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CNRO-2007-00027

August 7, 2007

U. S. Nuclear Regulatory Commission
Attn.: Document Control Desk
Washington, DC 20555-0001

SUBJECT: Request for Alternative W3-ISI-004
Proposed Alternative to Second Interval ISI Examinations

Waterford Steam Electric Station, Unit 3
Docket No. 50-382
License No. NPF-38

REFERENCE: Entergy Operations, Inc. letter to the NRC dated March, 2007, *Request for Alternative W3-ISI-002 - Request to Extend the Current ASME Inservice Inspection Interval in accordance with NRC Information Notice 98-44*

Dear Sir or Madam:

Pursuant to 10 CFR 50.55a(a)(3)(ii), Entergy Operations, Inc. (Entergy) proposes an alternative to the inspection requirements of ASME Code, Section XI IWA-2430(a) and IWB-2500(a) for seven (7) dissimilar metal welds found in the Reactor Coolant System (RCS) cold leg piping at Waterford Steam Electric Station, Unit 3 (Waterford 3). This request is contained in Enclosure 1 as Request for Alternative W3-ISI-004.

Entergy is submitting W3-ISI-004 as a result of a discussion with the NRC staff regarding previously submitted Request for Alternative W3-ISI-002 (see the referenced letter). Per W3-ISI-002, Entergy requested approval to extend the second Inservice Inspection (ISI) interval for piping welds at Waterford 3 to the end of its sixteenth refueling outage (RF16), currently scheduled for the fall 2009. The requested extension was for approximately seventeen months beyond the one-year extension allowed by ASME Section XI IWB-2412(b). Entergy based the extension on guidance provided in NRC Information Notice 98-44 (IN 98-44). The NRC staff informed Entergy that this extension was beyond that specified in IN 98-44 and, therefore, the staff would not be able to grant the request. However, the staff informed Entergy that specific welds for which inspection resulted in a hardship or unusual difficulty in accordance with 10 CFR 50.55a(a)(3)(ii) would be appropriate for considering an extension. Hence, Entergy is submitting W3-ISI-004 for such welds and withdraws previously submitted W3-ISI-002.

Entergy requests approval of W3-ISI-004 by April 1, 2008 to support the upcoming fifteenth refueling outage at Waterford 3 (RF15) currently scheduled for the spring 2008.

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NRR

Should you have any questions regarding this request, please contact Guy Davant at (601) 368-5076.

This letter contains one commitment identified in Enclosure 2.

Sincerely,

JSF/GHD/ghd

Enclosures: 1. Request for Alternative W3-ISI-004
2. Licensee-Identified Commitments

cc Mr. O. Limpias (WPO)
Mr. K. T. Walsh (W3)

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ENCLOSURE 1

CNRO-2007-00027

REQUEST FOR ALTERNATIVE
W3-ISI-004

ENTERGY OPERATIONS, INC.
WATERFORD STEAM ELECTRIC STATION, UNIT 3
REQUEST FOR ALTERNATIVE
W3-ISI-004

I. COMPONENTS

Component/ Number:	11-002	Weld in 1RC30-9RL2A, Loop 2A Reactor Coolant Pump (RCP) 2A Suction from Steam Generator (SG) 2
	12-012	Weld in 1RC30-5RL2A, Loop 2A From RCP 2A to Reactor Vessel
	13-016	Weld in 1RC30-10RL2B, Loop 2B RCP 2B Suction from SG 2
	14-002	Weld in 1RC30-6RL2B, Loop 2B From RCP 2B to Reactor Vessel
	10-008	Weld in 1RC12-38RL1B, Safety Injection (SI) System Tie to Reactor Coolant (RC) Cold Leg 1B
	12-009	Weld in 1RC12-39RL2A,SI System Tie to RC Cold Leg 2A
	14-006	Weld in 1RC12-40RL2B, SI System Tie to RC Cold Leg 2B
Code Class:	1	

References:

1. CEP-ISI-001, *Waterford 3 SES Inservice Inspection Plan*
2. ASME Code, Section XI, 1992 Edition with portions of the 1993 Addenda as listed in Reference 1
3. ASME Section XI, 1995 Edition/1996 Addenda for Appendix VIII, *Performance Demonstration for Ultrasonic Examinations Systems*
4. ASME Code Case N-460, *Alternative Examination Coverage for Class 1 and Class 2 Welds*
5. EPRI Report 1010087, *Primary System Piping Butt Weld Inspection and Evaluation Guidelines (MRP-139)*
6. IR-2006-116, *EPRI Review of Waterford, Unit 3 Dissimilar Metal Weld Walkdown Information*
7. EPRI Report 103696, *PWSCC of Alloy 600 Materials in PWR Primary System Penetrations*
8. EPRI Report 1007029, *Alloy 82/182 Pipe Butt Weld Safety Assessment for US PWR Plant Designs (MRP-113)*
9. EPRI Report 1009804, *Alloy 82/182 Pipe Butt Weld Safety Assessment for PWR Plant Designs (MRP-109)*

10. CNRO-2007-0005, *Inspection and Mitigation of Alloy 600/82/182 Pressurizer Butt Welds*

11. CNRO-2007-00021, *Request for Alternative W3-R&R-006 - Proposed Alternative to ASME Code Requirements for Weld Overlay Repairs*

Unit/Inspection Interval:	Waterford 3 Steam Electric Station (Waterford 3) / Second (2^{nd}) 10-Year Interval

II. CODE REQUIREMENTS

The inservice examination of welds at Waterford 3 is currently performed in accordance with the 1992 Edition of ASME Section XI with the exception of ultrasonic examinations, which are performed in accordance with the 1995 Edition/1996 Addenda. The following code requirements are applicable to this request.

- IWA-2430(a) requires that "inservice examinations and system pressure tests required by IWB, IWC, IWD, IWE, and inservice examinations and tests of IWF shall be completed during each of the inspection intervals for the service life-time of the plant."

- IWB-2500(a) requires that the examination and testing of Class 1 component welds and materials be performed in accordance with Table IWB-2500-1. Inservice examination requirements for pressure-retaining welds [including dissimilar metal welds (DMWs)] in piping are addressed under Examination Category B-J of Table IWB-2500-1. These requirements include the following provisions:

  - Twenty-five (25) percent of all Examination Category B-J welds must be examined using surface or volumetric examination methods during each inspection interval. According to Note (1)(c) of Table IWB-2500-1, the selected population for inservice examination must include all DMWs.

  - Inservice examination areas and volumes must comply with coverage requirements of Figure IWB-2500-8 except that a 10% reduction in coverage is allowed as specified in ASME Code Case N-460. (The NRC has approved Code Case N-460 for use, as documented in Regulatory Guide 1.147.)

III. REASON FOR PROPOSED ALTERNATIVE

Waterford 3 has seven-hundred twenty-three (723) Examination Category B-J piping welds. Based on Table IWB-2500-1, one-hundred eighty-one (181) of these welds, which include twenty-nine (29) DMWs, were selected for inservice examination during the second 10-year inservice inspection (ISI) interval. As of the submittal date of this request, 118 (65%) of these inservice examinations have been completed. The remaining examinations must be completed during Waterford 3's spring 2008 refueling outage (RF15) to comply with ASME Section XI IWA-2430(a) and IWB-2500(a).

Entergy Operations, Inc. (Entergy) plans to complete the remaining Examination Category B-J inservice examinations applicable to the second 10-year ISI interval during RF15. The ultrasonic (volumetric) examination of these welds must be performed in accordance with the requirements of ASME Section XI, Appendix VIII, as implemented by the Performance Demonstration Initiative (PDI) program.

Description of Hardship

Seven (7) of the Examination Category B-J welds requiring inservice examination during RF15 cannot be examined in accordance with ASME Section XI, Appendix VIII. These seven welds are Alloy 82/182 DMWs and are located in the cold leg piping of the Reactor Coolant System (RCS). As the subject of this request, these seven (7) welds are identified in the table below. See Attachment 1 for additional weld information.

ISI Weld No.	Axial Scan Coverage	Circumferential Scan Coverage
11-002	18%	57%
12-012	89%	86%
13-016	46%	63%
14-002	43%	47%
10-008	54%	6%
12-009	55%	43%
14-006	55%	44%

The information in the above table was obtained from EPRI Report IR-2006-116 (ref. 6). To comply with MRP-139 (ref. 5), Entergy requested that EPRI perform a technical review of the twenty-nine (29) DMW (butt weld) configurations at Waterford 3, which includes the seven welds identified above. Using detailed inspection data obtained during plant walkdowns, the EPRI evaluation revealed that these seven welds cannot meet the volumetric coverage requirements of ASME Section XI as defined in IWB-2500 (Figure IWB-2500-8) and ASME Code Case N-460. As shown in the table above, the estimated achievable coverage as calculated by EPRI is less than 90% in all cases.

ASME Section XI coverage requirements cannot be met due to weld conditions that inhibit performing ultrasonic examinations when using ASME Section XI, Appendix VIII procedures qualified in accordance with the PDI program. These inhibiting conditions include:

- Poor weld surface profiles
- Weld configurations or geometries that are not conducive to ultrasonic examination
- The presence of cast austenitic stainless steel safe ends.

Entergy has evaluated several options to address this condition. The results of this evaluation are summarized below.

1. *Modify Weld Configuration to Improve Inspection Coverage*

   Improved examination coverage may be obtained in some cases if the weld configurations/geometries of the subject welds are modified. However, implementing this option would involve redesign and reanalysis of the subject welds, the use of extensive machining operations, the potential use of welding, and nondestructive examination of areas significantly machined and built up by welding. This option would be costly, schedule intensive, and result in increased radiological exposure to personnel. Furthermore, even after implementing these modifications,

Entergy believes the obtainable coverage for most of the welds would remain less than 90%. To improve obtainable coverage to some value above 90%, Entergy would also have to perform the following actions, which cannot be completed prior to RF15:

- Assist in developing new inspection technology that has the capability of examining DMWs involving cast austenitic stainless steels. (At present, no such technology exists.)
- Fund the fabrication of new mock-ups that include cast stainless steel safe-ends.
- Qualify new ultrasonic examination procedures and personnel once the new technology to examine welds in cast austenitic stainless steels is developed.

2. *Install Preemptive Structural Weld Overlays During RF15*

Preemptive structural weld overlays using Alloy 52/52M weld metal could be installed onto the subject welds based on ASME Code Case N-740. While this would be an acceptable approach, it is not a viable option to be implemented during RF15. Entergy already plans to install preemptive structural weld overlays onto nine (9) DMWs associated with the Waterford 3 pressurizer, surge line, and hot leg nozzles during RF15. Due to their exposure to high operating temperatures, the susceptibility of these nine DMWs to primary water stress corrosion cracking (PWSCC) is highest among the DMWs within the RCS. Therefore, installing weld overlays onto these high-temperature DMWs is of the highest priority and is consistent with industry guidance in MRP-139.

Note: (1) Entergy previously committed to the NRC staff to install preemptive structural weld overlays onto five of these nine DMWs during RF15.[1] The five DMWs are associated with the Waterford 3 pressurizer nozzles.

(2) Preemptive weld overlays are planned to be installed onto the nine DMWs in accordance with Request W3-R&R-006, which has been submitted to the NRC.[2]

Conversely, the identified seven welds have low susceptibility to PWSCC based on their exposure to the low operating temperatures of the RCS cold leg piping. Installing preemptive weld overlays onto these seven welds cannot precede or obstruct installing weld overlays onto the DMWs associated with the pressurizer, surge line, and hot leg nozzles. That said, Entergy does not believe it can be ready to install these seven weld overlays during RF15. Even if the required design and analytical work could be completed, the following challenges make it impractical to undertake such a complex task when there is insufficient time to make required preparations.

[1] See Entergy letter CNRO-2007-00005, *Inspection and Mitigation of Alloy 600/82/182 Pressurizer Butt Welds*, dated February 21, 2007.

[2] See Entergy letter CNRO-2007-00021, Request for Alternative W3-R&R-006 - Proposed Alternative to ASME Code Requirements for Weld Overlay Repairs, dated April 26, 2007.

- *Welding vendor personnel and equipment resources are limited and may not be available.* It would be difficult for the welding vendor to obtain a sufficient number of additional welding operators and technicians to support installing these additional weld overlays due to limited availability of qualified personnel and the demand for their services. Secondly, new welding equipment would have to be purchased and modified to support this added scope. Due to procurement lead times, the vendor may not be able to provide the required welding equipment by RF15.

- *There is insufficient time for process development and qualification. Installing weld overlays is a complex evolution.* To ensure success and minimize welding problems, repairs, and personnel radiological exposure, extensive process and mock-up qualification testing should be performed for welding procedures, equipment, and personnel. If weld overlays were to be installed on the subject welds during RF15, it would be difficult to properly complete all required testing. In addition, PDI procedures for examining weld overlays may not presently qualified for the overlay thickness range that would be used on the seven subject DMWs.

- *Installing a total of 16 weld overlays during one refueling outage would be a logistical challenge most likely resulting in outage delays.* Due to limitations on electrical power, equipment accessibility, and plant support resources, the weld overlay activities would have to be carefully coordinated and would likely experience delays due to competing demands for limited resources. In addition, such a large project could challenge the completion of other refueling outage activities.

3. <u>Perform a "Best Effort" Inservice Examination</u>

Entergy considered performing a "best effort" inservice examination of the subject welds. (The problems encountered with this type of exam were discussed above.) However, Entergy already plans to perform one of the following during the fall 2009 refueling outage at Waterford 3 (RF16).

- Ultrasonically examine the subject seven welds using NRC-accepted examination techniques that have the capability to examine DMWs involving cast stainless steels. While the technology to ultrasonically examine DMWs in cast stainless steels has not yet been developed, Entergy is working with the industry to resolve this issue. Should the inspection technology be developed in time for new procedures and personnel to be qualified by RF16, Entergy plans to ultrasonically examine these welds using the newly developed techniques.

- If the ultrasonic inspection technology described above is not developed in time to support RF16, preemptive structural weld overlays will be installed on the subject seven welds. Entergy would take this step as a proactive measure to address PWSCC concerns and improve structural integrity of the RCS pressure boundary. The weld overlays would be installed using Alloy 52/52M weld metal based on an ASME-approved code case such as N-740. The acceptance and pre-service examinations of the weld overlays would also be performed using ultrasonic procedures qualified in accordance with ASME Section XI, Appendix VIII as implemented by the PDI.

Due to these plans, Entergy believes that performing a costly and substandard "best effort" ultrasonic examination of these welds - which have a recognized low susceptibility to PWSCC – just one operating cycle (18 months) prior to performing ultrasonic examinations using NRC-accepted inspection technology capable of examining DMWs in cast stainless steels or installing preemptive structural weld overlays is a hardship or unusual difficulty without a compensating increase in the level of quality and safety.

In conclusion, the seven subject Examination Category B-J welds cannot meet the coverage requirements of ASME Section XI due to weld conditions that inhibit performing PDI-qualified ultrasonic examinations. To address this condition, Entergy has considered several options as discussed above. Because of the difficulties associated with each option, Entergy proposes the alternative described in Section IV, below.

IV. PROPOSED ALTERNATIVE

Pursuant to 10 CFR 50.55a(a)(3)(ii), Entergy proposes the following as an alternative to the code requirements of ASME Section XI, IWA-2430(a) and IWB-2500(a) as described in Section II above. The proposed alternative is applicable to the seven Examination Category B-J DMWs identified in Section I, above.

1. Perform a bare metal visual examination during RF15 using personnel qualified to perform VT-2 visual examinations in accordance with ASME Section XI, IWA-2300.
2. Perform one of the following actions during RF16:
   a. Perform ultrasonic examinations using NRC-accepted techniques for inspecting DMWs involving cast stainless steel; or
   b. Install preemptive structural weld overlays. The proposed weld overlays will be installed using PWSCC-resistant weld metal such as Alloy 52/52M. To support this option, Entergy will submit for NRC staff approval a request for alternative that specifies the requirements applicable to the design, fabrication, examination, and inservice examination of the proposed preemptive weld overlays.

V. BASIS FOR PROPOSED ALTERNATIVE

A. Background

Seven Examination Category B-J welds requiring inservice examination during RF15 cannot be examined (i.e., cannot meet the coverage requirements) as specified by ASME Section XI. These seven welds are Alloy 82/182 DMWs and are located in the cold leg piping of the RCS. The inability to comply with the coverage requirements of ASME Section XI is due to weld conditions which inhibit performing ultrasonic examination using ASME Section XI, Appendix VIII procedures qualified in accordance with the PDI program. The hardship associated with this condition is described in Section III, above. As a result, Entergy proposes an alternative to the inservice examination requirements of ASME Section XI, IWA-2430(a) and IWB-2500(a). The basis for the proposed alternative is provided below.

B. Basis for a One-Cycle Deferral

In Section IV, above, Entergy proposes to perform a bare metal visual examination of the subject welds during RF15. This bare metal visual examination will be performed using personnel qualified to perform VT-2 visual examinations in accordance with ASME Section XI, IWA-2300.

As explained below, the seven Examination Category B-J DMWs have a low susceptibility to PWSCC due to their exposure to low operating temperatures. Therefore, the proposed visual examination will provide assurance that the subject welds do not have through-wall cracks or leaks due to PWSCC. However, even if these welds contained an undetected part-through-wall crack, that crack would not grow to a critical flaw size in one operating cycle. The bases for this conclusion are provided below.

1. Low Susceptibility to PWSCC

The ISI provisions of ASME Section XI are established to identify and monitor degradation in component welds due to mechanisms such as fatigue and corrosion. The primary degradation mechanism for the seven Examination Category B-J DMWs is PWSCC. However, due to their exposure to low operating temperatures, these welds have a low susceptibility to PWSCC.

Temperature has long been recognized as a significant factor for assessing the susceptibility of an Alloy 82/182 weld to PWSCC. For example, EPRI Report TR-103696 (ref. 7), which was issued in July 1994 to assess PWSCC of Alloy 600 materials in PWR primary system penetrations, states the following on page 4-27:

> "Temperature is a significant environment factor influencing the initiation of PWSCC in PWR environments. This is evidenced by the fact that the vast majority of PWSCC of steam generator expansion transitions has occurred on the hot leg side of the tube sheet. The 50° – 70°F temperature difference between hot and cold legs is enough to significantly influence the time to initiation and subsequent rate of PWSCC degradation... This experience suggests that, for the same material susceptibility and stress level, PWSCC would be expected to occur more rapidly in pressurizer penetrations at 650°F than in hot leg penetrations at 600° – 620°F. PWSCC would be least likely to occur in cold leg temperature penetrations at about 550°F."

In July 2004, EPRI issued Report 1007029 (ref. 8) that provides a safety assessment of PWSCC of Alloy 82/182 butt welds in the RCS of PWR plants. On page 5-2 of the report, EPRI states the following:

> "The general experience is that, for materials of equal PWSCC susceptibility with equal applied tensile stress, the time to crack initiation is a function of the operating temperature. Locations that operate at higher temperatures, such as in the pressurizers, typically exhibit cracking sooner than locations that operate at lower temperatures, such as in the RCS cold legs. For typical PWR plant pressurizer (650°F), hot leg (600°F) and cold

leg (550°F) temperatures, and thermal activation energy of 50 kcal/mole for crack initiation, the multipliers for time to PWSCC for hot and cold leg locations relative to pressurizer locations are 7.7 and 63.7, respectively. If predictions are based on crack growth rate data, the activation energy can be taken as 31 kcal/mole and the corresponding multipliers on time are 3.5 and 13.1, respectively."

The above references document that temperature has a significant effect on the susceptibility of an Alloy 82/182 butt weld to PWSCC. Industry operating experience also supports this position.

2. Analytical Basis

EPRI report 1009804 (MRP-109) (ref. 9) provides an assessment of critical Alloy 82/182 butt welds in Westinghouse and Combustion Engineering (CE)-designed PWRs. Waterford 3 is a CE-designed PWR and is addressed by the report. For the purposes of this request, discussion regarding EPRI Report MRP-109 is limited to CE-designed PWRs and Waterford 3 in particular.

EPRI Report MRP-109 quantifies the relationships between flaw size, leakage, and component failure for critical dissimilar metal butt weld locations in the RCS. Analyzed dissimilar metal butt weld locations include the RCP suction and discharge nozzles and hot leg surge line nozzle. The analysis documented by MRP-109 determined the critical flaw sizes (largest allowable) for axial and circumferential flaws at each of the critical dissimilar metal butt weld locations. Calculation of critical flaw sizes was based on the worst-case loading and geometry for the CE fleet.

a. Flaw Orientation

The orientation of flaws in Alloy 82/182 welds has a significant impact on structural integrity, leakage rate, and safety. While circumferential flaws in Alloy 82/182 DMWs can have significant impact, the potential impact of axial flaws on structural integrity, leakage rate, and safety is much lower. As documented in MRP-109, the stress analyses for the evaluated dissimilar metal butt welds revealed that the hoop stresses exceed the axial stresses. See Figures 4-1 and 4-3 below, which were extracted from MRP-109.

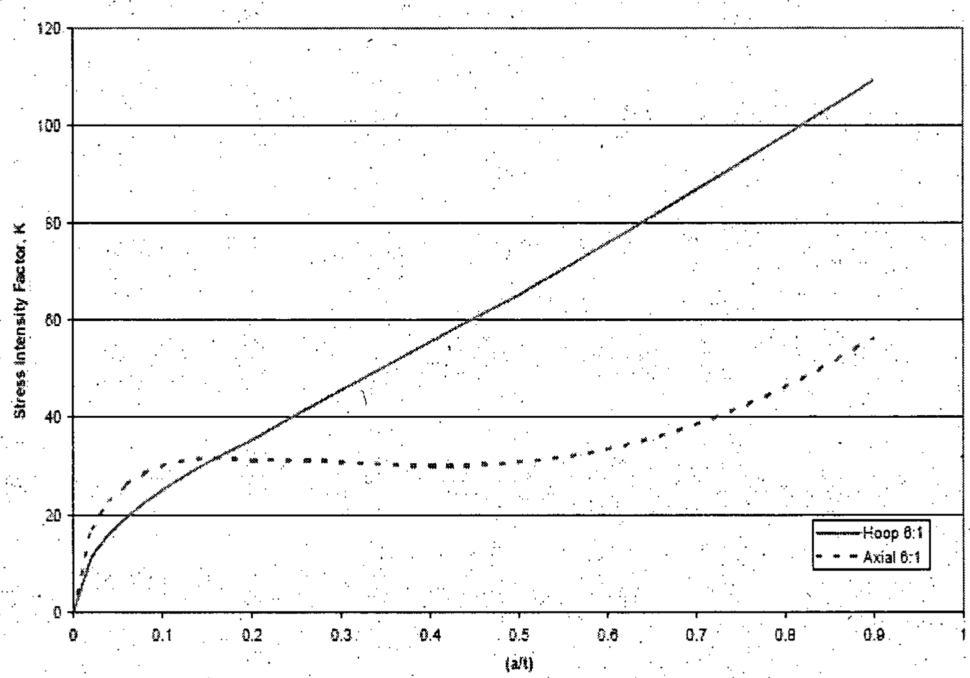

Figure 4-1
Example Comparison of Crack Driving Force from Hoop vs. Axial Stresses, Aspect Ratio 6:1, Showing a Higher Driving Force for Axial Flaws

Based on Figure 4-1 (aspect ratio of 6:1), the driving force for axial flaws and circumferential flaws is approximately the same for shallow flaws. For flaws with depths greater than 15-20% of the wall thickness, the hoop stresses dominate. For flaws with depths greater than 45% of the wall thickness, the hoop stresses are about twice that of axial stresses.

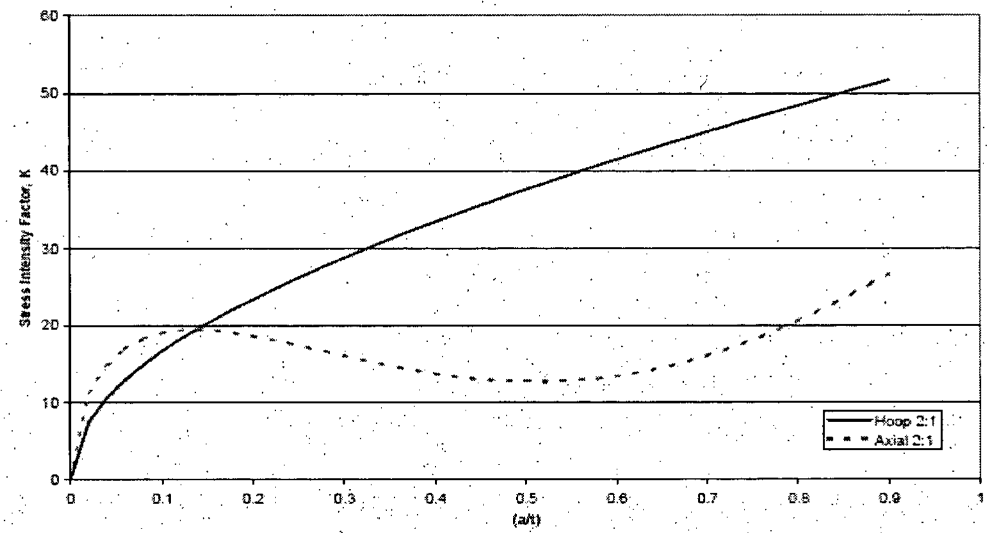

Figure 4-3
Example Comparison of Crack Driving Force from Hoop vs. Axial Stresses, Aspect Ratio 2:1, Showing a Higher Driving Force for Axial Flaws

Based on Figure 4-3 (aspect ratio of 2:1), the driving force for axial flaws and circumferential flaws is approximately the same for shallow flaws. For flaws with depths greater than 15% of the wall thickness, the hoop stresses dominate. For flaws with depths greater than 35% of the wall thickness, hoop stresses are about twice that of axial stresses.

In summary, axial flaws are much more likely to occur than circumferential flaws in RCS dissimilar metal butt welds. Industry operating experience supports these results.

Note: During its fall 2006 refueling outage, the Wolf Creek Generating Station identified circumferentially-oriented indications in the pressurizer nozzle dissimilar metal butt welds that could have resulted from PWSCC. Analysis is ongoing by engineering consultants Dominion Engineering and Engineering Mechanics Corporation of Columbus (EMC^2) to evaluate these specific indications with regard to crack growth and duration from leakage to critical crack size. However, based on preliminary results from these analyses, the time between detection of a through-wall flaw by leakage and its postulated growth to a critical flaw size is sufficient for a utility to take appropriate corrective actions. It is also worth noting that the Wolf Creek indications do not invalidate the information in Figures 4-2 and 4-3 since these figures show that a part-through-wall flaw could grow circumferentially to some partial weld depth. However, prior to growing through-wall, axial flaw growth would control based on the dominance of hoop stresses.

b. Crack Growth Evaluation

Crack growth by both fatigue and PWSCC was considered by the MRP in their evaluations. As would be expected, the MRP evaluations showed that fatigue crack growth is negligible when compared to crack growth by PWSCC. Therefore, PWSCC crack growth governed.

Crack growth by PWSCC as a function of time was determined for each evaluated location. The calculations include appropriate loadings including thermal, dead weight, pressure, and residual stresses. The residual stresses used in the analysis were taken from the technical basis document for the ASME Section XI pipe flaw evaluation procedures[3] and are based on a large database of actual measurements.

In its evaluation, the MRP determined through-wall flaw sizes that would result in 1 gpm leaks, critical through-wall flaw sizes, and leakage rates as a function of flaw size for both axial and circumferential flaws at each location at each plant including Waterford 3. By comparing the crack growth rates and critical through-wall flaw sizes with the flaw size resulting in a 1 gpm leak, the margins between detectable leakage and break can be determined. The results reported in MRP-109 demonstrate that it will take substantially longer than an 18-month operating cycle for a through-wall circumferentially-oriented flaw leaking at 1 gpm to grow to a critical flaw size where failure of the component could occur. While this is the case, it is also worth noting that deep circumferentially-oriented flaws are not likely to occur due to the dominance of hoop stresses in these weldments as shown in Section V.B.2.a, above.

Regarding axial flaws in Alloy 82/182 dissimilar metal butt welds, these flaws could never grow to a critical flaw size due to the presence of non-susceptible materials on both sides of these welds. Therefore, an axially-oriented flaw in an Alloy 82/182 dissimilar metal butt weld would not result in a component failure.

- RCP Suction and Discharge Welds

  The table below is applicable to the RCP suction and discharge welds 11-002, 13-016, 12-012, and 14-002. It identifies the time it takes for a through-wall flaw with a 1 gpm leak to reach its critical size. The information in the table is based on MRP-109, Table 5-5 and represents the most limiting condition for the entire CE fleet, including Waterford 3. This information is also presented graphically in Figures 5-64 (RCP Suction DMW) and 5-65 (RCP Discharge DMW) of Attachment 2. The Attachment 2 graphs were obtained from MRP-109.

[3] "Evaluation of Flaws in Austenitic Steel Piping" – Journal of Pressure Vessel Technology, Volume 108, August 1986, pages 352-366

Weld Analyzed (MRP-109)	WF3 ISI Weld No.	1 GPM Leak Crack Size	Time for Thru-wall Crack[1] to Reach Critical Flaw Size[2]	Critical Flaw Size[2] - Circumferential Thru-wall Length
RCP Suction	11-002 13-016	2.65 inches	> 40 Years	36.5 inches (32% of Circ.)
RCP Discharge	12-012 14-002	2.24 inches	> 40 Years	33.2 inches (29% of Circ.)

Notes:

1. "Through-wall crack" is defined as producing a 1 gpm leak.
2. "Critical flaw size" is the flaw size that would result in failure under a specified load calculated using fracture mechanics.

- <u>Cold Leg Safety Injection Tie-in Welds</u>

DMWs 10-008, 12-009, and 14-006 connect the Safety Injection system to the RCP discharge piping (i.e., cold leg piping). Hence, the susceptibility of the Safety Injection system tie-in welds to PWSCC should be similar to that of the RCP discharge welds. However, these welds were not specifically analyzed by the MRP. Therefore, the MRP-109 evaluation results applicable to the hot leg surge line nozzle are used in this request.

The hot leg surge nozzle DMW has a diameter (12-inch NPS) and thickness similar to that of the cold leg Safety Injection tie-in welds. However, it operates at a much higher temperature and under loading conditions that are significantly more severe than those associated with the Safety Injection system tie-in welds. Because of this, the analysis of the surge nozzle in MRP-109 is bounding for the Safety Injection system tie-in welds. Applying the surge line evaluation results in MRP-109 to the cold leg Safety Injection tie-in welds reveals that it will still take longer than an 18-month operating cycle for a through-wall circumferentially-oriented flaw leaking at 1 gpm to grow to its critical flaw size, as shown in the table below. The information in the table is based on MRP-109, Table 5-5 and represents the most limiting condition for the entire CE fleet, including Waterford 3. Because the analysis results in the table specifically apply to the hot leg surge nozzle DMW, it is conservative to apply these results to the Safety Injection tie-in welds. This information is also presented graphically in Figure 5-67 (Hot Leg Surge Nozzle DMW) of Attachment 2. The Attachment 2 graphs were obtained from MRP-109.

Weld Analyzed (MRP-109)	WF3 ISI Weld No.	1 gpm Leak Crack Size	Time for Thru-wall Crack[1] to Reach Critical Flaw Size[2]	Critical Flaw Size[2] - Circumferential Thru-wall Length
Hot Leg Surge Nozzle	10-008 12-009 14-006	2.93 inches	14.2 Years	10.3 inches (25% of Circ.)

Notes:

1. "Through-wall crack" is defined as producing a 1 gpm leak.
2. "Critical flaw size" is the flaw size that would result in failure under a specified load calculated using fracture mechanics.

3. Conclusion

In conclusion, Entergy proposes to perform a bare metal visual examination of the identified seven Examination Category B-J DMWs during RF15 as an alternative to the required ASME Section XI inservice examinations. These seven ISI welds have a low susceptibility to PWSCC due to their exposure to low operating temperatures.

The EPRI MRP performed an evaluation of critical dissimilar metal butt welds in CE-designed PWRs. Based on this evaluation, the following can be concluded:

- Axial flaws in the subject Alloy 82/182 dissimilar metal butt welds would not grow to a critical flaw size due to the presence of non-susceptible materials on both sides of these welds. Therefore, an axially-oriented flaw in an Alloy 82/182 dissimilar metal butt weld would not result in a component failure.

- It will take substantially longer than an 18-month operating cycle for a through-wall circumferentially-oriented flaw leaking at 1 gpm to grow to a critical flaw size where failure of the component could occur. While this is the case, it was also shown that deep circumferentially-oriented flaws are not likely to occur due to the dominance of hoop stresses in these weldments.

Therefore, performing a bare metal visual examination during RF15 will provide a high level of confidence that the subject welds are structurally sound and capable of performing their required safety function for a single operating cycle (18 months) until these welds can be ultrasonically examined or overlaid in RF16, as specified in Section IV, above.

C. Proposed Actions for RF16

As a condition of this request, Entergy will actively work with the industry to develop ultrasonic inspection technology for examining DMWs involving cast stainless steels. At present, this technology does not exist. Should the inspection technology be developed in time for new procedures and personnel to be qualified by the fall 2009, Entergy will ultrasonically examine the seven DMWs (Inconel

82/182) identified in Section I, above, using the newly developed techniques during RF16. Although the weld configurations/geometries of these welds may still require modification as described in Section III, above, the cost and dose associated with these modifications can be justified based on the long-term ability to comply with the volumetric coverage requirements of ASME Section XI.

However, if the above ultrasonic inspection technology cannot be developed in time to support RF16, Entergy will install preemptive, full structural weld overlays onto the seven subject DMWs. Weld overlays provide an acceptable methodology for preventing potential failures due to PWSCC based on the use of filler metals that are resistant to PWSCC (e.g., Alloy 52M), welding procedures that create compressive residual stress profiles in the original weld, and post-overlay acceptance, preservice, and inservice examination requirements that ensure structural integrity. Ultrasonic examination of weld overlays are performed in accordance with ASME Section XI, Appendix VIII procedures qualified in accordance with the PDI program. The proposed weld overlays will also meet the applicable stress limits from ASME Section III. Crack growth evaluations for PWSCC and fatigue of any conservatively postulated flaws will demonstrate that structural integrity will be maintained. Details applicable to the design, fabrication, examination, and testing of the proposed weld overlays will be addressed in a separate request for alternative.

VI. CONCLUSION

10 CFR 50.55a(a)(3) states:

"Proposed alternatives to the requirements of (c), (d), (e), (f), (g), and (h) of this section or portions thereof may be used when authorized by the Director of the Office of Nuclear Reactor Regulation. The applicant shall demonstrate that:

(i) The proposed alternatives would provide an acceptable level of quality and safety, or

(ii) Compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety."

Entergy believes that performing the examinations required by ASME Section XI IWA-2430(a) and IWB-2500(a) on the identified seven Examination Category B-J welds during RF15 poses a hardship or unusual difficulty without a compensating increase in the level of quality and safety. These welds cannot meet the coverage requirements of ASME Section XI due to weld conditions that inhibit the performance of PDI qualified ultrasonic examinations. To address this condition, Entergy considered several options including: (1) modifying weld configuration to improve inspection coverage, (2) installing preemptive structural weld overlays, and (3) performing "best effort" inservice examinations, as discussed in Section III, above. However, because of the difficulties or hardship associate with each of these options, Entergy has proposed the alternatives described in Section IV, above. Entergy requests that the NRC staff authorize the proposed alternatives in accordance with 10 CFR 50.55a(a)(3)(ii).

VII. ATTACHMENTS

Attachment 1: ISI Weld Details

Attachment 2: MRP-109 Graphs Depicting Critical Crack Growth

REQUEST FOR ALTERNATIVE
W3-ISI-004

ATTACHMENT 1

ISI WELD DETAILS

REACTOR COOLANT SYSTEM (RCS) COLD LEG WELDS

Piping Component Number and Description	ISI Weld No.	Material Identification			Pipe Size (Approx.)
		Safe End	Weld	Pipe/Fitting	
1RC30-9RL2A: RCP2A Suction from SG2 - Loop 2A	11-002	SA-351, CF8M (Cast SST)	082 / 182	SA-516, Gr. 70 (Elbow)	36.5-inch OD 30.0-inch ID
1RC30-5RL2A: RCP2A Discharge to Reactor Vessel - Loop 2A	12-012	SA-351, CF8M (Cast SST)	082 / 182	SA-516, Gr. 70 (Pipe)	36.5-inch OD 30.0-inch ID
1RC30-10RL2B: RCP2B Suction from SG2 - Loop 2B	13-016	SA-351, CF8M (Cast SST)	082 / 182	SA-516, Gr. 70 (Elbow)	36.5-inch OD 30.0-inch ID
1RC30-6RL2B: RCP 2B Discharge to Reactor Vessel - Loop 2B	14-002	SA-351, CF8M (Cast SST)	082 / 182	SA-516, Gr. 70 (Pipe)	36.5-inch OD 30.0-inch ID

SAFETY INJECTION TIE IN WELDS TO RCS COLD LEGS

Piping Component Number and Description	ISI Weld No.	Material Identification			Pipe Size (Approx.)
		Nozzle	Weld	Safe End	
1RC12- 38RL1B: Safety Injection System Tie to RC Cold Leg 1B	10-008	SA-182, F1	082 / 182	SA-351, CF8M (Cast SST)	13.0-inch OD 10.2-inch ID
1RC12- 39RL2A: Safety Injection System Tie to RC Cold Leg 2A	12-009	SA-182, F1	082 / 182	SA-351, CF8M (Cast SST)	13.0-inch OD 10.2-inch ID
1RC12- 40RL2B: Safety Injection System Tie to RC Cold Leg 2B	14-006	SA-182, F1	082 / 182	SA-351, CF8M (Cast SST)	13.0-inch OD 10.2-inch ID

REQUEST FOR ALTERNATIVE
W3-ISI-004

ATTACHMENT 2

MRP-109 GRAPHS DEPICTING CRITICAL CRACK GROWTH

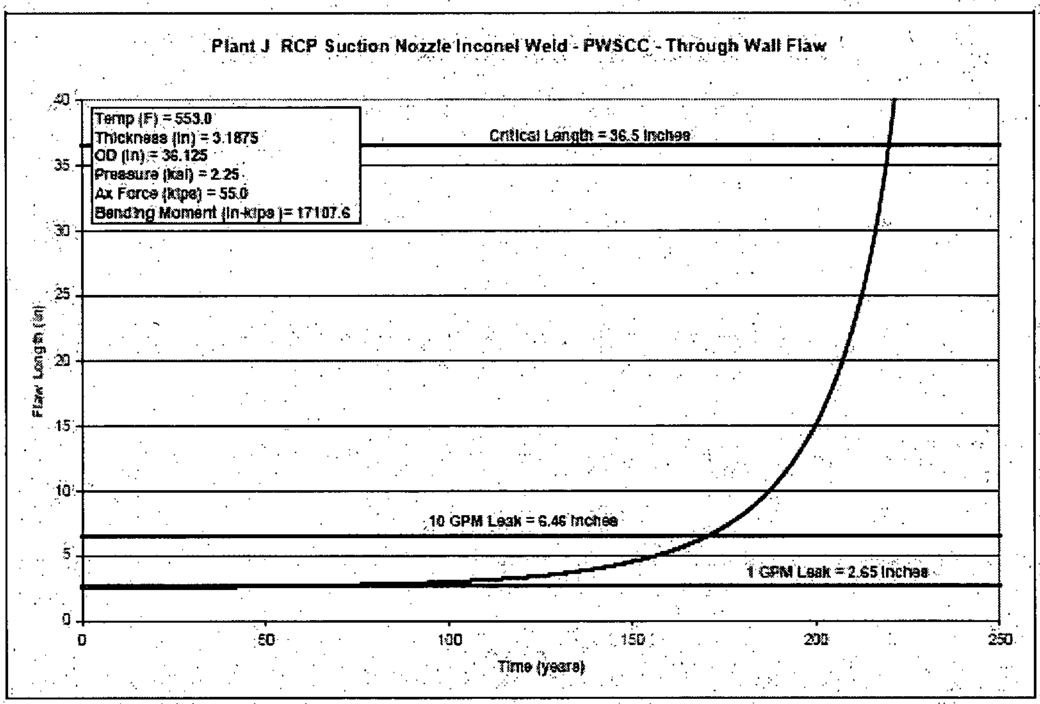

Figure 5-64
Plant J, RCP Suction Nozzle Weld, PWSCC Growth (Circumferential Through Wall Flaw)

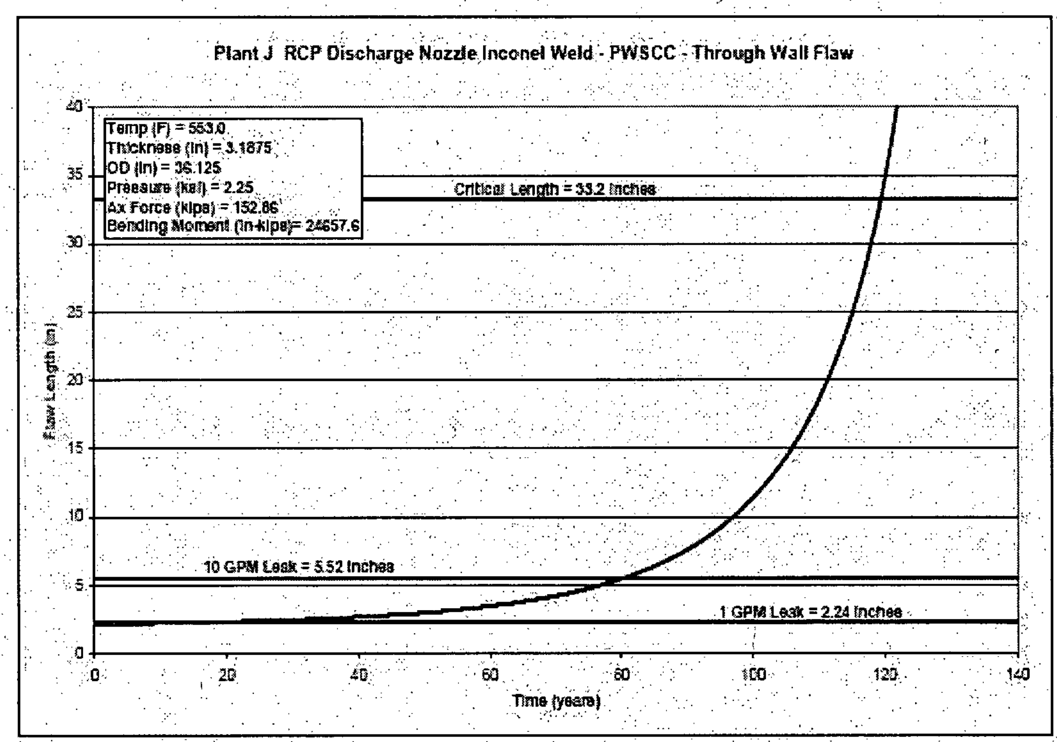

Figure 5-65
Plant J, RCP Discharge Nozzle Weld, PWSCC Growth (Circumferential Through Wall Flaw)

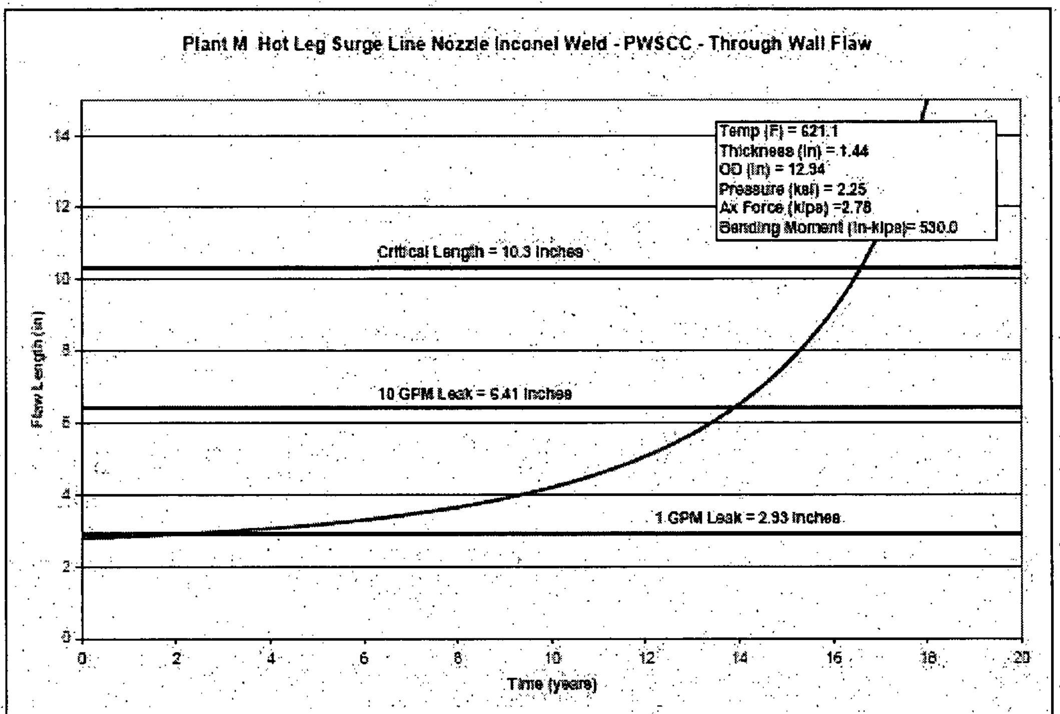

Figure 5-67
Plant M, Hot Leg Surge Nozzle Weld, PWSCC Growth (Circumferential Through Wall Flaw)

ENCLOSURE 2

CNRO-2007-00027

LICENSEE-IDENTIFIED COMMITMENTS

LICENSEE-IDENTIFIED COMMITMENTS

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
To support the option of installing weld overlays, Entergy will submit for NRC staff approval a request for alternative that specifies the requirements applicable to the design, fabrication, examination, and inservice examination of the proposed preemptive weld overlays.	✓		October 2008