants. Thickness measurements may be

determined using ultrasonic techniques or by mechanical measurement. Liquid penetrant examinations will be performed at the same stages of the overlay application as the thickness measurements identified above.

3.7 Licensee's Proposed Alternative and Associated Basis

For the proposed repair, Entergy will use ASME Code Case N–504-2 and ASME Code Case N–638 with the following exceptions and clarifications.

Clarification of Asme Code Case N–504-2 for Applicability to Nickel-Based Austenitic Alloy

ASME Code Case N–504-2 was prepared specifically for austenitic stainless steel material. An alternate application to use nickel-based austenitic materials (i.e., Alloy 52) is requested due to the specific configuration of the nickel-based austenitic weldment.

Basis: 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. ASME Code Case N–504-2 should be interpreted to apply equally to both weldment and base metal materials.

Exception from ASME Code Case N–504-2 Paragraph (b)

ASME Code Case N–504-2 paragraph (b) requires that the reinforcement weld metal shall be low carbon (0.035% maximum) austenitic stainless steel. In the proposed application, a nickel-based filler is required and Alloy 52 has been selected in place of low carbon austenitic stainless steel.

Basis: Entergy selected a consumable welding wire resistant to IGSCC 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 GTAW process. Alloy 52 contains about 30% chromium that provides stress corrosion cracking resistance to this material. By comparison, Alloy 82 is identified as an IGSCC-resistant material in NUREG-0313 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.

Exception from ASME Code Case N–504-2 Paragraph (e)

ASME 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 weld materials and will not be performed for this overlay.

Basis: The composition of nickel-based Alloy 52 is such that delta ferrite is not formed during welding. Ferrite measurement requirements were developed for welding of 300 series stainless steels that required delta ferrite to develop corrosion resistance. The Alloy 52 weld is 100% austenitic and contains no delta ferrite due to the high nickel composition (approximately 60% nickel and low iron content). The Alloy 52 weld, with its high chromium content, provides a high

level of resistance to hot cracking and IGSCC. This characteristic is consistent with the purpose for the delta ferrite requirements for stainless steels of the code case.

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

ASME 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.

Basis: In lieu of the hydrostatic pressure test requirements defined in ASME Code Case N–504-2, Entergy stated that the required pressure test shall be performed in accordance with the third interval ISI program and plan and ASME Code Case N–416-2 with the exception that the volumetric examination performed shall be an ultrasonic examination of the weld overlay.

Exception from ASME Code Case N–638 Paragraph 1(a)

ASME Code Case N–638 paragraph 1(a) limits the maximum finished surface area of the weld overlay repair to 100 square inches. Relief is requested to extend the size of the repairs up to a 300 square-inch finished area to accommodate overlay repair on large diameter (13 and 29-inch outside diameter) recirculation nozzle safe-end welds.

Basis: Entergy stated that ASME Code Case N–638 was developed for temper bead applications to similar and dissimilar metals. It permits the use of machine GTAW at ambient temperature without the use of preheat or post-weld heat treatment on ASME Code Class 1, 2, and 3 components.

Numerous applications over the past decade have demonstrated the acceptability of temper bead technology in nuclear environments. Temper bead welding achieves heat-affected zone tempering and grain refinement without subsequent post-weld heat treatment. Excellent heat affected zone toughness and ductility are produced. The use of ASME Code Case N–638 has been accepted in RG 1.147, Revision 13, as providing an acceptable level of quality and safety.

The overlay repair on large diameter (13 and 29-inch outside diameter) recirculation nozzle safe-end welds would exceed the 100 square inch limit specified in ASME Code Case N–638, paragraph 1(a). EPRI Technical Report 1003616 justifies extending the size of the temper bead repairs up to a 500 square-inch finished area. Entergy stated that the ASME Code Committees has recognized that the 100 square inches on the overlay surface area is too restrictive and a draft code case, RRM-04, is currently being processed within ASME Code Section XI to increase the area limit to 500 square inches.

3.8 Duration of the Proposed Alternative

Entergy stated that the proposed alternative applies to the repairs of reactor pressure vessel nozzle safe-end and piping welds for the scheduled outage and for the remaining service life of the welds. Re-inspection of the welds will be conducted in accordance with the guidelines in BWRVIP-75.

4.0 TECHNICAL EVALUATION

The staff evaluated the following issues:

1. The staff asked Entergy to discuss: (1) whether hydrogen water chemistry in BWRVIP-75 has been implemented in the primary water system to mitigate the potential of stress corrosion cracking in the recirculation and core spray piping at PNPS; (2) whether there have been any chemical intrusions which have occurred in the primary water system that would affect the welds in the proposed PRR; and (3) whether corrective actions have been implemented to minimize the chemical intrusions.

In its October 12, 2004, letter, Entergy responded that PNPS has maintained an average hydrogen water chemistry availability of 90.7% for the past five operating cycles since June 1993. The hydrogen water chemistry availability for the current operating cycle (15) is 93.0%. Hydrogen water chemistry availability should be 80% or greater for the weld inspection interval for a moderate hydrogen water chemistry plant in accordance with the staff's safety evaluation report for BWRVIP-75.

Only one chemical intrusion from a condensate polisher in December 2000 has occurred while above 200 degrees F. Entergy included this intrusion in the hydrogen water chemistry availability calculation. The intrusion was due to a failed condensate polisher lateral and under-drain. This problem was subsequently corrected for all the condensate polishers by a redesign of the laterals and under-drains. A review of the welds in PRR-39 showed that six safe-end-to-nozzle welds receive protection from hydrogen water chemistry. The six core spray welds are not protected by hydrogen water chemistry; however, Entergy will inspect the six core spray welds every 6 years in accordance with the guidelines in BWRVIP-75. The welds in recirculation systems that are protected by the hydrogen water chemistry will be inspected every 10 years.

The staff finds Entergy's management of those welds affected by water chemistry acceptable because Entergy follows the inspection frequency specified in BWRVIP-75. The periodic inspection provides adequate monitoring of potential degradation in the affected welds.

2. In PRR-39, Entergy specified that either UT or mechanical height measurement will be used to measure the thickness of the weld overlay. The staff asked Entergy to discuss the subsection in ASME Code Case N–504-2 that specifies these measurement requirements and which method will most likely be used in terms of reliability, sensitivity, and accuracy.

In its October 12, 2004, letter, Entergy responded that ASME Code Case N–504-2, paragraphs (c) and (g) provide examination requirements to verify the integrity of the weld overlay. A PT will be performed on the area to be welded in accordance with ASME Code Section III, NB Sections, 1992 Edition. If localized seal welding is required, this examination will be performed after the localized seal welding is completed. A final PT, in accordance with ASME Code Section III, NB Sections, 1992 Edition, and ASME Code Section XI, 1989 Edition, will be performed after completing all weld overlays.

ASME Code Case N–504-2 does not specify the method for measuring overlay thickness. A thickness examination using UT will be performed to demonstrate that the weld overlay meets the thickness requirements of the repair plan. UT is the preferred method for determining the thickness of the weld overlay. Mechanical measurements are included as an alternative to UT where suitable reference surfaces are available. If for any reason the UT method is not used to provide thickness data, mechanical measurements will be used where a suitable reference surface is available. Both methods provide reliable and accurate thickness measurement results, but the UT method is more sensitive to the surface roughness and requires a smooth surface for the UT probe. The final examination, in addition to a VT-2 visual inspection, will be a volumetric examination based on PDI/UT procedures in accordance with PRR-38.

Entergy will perform UT of the weld overlay volume to demonstrate that the repair volume is unflawed and meets thickness requirements of the design following application of the repair. Since the weld repair material is resistant to ongoing crack propagation and provides compressive residual stress, this examination assures continued integrity and adequacy of the weld overlay.

The staff finds that Entergy provides an acceptable strategy because it considered both UT and mechanical measurements in the measurement of weld overlay thickness.

3. In Sections C and D of PRR-39, Entergy stated that the system leakage test is adequate to ensure the pressure boundary integrity. However, ASME Code Case N–504-2, paragraph (h) specifies that if a flaw penetrates the original pressure boundary prior to or during the welding operation, a system hydrostatic test shall be performed. If the system pressure boundary has not been penetrated, a system leakage, in-service, or functional test shall be performed. ASME Code Case N–416-2 allows a system leakage test in lieu of a hydrostatic pressure test in weld repairs if an NDE is performed in accordance with the 1992 Edition of ASME Code Section III, which specifies that radiographic examination be performed.

Considering the above, the staff asked Entergy to: (a) Clarify whether a radiographic examination will be performed on the weld repair per the 1992 Edition of ASME Code Section III, if a flaw penetrates the pressure boundary prior to or during the welding process. If a radiographic examination will not be performed, discuss the basis and justify the performance of a ultrasonic examination in lieu of a radiographic examination of the weld overlay repair; (b) Discuss the technical basis why the system leakage test is adequate as compared to a hydrostatic test in demonstrating the structural integrity of the weld overlay repair; and (c) Discuss whether a system leakage test will be performed after each completed repair.

In response to Item (a), Entergy stated that the overlay welding would be examined to Supplement 11 as modified by PRR-38 for specific PDI procedures. The qualified procedures are in accordance with the ultrasonic acceptance standards included in ASME Code Section III NB-5330. The ultrasonic procedures and personnel used for this examination result in a weld material assessment for an overlay that cannot be achieved by radiography. This is based on the special nature of the weld overlay, which is similar to that recognized in ASME Code Section III NB-5270 "Special Welds” and the allowance as described in NB-5279 that there are special exceptions requiring ultrasonic rather than radiographic examinations. Pressure vessel and safe-end welded piping are filled with reactor water, which precludes use of radiography for

weld material assessment. Removal of fuel and draining the vessel to accommodate radiography presents additional nuclear safety and personal hazards. Radiography is not qualified under PDI for weld overlay inspections. Thus, UT under the PDI examination is the preferred method for weld method assessment. The qualification process for the Supplement 11 ultrasonic examination, the ability to size flaws for length and depth, and the fact that the qualification includes flaws that may be created during fabrication, meets the ultrasonic procedural requirements of the cited ASME Code Section III paragraphs.

The final weld examination would be a complete UT using EPRI PDI procedures in accordance with PRR-38. The weld overlay would meet the requirements of the ASME Code Section XI repair plan and PDI procedures. There would be no deviations from ASME Code Section III 1992 methods, as discussed above, and acceptance criteria or PDI and UT procedures.

ASME Code Section XI allows a repair to be performed by either removing a flaw or reducing it to an acceptable size, as documented in ASME Code Case N–504-2. The weld overlay approach does the latter. The allowable flaw size is defined in Table IWB-3641-1 of ASME Code Section XI. The initial flaw is conservatively assumed to be entirely through-wall and to extend entirely around the circumference of the repair location (through-wall x 360 degrees around). The weld overlay approach applies additional thickness to the flawed location, such that the repaired component meets the requirements of IWB-3640. This approach has been extensively used since the mid-1980's in repair of piping in BWRs. The weld overlay also imparts a compressive residual stress, which has been shown to reduce crack growth.

The weld overlay repairs will be completed using ASME Code Case N–504-2 for the repair design, fabrication, and examination methods applicable to a structural overlay type of repair. This type of repair is not included in ASME Code Section III. The NDE of weld overlays is not addressed in ASME Code Section III because Section III is a construction code used for the initial installation of welded joints. Welding performed under an ASME Code Section XI repair plan is typically examined in accordance with the code of construction, when applicable, and any Section XI baseline (preservice) ISI examinations.

For weld overlay repairs, the repair rules are provided by ASME Code Case N–504-2 which states that the required examinations are by the liquid penetrant and ultrasonic methods. This ASME Code Case is prescriptive about all aspects of the weld overlay repair including the overlay design, its fabrication, and the examinations performed before, during, and after the welding.

The type of weld examinations to be performed on the structural overlay weld would be based on ASME Code Case N–504-2, rather than ASME Code Section III, such that the required volumetric examination of weld overlay would be by the ultrasonic rather than radiographic method. An initial liquid penetrant examination would be performed on the area to be welded in accordance with ASME Code Case N–504-2. This examination will be performed, if required, after the localized seal welding is completed. A final liquid penetrant examination, in accordance with N–504-2 and ASME Code Section III 1992, would be performed after completing all weld overlay layers. An ultrasonic thickness examination will also be performed to demonstrate that the weld overlay met the thickness requirements of the repair plan.

The staff finds that Entergy provided sufficient basis to justify the use of liquid PT and UT in lieu of radiographic examination.

In response to Items (b) and (c), Entergy stated that the pressure test requirements in ASME Code Case N–504-2 are consistent with ASME Code Section XI Subarticle IWA-4700 "Pressure Test" rules that are applicable to all pressure boundary weld repairs performed under Section XI.

ASME Code Case N–416-2 is routinely used to allow a system leakage test to be performed in lieu of a system hydrostatic pressure test in most cases of weld repairs to existing piping, pump, and valve components at PNPS and other plants, including repairs that entirely replace components or penetrate the pressure boundary. ASME Code Case N–416-2 requires NDE be performed on welded repairs, fabrication and installation joints in accordance with the methods and acceptance criteria of the applicable Subsection of the 1992 Edition of Section III. As discussed above, the staff has determined that the performance of an ultrasonic examination in lieu of radiographic examination of the overlay is acceptable. Therefore, PNPS's use of AMSE Code Case N–416-2, which allows system leakage testing in accordance with IWA-5000 at nominal operating pressure and temperature, in lieu of a hydrostatic testing, continues to be acceptable.

4. Entergy stated that re-inspection of the welds will be conducted in accordance with the guidance in BWRVIP-75. The staff asked Entergy to (a) discuss the exact inspection schedule for the welds in the proposed relief request, identify the page, category, and section in BWRVIP-75 that discusses the inspection schedule that the licensee will follow; and (b) discuss the inspection method that will be used in the re-inspection of the welds.

In the October 12, 2004, letter, Entergy responded that PNPS intends to inspect any overlaid dissimilar welds in accordance with the requirements for Category E overlaid welds as described in Table 3-1 and Section 3.5.1.1 of BWRVIP-75, which states, in part, that "...For weld overlays applied in the future, a preservice examination followed by an inservice examination within three outages is required..." After this initial inservice examination within three outages of the repair, the inspection schedule would then revert to the sample frequency shown in Table 3-1 of BWRVIP-75, i.e., either 25% or 10% every 10 years depending on water chemistry classification. The re-inspection of the welds will be conducted using VT-2 visual inspection and volumetric ultrasonic testing of the PDI process in the re-inspection of the welds.

The staff finds that Entergy's response is acceptable because it will follow the appropriate inspection schedule and criteria of BWRVIP-75.

5. Entergy stated that the proposed alternative applies to the repairs of reactor pressure vessel nozzle safe-end and piping welds for the remaining service life of the welds, meaning to the end of the operating license of the plant. In general, the staff approves relief requests for only one inspection interval within certain fixed calendar dates. The staff requested Entergy to: (a) identify which inspection interval(s) this relief request will be applicable; (b) identify the current inspection interval; and (c) provide the end date of the operating license of the plant and the starting and end dates of the 3rd and 4th inspection intervals.

In the October 12, 2004, letter, Entergy responded that PNPS is in the third 10-year ISI interval, which began on July 1, 1995, and will end on June 30, 2005. The fourth 10-year ISI interval would begin on July 1, 2005 and would end on June 30, 2015. Entergy requested that PRR-39 be granted for the third 10-year ISI interval and the remaining service life of these welds, i.e., fourth 10-year inspection interval. The upcoming refueling outage 15 is the last refueling outage in the third inspection interval. The fourth inspection interval is short by 3 years of a 10-year interval because the operating license for PNPS expires on June 8, 2012. Therefore, the subject welds have a remaining service life of 8 years (2005 to 2012). The staff finds that Entergy's requested relief for the third and fourth 10-year inspection intervals is acceptable because the actual duration of this request is only 8 calendar years.

6. The staff reviewed EPRI Report 1003616 with respect to the request of allowing a weld overlay area of 300 square inches. The staff found that the EPRI report did not include a stress analysis of a weld overlay repair area of 300 square inches. The report does provide a stress analysis of weld overlay areas of 100 and 126 square inches. Although it was not analytically determined whether the stresses derived from the 100 or 126 square-inch model would be applicable to the 300 square-inch weld overlay area, the staff believes that the analyses presented in the EPRI report do provide sufficient understanding of the structural integrity of a weld overlay of 300 square-inch area. Also, the staff has approved a relief request from the Susquehanna nuclear power plant for a weld overlay area of 300 square inches based on the EPRI report. Therefore, the staff finds Entergy's requested weld overlay area of 300 square inches acceptable. The acceptability of any weld overlay area greater than 300 square inches would need to be demonstrated by a stress analysis that considers the exact weld overlay area, to demonstrate that the residual stresses from the weld overlay will not affect the structural integrity of the piping.

The staff has determined that the proposed alternative to use ASME Code Cases N–504-2 and N–638 for the weld overlay repair of recirculation and core spray piping is acceptable because the alternative will provide an acceptable level of quality and safety.

5.0 CONCLUSION

Based on the review of information submitted, the staff has determined that Entergy's proposed PRR-39 will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes Entergy's proposed use of ASME Code Section XI Code Cases N–504-2 and N–638 with modifications as identified in Entergy's submittal to perform structural weld overlay repair of potential crack(s) in the recirculation and core spray piping at PNPS.

All other requirements of Section XI of the ASME Code for which relief has not been specifically requested remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

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