February 29, 2008

Mr. M. R. Blevins
Executive Vice President
& Chief Nuclear Officer
Luminant Generation Company LLC
ATTN: Regulatory Affairs
P. O. Box 1002
Glen Rose, TX 76043

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION, UNIT 2 - REQUEST FOR RELIEF NO. B-4 FROM CERTAIN REQUIREMENTS OF ASME CODE, SECTION XI FOR IMPLEMENTATION OF THE EPRI-PDI SUPPLEMENT 11 PROGRAM AND APPLICATION OF WELD OVERLAYS (TAC NO. MD6563)

Dear Mr. Blevins:

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed and evaluated the information provided by TXU Generation Company LP (subsequently renamed Luminant Generation Company LLC, the licensee), in its letter dated August 22, 2007. The licensee requested approval of Relief Request (RR) B-4, for Comanche Peak Steam Electric Station (CPSES), Unit 2, seeking relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, for Unit 2's second 10-year inservice inspection (ISI) interval, which started in August 2004 and is scheduled to end in August 2014. Specifically, the licensee's relief request would allow the application of full-structural weld overlays in pressurizer nozzle safe-end welds that diverge from the requirements contained in Section XI of the ASME Code.

Based on its evaluation of the information provided in the licensee's submittal, the NRC staff determines that the licensee has proposed acceptable alternatives to the requirements of the ASME Code. The NRC staff concludes that the alternatives proposed by the licensee provide an acceptable level of quality and safety. Therefore, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, paragraph 50.55a(a)(3)(i), the proposed alternatives are authorized for the CPSES, Unit 2, for the remainder of its second 10-year ISI interval.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

The NRC staff's safety evaluation is enclosed.

Sincerely,

/RA/

Thomas G. Hiltz, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-446

Enclosure: Safety Evaluation

cc w/encl: See next page

All other ASME Code, Section XI, requirements for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

The NRC staff's safety evaluation is enclosed.

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ADAMS Accession No. ML080430662 (*) SE Memo dated 2/8/08 (**) See previous concurrence NRR-028

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST B-4, APPLICATION OF FULL-STRUCTURAL

WELD OVERLAYS ON PRESSURIZER NOZZLE SAFE ENDS

COMANCHE PEAK STEAM ELECTRIC STATION, UNIT 2

LUMINANT GENERATION COMPANY LLC

DOCKET NO. 50-446

1.0 INTRODUCTION

By letter dated August 22, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML072410396), TXU Generation Company LP (subsequently renamed Luminant Generation Company LLC, the licensee), submitted to the U.S. Nuclear Regulatory Commission (NRC) Relief Request B-4. Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), paragraph 50.55a(a)(3)(i), the licensee requested relief from the repair requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, IWA-4420 and IWA-4520. The modifications would be used to perform preemptive full-structural weld overlays on pressurizer spray, relief, safety, and surge nozzle safe-ends at Comanche Peak Electric Generating Station (CPSES), Unit 2.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection (ISI) of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 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 CPSES, Unit 2 for the second 10-year ISI interval, which started in August 2004 and ends in August 2014, is the 1998 Edition of the ASME Code through the 2000 Addenda.

In accordance with 10 CFR 50.55a(g)(6)(ii)(C)(1), the implementation of Supplements 1 through 8, 10, and 11 of Appendix VIII to Section XI, 1998 Edition with the 2000 Addenda of the ASME Code, was required on a phased schedule ending on November 22, 2002. Supplement 11 was required to be implemented by November 22, 2001. Additionally, 10 CFR 50.55a(g)(6)(ii)(C)(2) requires licensees implementing the 1989 Edition and earlier editions of paragraph IWA-2232 of

Section XI of the ASME Code to implement the 1995 Edition with the 1996 Addenda of Appendix VIII and supplements to Appendix VIII of Section XI of the ASME Code.

Pursuant to 10 CFR 50.55a(g)(4)(iv), ISI items may meet the requirements set forth in subsequent editions and addenda of the ASME Code that are incorporated by reference in 10 CFR 50.55a(b), subject to the limitations and modifications listed therein, and subject to Commission approval. Portions of editions and addenda may be used provided that related requirements of the respective editions and addenda are met.

Pursuant to 10 CFR 50.55a(a)(3), alternatives to requirements may be authorized by the NRC if the licensee demonstrates that: (i) the proposed alternative provides 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. The licensee submitted this relief request pursuant to 10 CFR 50.55a(a)(3)(i), and proposes alternatives to the implementation of the ASME Code, Section XI, Appendix VIII, Supplement 11, and modifications to ASME Code Cases, N-504-2, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping, Section XI, Division 1 (N-504-2)", and N-638-1, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW [Gas Tungsten Arc Weld] Temper Bead Technique (N-638-1)," for the application of preemptive full-structural weld overlays.

3.0 TECHNICAL EVALUATION

3.1 Components for Which Relief is Requested

The request for relief is applicable to the following safe-end welds for the pressurizer safety, relief, spray, and surge nozzles in CPSES, Unit 2:

TCX-1-4506-22	4" spray nozzle-to-safe end weld
TCX-1-4506-21	4" spray safe end-to-piping weld
TCX-1-4501-1	6" safety "1" nozzle-to-safe end weld
TCX-1-4501-2	6" safety "1" safe end-to-piping weld
TCX-1-4502-1	6" safety "2" nozzle-to-safe end weld
TCX-1-4502-2	6" safety "2" safe end-to-piping weld
TCX-1-4503-1	6" safety "3" nozzle-to-safe end weld
TCX-1-4503-2	6" safety "3" safe end-to-piping weld
TCX-1-4504-1	6" relief nozzle-to-safe end weld
TCX-1-4504-2	6" relief safe end-to-piping weld
TCX-1-4500-6	14" surge nozzle-to-safe end weld
TCX-1-4500-5	14" surge safe end-to-piping weld

3.2 ASME Code Requirements for Which Relief is Requested

Under the provisions of ASME Code, Section XI, IWA-4420 and IWA-4520(a), repairs shall be performed in accordance with the licensee's design specification and the original Construction Code. IWA-4430 and IWA-4600 provide for alternative welding methods when the requirements of IWA-4420 cannot be met. IWA-4530 requires a preservice examination to be performed in accordance with IWB-2200. Table IWB-2500-1, Categories B-F and B-J, prescribe inservice examination requirements for Class 1 butt welds. IWA-4421 states that later editions and

addenda of the Construction Code or of ASME Code, Section III, either in their entirety or portions thereof, and Code cases may be used.

The licensee proposes to use ASME Code Cases N-638-1 and N-504-2, with conditions as specified in Regulatory Guide (RG) 1.147, Revision 14, and ASME Code, Section XI, Appendix VIII, Supplement 11, and as modified by this relief request, to meet the requirements.

3.3 Code Case N-504-2

3.3.1 Licensee's Proposed Modifications to Code Case N-504-2

The licensee proposed to use Code Case N-504-2 with the following modifications for full-structural weld overlays:

Paragraph (b)	Modified to allow use of a nickel-based alloy weld material, Alloy 52/52M/52MS, rather than the low-carbon (0.035 percent maximum) austenitic stainless steel.
Paragraph (e)	Modified to allow relaxation from the requirement to perform delta ferrite measurements to meet the 7.5 Ferrite Number (FN) requirement.
Paragraph (h)	Modified to allow a system leakage test to be performed in lieu of a hydrostatic test.
Paragraph (c)	Modified to allow ultrasonic testing in addition to liquid dye penetrant testing.
Paragraphs (f) & (g)	Modified to allow use of Appendix Q of the 2006 Addenda of Section XI of the ASME Code, which was edited from the 2005 Addenda for clarification of use.

3.3.2 Licensee's Basis for Relief

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee stated that the weld overlay has been designed consistent with the provisions of N-504-2 with the specific thickness and length computed according to the guidance provided in the subject Code Case. The licensee stated that Alloy 52/52M/52MS material is highly resistant to primary water stress-corrosion cracking (PWSCC) and that industry operational experience has shown that PWSCC in Alloy 82/182 will arrest at the interface with stainless steel base metal, ferritic base metal, or Alloy 52/52M/52MS weld metal. The licensee stated that the 360-degree structural weld overlay will control growth in any PWSCC crack and maintain weld integrity. The licensee stated that the weld overlay will induce compressive stress in the weld, thus impeding growth of any reasonably shallow cracks.

The weld metal used will be Alloy 52/52M/52MS, which is an austenitic nickel alloy. According to the licensee, these filler materials were selected for their improved resistance to PWSCC. The licensee stated that Alloys 52 and 52M contain about 28 to 31.5 percent chromium that imparts excellent corrosion resistance. According to the licensee, the existing Alloy 82/182 weld and the Alloy 52M/52M/152 overlay are nickel-based and have ductile properties and toughness similar

to austenitic stainless steel piping welds at pressurized-water reactor operating temperature. As explained by the licensee, these filler materials are suitable for welding over the ferritic nozzle, Alloy 82/182 weld, and the austenitic stainless steel materials.

Paragraph (e) of N-504-2 requires as-deposited delta ferrite measurements of at least 7.5 FN for the weld reinforcement. The licensee proposed that delta ferrite measurements not be performed for this overlay because the deposited Alloy 52/52M/52MS is 100 percent austenitic and contains no delta ferrite due to the high-nickel composition (approximately 60 percent nickel).

The licensee stated that a system hydrostatic test at 1.02 times Class 1 reactor coolant system operating pressure at normal temperature is of no value. According to the licensee, it provides no more assurance about the structural condition of the weld overlay than a system leakage test performed at Class 1 reactor coolant system operating pressure. The licensee further stated that the additional nondestructive examination (NDE) required to be performed provides much more information about the condition of the repair/replacement activity than does the pressure test. The licensee proposes that the NDE requirements of Nonmandatory Appendix Q of the ASME Code, Section XI, be followed for the required NDE in lieu of ASME Code, Section III. According to the licensee, Code Case N-504-2 and Nonmandatory Appendix Q provide appropriate examination requirements including examination volume, acceptance criteria, and examination methods per Appendix VIII.

The licensee has requested this relief for the one-time application of full-structural weld overlays for components identified in Section 3.1.

3.3.3 NRC Staff Evaluation of Modifications to Code Case N-504-2

Under the provisions of IWA-4420, in editions and addenda up to and including the 1998 Edition with the 2000 Addenda, repairs shall be performed in accordance with the Owner's Design Specification and the original Construction Code of the component or system. Later editions and addenda of the Construction Code, or of Section III, either in their entirety or portions thereof, and Code Cases may be used. In addition to the above requirements, defects shall be removed or reduced in size in accordance with IWB-3640. Alternatively, the component may be evaluated and accepted in accordance with the design rules of either the Construction Code, or Section III, if the Construction Code was not Section III. The licensee is proposing to use ASME Code Case N-504-2 to perform full-structural weld overlays on the CPSES, Unit 2 reactor coolant system welds, listed in Section 3.1 above, as a preemptive measure against cracking due to PWSCC.

Code Case N-504-2 was conditionally approved by the NRC staff for use under RG 1.147, Revision 14. The condition specified the use of the ASME Code, Section XI, Nonmandatory Appendix Q, which provides the NDE methods, volume, and acceptance criteria for the weld overlay. Therefore, the licensee's use of Code Case N-504-2 as an alternative to the mandatory ASME Code repair provisions is acceptable to the NRC staff, provided that the licensee complies with all conditions and provisions of Code Case N-504-2. The NRC staff notes that it has approved Code Case N-504-3 in RG 1.147, Revision 15. There are no significant differences between Code Cases N-504-2 and N-504-3 that would affect the NRC staff's evaluation of the proposed alternative. Therefore, the NRC staff will be using Code Case N-504-2 to evaluate the licensee's submittal.

The first proposed modification to the Code Case N-504-2 provisions involves the use of a nickel-based alloy weld material, rather than the low-carbon austenitic stainless steel. The licensee stated that paragraph (b) of Code Case N-504-2 requires that the reinforcement weld material be low-carbon (0.035 percent maximum) austenitic stainless steel. In lieu of the stainless steel weld material, the licensee proposes to use Alloy 52/52M/52MS, a consumable weld wire highly resistant to PWSCC, for the overlay weld material. The NRC staff notes that the use of Alloy 52/52M/52MS material is consistent with weld filler material used to perform similar weld overlays at operating boiling-water reactor facilities. The NRC staff notes that the licensee is performing a full-structural overlay on dissimilar metal welds made of Alloy 182 material. For material compatibility in welding, the NRC staff considers Alloy 52/52M/52MS a better choice of filler material than austenitic stainless steel material for this weld joint configuration. Alloy 52/52M/52MS contains about 28 percent to 30 percent chromium which would provide excellent resistance to PWSCC in the reactor coolant environment. This material is identified as F-No. 43 Grouping for Ni-Cr-Fe, classification UNS N06052 Filler Metal and has been previously approved by the NRC staff for similar applications. Therefore, the licensee's proposed use of Alloy 52/52M/52MS for the weld overlays as a modification to the requirements of Code Case N-504-2 paragraph (b) will provide an acceptable level of quality and safety and is, therefore, acceptable.

The second proposed modification to the Code Case N-504-2 provisions involves paragraph (e), which requires as-deposited delta ferrite measurements of at least 7.5 FN for the weld reinforcement. The licensee proposed that delta ferrite measurements not be performed for this overlay because the deposited Alloy 52/52M/52MS material is 100 percent austenitic and contains no delta ferrite due to the high-nickel composition (approximately 60 percent nickel). Code Case N-504-2 allows the use of weld overlay repair by deposition of weld reinforcement on the outside surface of the pipe in lieu of mechanically reducing the defect to an acceptable flaw size. However, Code Case N-504-2 is only applicable to weld overlay repair of austenitic stainless steel piping. Therefore, the material requirements regarding the carbon content limitation (0.035 percent maximum) and the delta ferrite content of at least 7.5 FN, as delineated in Code Case N-504-2, paragraph (e), apply to austenitic stainless steel weld overlay materials. These requirements are not applicable to Alloy 52/52M/52MS, a nickel-based material which the licensee will use for the weld overlays. Based on the discussion above, the NRC staff concludes that the modification to paragraph (e) of the subject Code Case will provide an acceptable level of quality and safety, and is, therefore, acceptable.

The third modification requested by the licensee is to use a system leakage test instead of a system hydrostatic test. A system leakage test in accordance with IWA-5000 is allowed contingent on meeting the provision of IWA-4540(a)(2)(a) requiring NDE acceptance criteria of the 1992 Edition or later of Section III to be met prior to return to service. The licensee's proposed modification of performing a system leakage test rather than a hydrostatic test is supported by the NRC staff's position with respect to Code Case N-416-3. The NRC staff notes that Code Case N-416-3, "Alternative Pressure Test Requirement for Welded or Brazed Repairs, Fabrication Welds or Brazed Joints for Replacement Parts and Piping Subassemblies, or Installation of Replacement Items by Welding or Brazing, Classes 1, 2, and 3, Section XI, Division 1 (N-416-3)," was unconditionally approved for use in RG 1.147, Revision 14. Code Case N-416-3 states that: ".....a system leakage test may be used provided the following requirements are met:" Paragraph (a) states: "NDE shall be performed on weld or brazed repairs and fabrication and installation joints in accordance with the methods and acceptance criteria of the applicable subsection of the 1992 Edition of Section III." However, the acceptance

criteria in ASME Code, Section III do not allow the presence of cracks, regardless of length, and are geared more towards construction-type welds.

The licensee's modification, which is a system pressure test, with the use of the post-repair NDE requirements of Code Case N-504-2 and Appendix Q, utilizing the appropriate Performance Demonstration Initiative (PDI) procedures, as discussed later in this safety evaluation, is acceptable. The post-repair examination volume includes the full thickness of the weld overlay plus 25 percent of the underlying base metal thickness. The specimen sets for PDI qualification for weld overlay examinations include construction-type flaws. Therefore, use of PDI qualified personnel and procedures for the examination of the weld overlay will result in the reliable detection of construction-type flaws and meets the intent of compliance with the applicable subsection of the 1992 Edition of Section III, and therefore, provides an acceptable level of quality and safety.

The licensee's modification to Paragraph (c) of Code Case N-504-2 allows the licensee to use ultrasonic testing (UT) in addition to the requirement for liquid dye penetrant testing. As this change does not reduce the required inspection requirements, this modification is acceptable. The licensee's modifications to Paragraphs (f) and (g) update the version of Appendix Q which will be used with ASME Code Case N-504-2. ASME Code Case N-504-2 is approved for use for austenitic stainless steel material in RG 1.147, Revision 14, provided that it is used with Nonmandatory Appendix Q of the 2005 Addenda of ASME Code, Section XI. The Appendix Q version of the 2006 Addenda was modified by ASME for clarification of use with the RG 1.147 condition, and there was no reduction in the design requirements for the weld overlay. As the licensee's modifications to Paragraphs (c), (f), and (g) do not reduce the inspection or design requirements of Code Case N-504-2 as approved for use in RG 1.147, Revision 14, the NRC staff finds the modifications acceptable.

Based on the discussion above, the NRC staff concludes that the modifications to Code Case N-504-2 will provide an acceptable level of quality and safety and are, therefore, acceptable.

3.4 Code Case N-638-1

3.4.1 Licensee's Proposed Modifications to Code Case N-638-1

The licensee proposed to use Code Case N-638-1 with the following modifications for full-structural weld overlays:

Paragraph 1.0(a)	Modify the allowed maximum area of an individual weld based on the finished surface over the ferritic material to be 300 square inches.
Paragraph 1.0(d)	Full ultrasonic testing (UT) of the 1.5T (one and one-half times the thickness of the component) band on the ferritic side of the overlay(s) will not be performed. UT will be performed on the actual weld overlay and a one-half inch band around the weld overlay, meeting the requirements of ASME Code, Section XI, Nonmandatory Appendix Q.

Paragraph 4.0(b)	Modified to allow the 48-hour hold time to start after the completion of the third temper bead weld layer.
Paragraph 4.0(c)	In lieu of weld-attached thermocouples and recording instruments, process temperatures will be monitored with non-attached devices, such as contact pyrometers.

In addition, the licensee states that the NDE provisions of Code Case N-504-2 and Nonmandatory Appendix Q of the 2005 Addenda of ASME Code, Section XI will be used in lieu of that defined in Code Case N-638-1. Further, to support this relief request, within 14 days of the last UT, a summary of results will be submitted to the NRC.

3.4.2 Licensee's Basis for Relief

For the paragraph 1.0(a) modification, the licensee stated that the one-half base metal thickness limitation, which also includes the 100-square-inch surface area limitation under 1.0(a) of Code Case N-638-1, applies only to excavations and repairs, and is not applicable to the weld overlays that are the subject of this relief request. Therefore, according to the licensee, the 100-square-inch surface area limitation is not applicable to this configuration, which consists of an overlay. The licensee stated that there have been a number of temper bead weld overlay repairs applied to safe-end to nozzle welds in the nuclear industry and a similar 300-square-inch full-structural weld overlay was approved for the Susquehanna Steam Electric Station. The licensee also stated that weld shrinkage caused by application of the overlays will be measured and evaluated for any system impacts, as provided by Code Case N-504-2, paragraph (g)(3) prior to returning the system to service.

For the paragraph 1.0(d) modification, the licensee stated that in lieu of the requirement to perform an UT of the overlay and a 1.5T area, the post overlay NDE will be performed in accordance with the criteria of Code Case N-504-2 and Nonmandatory Appendix Q. The licensee stated that Code Case N-638-1 applies to any type of welding where a temper bead technique is to be employed and is not specifically written for a weld overlay repair. The licensee stated that if the cracking were to occur, it would be beneath the weld overlay instead of the 1.5T area that is not covered by the overlay.

For the paragraph 4.0(b) modification, the licensee stated that the 48-hour delay between return of the repair weld to ambient temperature and final NDE serves to enable detection of delayed hydrogen cracking in the ferritic nozzle heat-affected zone (HAZ). Delayed hydrogen cracking may occur in the ferritic HAZ as a result of the introduction of deleterious monatomic hydrogen into the hardened HAZ microstructure. Hydrogen contamination at deleterious levels is unlikely when ambient temperature temper bead machine GTAW process is used. The low-hydrogen characteristics and HAZ tempering effectiveness of machine GTAW are well documented in Electric Power Research Institute (EPRI) Report GC-111050, "Ambient Temperature Preheat for Machine GTAW Temperbead Applications."

For the paragraph 4.0(c) modification, the licensee stated that temperatures will be monitored with non-attached devices and the instruments used will be calibrated in accordance with approved calibration and control program requirements.

The licensee stated that it is requesting relief from the NDE provisions of Code Case N-638-1 because of the limitations in the applicable testing techniques combined with the increased radiation exposure of inspection personnel in applying such limited techniques. The licensee stated that that surface examinations will be conducted pre-overlay and UT in accordance with Code Case N-504-2, and Nonmandatory Appendix Q will be used to ensure adequate inspection effectiveness and coverage. The licensee also stated that within 14 days of the last UT, a summary of results will be submitted to the NRC.

3.4.3 NRC Staff Evaluation of Modification to Code Case N-638-1

The licensee's first proposed modification to Code Case N-638-1 notes that the Code case limits the size of the repair to a maximum of 100 square inches and a depth not greater than one-half the ferritic base metal thickness or 3/8 inch. Some of the reasons for these limits are distortion of weld and base metal, cracking in the weld and base metal, and high residual stresses when a large repair excavation is being performed in the ferritic material of a dissimilar metal weld. In the application of the preemptive weld overlay for this relief request, there is no large excavation in the ferritic portion of the material; therefore, the 100-square inch limitation does not significantly contribute to cracking when the ferritic material is overlaid rather than excavated. Based on the information provided by the licensee and the discussion above, the NRC staff concludes that the maximum overlay deposit of 300 square inches will provide reasonable assurance of the structural integrity of the weld, and is acceptable.

The licensee's second proposed modification is that full UT of the 1.5T band required under paragraph 4.0(b) will not be performed. The NRC staff notes that the post-weld overlay examination area, as defined under Appendix Q, is 1/2 inch on either side of the overlay for surface examination and the completed overlay for UT. The licensee specifically states that it will comply with use of Appendix Q which is a condition to the use of Code Case N-504-2, applied by the NRC staff under RG 1.147, Revision 14. The issues of cracking and/or distortion of the weld and base metal were not specifically addressed in the Code case development work. Since the weld overlays are fabricated from austenitic materials with inherent toughness, no cracking in the overlays is expected to occur due to the shrinkage associated with the weld overlay. With respect to the ferritic portion of the overlays, many temper bead weld overlays have been applied in the nuclear industry to these nozzle-to-safe end locations. In no instance has there been any reported cracking due to the weld overlay application. The stiffness and high toughness inherent in the low-alloy steel material is expected to protect against any cracking and limit any distortion that might occur in the low-alloy steel material.

The licensee stated that it will be measuring and evaluating axial shrinkage for impact on the materials and on the piping system after the weld overlay is deposited, which is in accordance with the provisions of Code Case N-504-2 (g)(2) and (g)(3). Also, any cracking which might occur should be detected by the final NDE of the weld overlay required under Appendix Q, which provides additional assurance of the deposition of a defect-free, structurally sound overlay.

The assessment of the shrinkage stresses on the piping, plus post-weld NDE volumes under Appendix Q, provide reasonable assurance that defect-free welds will result in maintaining the structural integrity of the piping. The NRC staff concludes that the examination under Appendix Q will provide an acceptable level of quality and safety; therefore, the NRC staff finds the proposed modification to the 1.5T band UT requirement under Code Case N-638-1 to be acceptable.

The licensee's third proposed modification concerns the Code Case N-638-1 provision that when temper bead welding is used, surface and UT shall be performed when the completed weld has been at ambient temperature for least 48 hours. This delay was provided to allow sufficient time for hydrogen cracking to occur (if it is to occur) in the HAZ of ferritic materials prior to performing examinations, to ensure detection of hydrogen cracking by NDE. However, based on research and industry experience, the EPRI has provided a technical basis for starting the 48-hour hold after completion of the third temper bead weld layer rather than waiting for the weld overlay to cool to ambient temperature.

EPRI found that weld layers beyond the third layer are not designed to provide tempering to the ferritic HAZ during ambient temperature temper bead welding. EPRI has documented its technical basis in Technical Update Report 1013558, "Repair and Replacement Applications Center: Temperbead Welding Applications 48-Hour Hold Requirements for Ambient Temperature Temperbead Welding" (ADAMS Accession No. ML070670060).

After evaluating all of the issues relevant to hydrogen cracking such as microstructure of susceptible materials, availability of hydrogen, applied stresses, temperature, and diffusivity and solubility of hydrogen in steels, EPRI concluded that: "...there appears to be no technical basis for waiting the 48 hours after cooling to ambient temperature before beginning the NDE of the completed weld. There should be no hydrogen present, and even if it were present, the temper bead welded component should be very tolerant of the moisture ..." EPRI also notes that over 20 weld overlays and 100 repairs have been performed using temper bead techniques on low-alloy steel components over the last 20 years. During this time, there has never been an indication of hydrogen cracking by the NDE performed after the 48-hour hold or by subsequent ISI.

An ASME Technical Basis Paper (ADAMS Accession No. ML070790679) that supports the proposed revision to the 48-hour hold time requirement indicates that the introduction of hydrogen to the ferritic HAZ is limited to the first weld layer because this is the only weld layer that makes contact with the ferritic base material. The Technical Paper states that while the potential for the introduction of hydrogen to the ferritic HAZ is negligible during subsequent weld layers, these layers provide a heat source that accelerates the dissipation of hydrogen from the ferritic HAZ in non-water-backed applications. The Technical Basis Paper concludes that there is sufficient delay time to facilitate the detection of potential hydrogen cracking when NDE is performed 48 hours after completion of the third weld layer.

Furthermore, the solubility of hydrogen in austenitic weld materials such as Alloy 52M is much higher than that of ferritic materials while the diffusivity of hydrogen in austenitic materials is lower than that of ferritic materials. As a result, hydrogen in the ferritic HAZ tends to diffuse into the austenitic weld metal, which has a much higher solubility for hydrogen. This diffusion process is enhanced by heat supplied in subsequent weld layers.

The NRC staff finds that the licensee has provided sufficient technical justification to show that hydrogen cracking in the weld overlay is unlikely to occur under the proposed alternative. The NRC staff reviewed previous operational experience with weld overlays with the materials in question and found no indications of cracking in the area of reduced inspection coverage. Further, the NRC staff's review of research confirmed the licensee's basis for applicability of the modification. Therefore, the NRC staff finds that it is not necessary to wait until 48 hours after the completed overlay has reached ambient temperature to perform NDE because any delayed

hydrogen cracking, were it to occur, would be expected to occur within the 48 hours following completion of the third temper bead weld layer. Based on this information, the NRC staff finds that starting the 48-hour hold time after completion of the third temper bead weld layer will provide an acceptable level of quality and safety and, therefore, is acceptable.

The licensee's fourth proposed modification is to manually record process temperatures using calibrated instruments such as contact pyrometers. Paragraph 4.0(c) of Code Case N-638-1 states that when weld-attached thermocouples and recording instruments are used, the area from which the thermocouples have been removed will be ground and examined using a surface examination. Published literature clearly identifies grinding as a method of cold working that acts as a crack initiation site for PWSCC-sensitive materials. Accordingly, the opportunity to reduce the amount of cold work in these materials is considered an effective tool to prevent cracking. The licensee's modification to monitor process temperatures with contact instrumentation that eliminates welding and grinding is considered a good practice and an effective remedy to minimize cold work. Based on the discussion above, the NRC staff concludes that the modification to monitor process temperatures with calibrated contact temperature monitoring devices will provide an acceptable level of quality and safety, and therefore, is acceptable.

The licensee provided additional justification for using the NDE acceptance criteria under Code Case N-504-2 and Appendix Q rather than the Construction Code criteria designated as a condition for use of Code Case N-638-1 under RG 1.147, Revision 14. The acceptance criteria of ASME Code, Section XI, Code Case N-504-2 and Nonmandatory Appendix Q will be used in lieu of those of NB-5330 of ASME Code, Section III.

ASME Code, Section III flaw acceptance standards are derived from the capability of radiography to detect and size flaws originating from the fabrication process used during new facility construction. The ASME Code, Section III acceptance criteria do not allow for the presence of any cracks or crack-like indications, regardless of size, and are geared more towards volumetric flaws. The detection and sizing capability of radiography is a function of density differences such as 2 percent or greater changes in density. The density changes normally associated with cracks, depending on orientation, are much less than the detection capability of radiography. There is an inherent, unknown tolerance in the ASME Code, Section III acceptance criteria for radiography that encompasses tight cracks and densities below the detection capabilities of radiography. Flaws detected using radiography are not precise enough for applying ASME Code, Section XI crack-growth analyses, as flaw depth cannot be measured with radiography. ASME Code, Section III radiography is not applicable for evaluating flaws for continued plant operations because of the difficulty associated with depth-sizing flaws.

The weld overlays proposed in this relief request are to mitigate PWSCC in dissimilar metal welds. Code Case N-504-2 would be used for applying austenitic (Alloy 52/52M) weld material on austenitic base material. Code Case N-638-1 would be used to apply austenitic weld metal on ferritic base material using a controlled heat input that relieves welding stresses and prevents crack-sensitive microstructures in the ferritic material. The purpose of Code Case N-638-1 is to establish an austenitic surface for the application of Code Case N-504-2 to complete the structural weld overlay. The Code Case N-638-1 applied weld metal is sandwiched between base metal and Code Case N-504-2 weld metal. Consequently, locating a flaw in Code

Case N-638-1 weld metal using ASME Code, Section III radiography would be extremely difficult.

Many flaws that are not detected or accurately sized with radiography have a high likelihood of being detected and sized with UT, depending on orientation. These flaws are normally detected with UT during the ASME Code, Section XI pre-service inspection. Also, the pre-service UT is used to characterize flaws detected during the ASME Code, Section III radiography examination. The flaws of concern are the ones that cause failure immediately or could grow to failure in the future. The ASME Code, Section XI pre-service acceptable flaw standards were developed to consider the materials in which the flaw indications are detected, the orientation and size of the indications, and ultimately their potential structural impact on the component. The flaws detected during pre-service inspections are subjected to periodic ISI as established in Appendix Q, Q-4300. This ISI includes inspection frequencies for monitoring existing crack growth and identifying new cracks. Thus, the established pre-service NDE acceptance criteria in Code Case N-504-2/Appendix Q for weld overlays made with Alloy 52/52M/52MS weld metal will also be applied to the portion of the weld overlay made during the application of Code Case N-638-1 so that adequate level of safety and quality will be maintained.

The licensee committed to submitting the results of the post-overlay NDE to the NRC staff within 2 weeks of the completion of the overlay.

Based on the discussion above, the NRC staff finds that the licensee-proposed modifications to Code Cases N-504-2 and N-638-1 as applied to CPSES, Unit 2, will provide an acceptable level of quality and safety and are, therefore, acceptable.

3.5 ASME Code Section XI, Appendix VIII, Supplement 11

3.5.1 Licensee's Proposed Relief from ASME Code, Section XI, Appendix VIII, Supplement 11

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee requested relief from the weld overlay examination qualification requirements in the following paragraphs to ASME Code, Section XI, Appendix VIII, Supplement 11. Only those items considered by the NRC staff to be modifications to Appendix VIII, Supplement 11, are listed:

1. Paragraph 1.1(b) limits the maximum thickness for which a procedure may be qualified. Also, the specimen set must include at least one specimen with overlay thickness within minus (-) 0.10 inch to plus (+) 0.25 inch of the maximum nominal overlay thickness for which the procedure is applicable.

2. Paragraph 1.1(d)(1) requires that all base metal flaws be cracks in or near the butt weld HAZ, open to the inside surface, and extending at least 75 percent through the base metal wall.

3. Paragraph 1.1(e)(1) requires that at least 20 percent but less than 40 percent of the flaws be oriented within plus/minus (±) 20 degrees of the axial direction.

4. Paragraph 1.1(e)(1) also requires that the rules of IWA-3300 be used to determine whether closely spaced flaws should be treated as single or multiple

flaws. Specimens are divided into base and overlay grading units with each specimen containing one or both types of grading units.

5. Paragraph 1.1(e)(2) requires that specimens be divided into base metal and overlay grading units.

6. Paragraph 1.1(e)(2)(a)(1) requires that a base grading unit include at least 3 inches of the length of the overlaid weld and the outer 25 percent of the overlaid weld and base metal on both sides.

7. Paragraph 1.1(e)(2)(a)(2) requires, when base metal cracking penetrates into the overlay material, that the base grading unit include the overlay metal within 1 inch of the crack location.

8. Paragraph 1.1(e)(2)(a)(3) requires that for unflawed base grading units, at least 1 inch of unflawed overlaid weld and base metal exist on either side of the base grading unit.

9. Paragraph 1.1(e)(2)(b)(1) requires that an overlay grading unit include the overlay material and the base metal-to-overlay interface of at least 6 square inches. The overlay grading unit shall be rectangular, with minimum dimensions of 2 inches.

10. Paragraph 1.1(e)(2)(b)(2) requires that an overlay grading unit designed to be unflawed be surrounded by unflawed overlay material and unflawed base material-to overlay interface for at least 1 inch around its entire perimeter.

11. Paragraph 1.1(e)(2)(b)(3) does not address the number of personal qualification sets to be included in a detection set or the number of personal qualification sets to be performed when essential variables are changed.

12. Paragraph 1.1(f)(1) does not address what sizing sets should contain or set the requirement to perform personnel qualification sets when essential variables are changed.

13. Paragraph 1.1(f)(3) requires base metal cracking used for length-sizing demonstrations to be oriented circumferentially.

14. Paragraph 1.1(f)(4) requires depth-sizing specimen sets to include at least two distinct locations where cracking in the base metal extends into the overlay material by at least 0.1 inches in the through-wall direction.

15. Paragraph 2.0 does not address whether the overlay fabrication flaw test and the base metal flaw test may be performed separately.

16. Paragraph 2.3 requires that, for depth-sizing tests, 80 percent of the flaws to be sized at a specific location on the surface of the specimen identified to the candidate. This requires detection and sizing tests to be separate.

17. Paragraph 3.1 requires examination procedures, equipment, and personnel to be qualified for detection when the results of the performance demonstration satisfy the acceptance criteria of Table VII-S2-1 for both detection and false calls. The criteria shall be satisfied separately by the demonstration results for base grading units and for overlay grading units.

18. Paragraph 3.2(b) requires that all extensions of base metal cracking into the overlay material by at least 0.1 inches are reported as being intrusions into the overlay material.

In lieu of the requirements of the ASME Code, Section XI, Appendix VIII, Supplement 11, the licensee proposed that the PDI program as described in its application be used.

3.5.2 Licensee's Basis for Relief

The licensee stated that the UT of the completed preemptive weld overlays will be accomplished in accordance with ASME Code, Section XI, 1998 Edition with the 2000 Addenda, Appendix VIII, Supplement 11 with the modifications described in its application. As explained by the licensee, these modifications were developed by the EPRI PDI program to implement the requirements of Appendix VIII and have previously been approved by the NRC staff for use by licensees in its letter dated July 3, 1984, the Tri-party Agreement between NRC, EPRI, and the Boiling Water Reactor Owners Group (BWROG), "Coordination Plan for NRC/EPRI/BWROG Training and Qualification Activities of NDE (Nondestructive Examination) Personnel."

3.5.3 NRC Staff Evaluation of Modification to Appendix VIII, Supplement 11

The U.S. nuclear utilities created the PDI program to implement performance demonstration requirements contained in Appendix VIII of Section XI of the ASME Code. Within the PDI program, EPRI has developed a program for qualifying equipment, procedures, and personnel in accordance with the UT criteria of Appendix VIII, Supplement 11. Prior to the Supplement 11 program, EPRI was maintaining a performance demonstration program for weld overlay qualification under the Tri-party Agreement in the letter dated July 3, 1984. Instead of having two programs with similar objectives, the NRC staff recognized the PDI program for weld overlay qualifications as an acceptable alternative to the Tri-party Agreement. However, the PDI program does not fully comport with the existing requirements in Supplement 11. The differences are addressed below:

1. Paragraph 1.1(b) states limitations to the maximum thickness for which a procedure may be qualified.

   The ASME Code states that "[t]he specimen set must include at least one specimen with overlay thickness within minus 0.10-inch to plus 0.25-inch of the maximum nominal overlay thickness for which the procedure is applicable." The ASME Code requirement addresses the specimen thickness tolerance for a single specimen set, but is confusing when multiple specimen sets are used. The PDI proposed alternative states that "the specimen set shall include specimens with overlay not thicker than 0.10-inch more than the minimum thickness, nor thinner than 0.25-inch of the maximum nominal overlay thickness for which the examination procedure is applicable." The proposed alternative provides

clarification on the application of the tolerance. The tolerance is unchanged for a single specimen set, however, it clarifies the tolerance for multiple specimen sets by providing tolerances for both the minimum and maximum thicknesses. The proposed wording eliminates confusion while maintaining the intent of the overlay thickness tolerance. Therefore, the NRC staff finds that this PDI program revision is acceptable.

2. Paragraph 1.1(d)(1) requires that all base metal flaws be cracks.

   The PDI program determined that certain Supplement 11 requirements pertaining to location and size of cracks would be extremely difficult to achieve. For example, flaw implantation requires excavating a volume of base material to allow a pre-cracked coupon to be welded into this area. This process would add weld material to an area of the specimens that typically consists of only base material, and could potentially make UT more difficult and not representative of actual field conditions. In an effort to satisfy the requirements, the PDI program developed a process for fabricating flaws that exhibit crack-like reflective characteristics. Instead of all flaws being cracks as required by paragraph 1.1(d)(1), at least 70 percent of the flaws in the PDI weld overlay performance demonstrations are cracks with the remainder being fabricated flaws exhibiting crack-like reflective characteristics. The fabricated flaws are semi-elliptical with tip widths of less than 0.002 inches. The licensee provided further information describing a revision to the PDI program alternative to clarify when real cracks, as opposed to fabricated flaws, will be used: "[f]laws shall be limited to the cases where implantation of cracks produces spurious reflectors that are uncharacteristic of actual flaws." The NRC staff has reviewed the PDI flaw fabrication process, compared the reflective characteristics between actual cracks and PDI-fabricated flaws, and found the fabricated flaws acceptable for this application because they provide similar UT responses to actual cracks.

3. Paragraph 1.1(e)(1) requires that at least 20 percent but less than 40 percent of the flaws be oriented within ±20 degrees of the axial direction (of the piping test specimen).

   Flaws contained in the original base metal HAZ satisfy this requirement; however, the PDI alternative excludes axial fabrication flaws in the weld overlay material. PDI has concluded that axial flaws in the overlay material are improbable because the overlay filler material is applied in the circumferential direction (parallel to the girth weld); therefore, fabrication anomalies would also be expected to have major dimensions in the circumferential direction. Supplement 11 requirements are based on developing mockups with flaw types that are expected to be found in service. The NRC staff review agrees that the likelihood of axial flaw development in the overlay material is less likely and not as safety significant as circumferentially-oriented flaws. This change does not reduce the number of flaws in the mockup but redefines the minimum requirements for manufactured flaws in the mockup to meet the expected flaw orientations and locations in service. Therefore, the NRC staff concludes that the licensee's PDI program alternative to remove the requirement to have a minimum number of axially-oriented flaws in the overlay material is acceptable.

4. Paragraph 1.1(e)(1) also requires that the rules of IWA-3300 be used to determine whether closely-spaced flaws should be treated as single or multiple flaws.

   The PDI program treats each flaw as an individual flaw and not as part of a system of closely-spaced flaws and controls the flaws going into a test specimen set such that the flaws are free of interfering reflections from adjacent flaws. In some cases, this permits flaws to be spaced closer than what is allowed for classification as a multiple set of flaws by IWA-3300 and, thus, the alternative potentially makes the performance demonstration more challenging. Based on this example, the NRC staff concludes that the licensee's PDI program alternative application for closely-spaced flaws is acceptable.

5. Paragraph 1.1(e)(2) requires that specimens be divided into base metal and overlay grading units.

   The PDI program clarifies the existing requirement with the addition of the word "fabrication." By adding that "[f]laws shall not interfere with ultrasonic detection or characterization of other flaws," it also ensures flaw identification by ensuring all flaws will not be masked by other flaws. In sum, the PDI alternative provides clarification and assurance that the flaws are identified. Therefore, the NRC staff finds the PDI alternative to the Supplement 11 requirements to be acceptable.

6. Paragraph 1.1(e)(2)(a)(1) requires that a base grading unit include at least 3 inches of the length of the overlaid weld, and the base grading unit include the outer 25 percent of the overlaid weld and base metal on both sides.

   The PDI program reduces the criteria to 1 inch of the length of the overlaid weld and eliminates from the grading unit the need to include both sides of the weld. The proposed change permits the PDI program to continue using test specimens from the existing weld overlay program that have flaws on both sides of the welds. These test specimens have been used successfully for testing the proficiency of personnel for over 16 years. The weld overlay qualification is designed to be a near-side [relative to the weld] examination, and it is improbable that a candidate would detect a flaw on the opposite side of the weld due to the sound attenuation and re-direction caused by the weld microstructure. However, the presence of flaws on both sides of the original weld (outside the PDI grading unit) may actually provide a more challenging examination, as candidates must determine the relevancy of these flaws, if detected. Therefore, the NRC staff concludes that the PDI program's use of the 1 inch length of the overlaid weld base grading unit and elimination from the grading unit the need to include both sides of the weld, as described in the licensee's PDI program alternative, is acceptable.

7. Paragraph 1.1(e)(2)(a)(2) requires, when base metal cracking penetrates into the overlay material, that a portion of the base grading unit not be used as part of the overlay grading unit.

   The licensee's proposed modification eliminates the requirement for the 1-inch area around the flaw from being used as an overlay grading unit. This modification is conservative such that in a blind test, the qualifying individual is not alerted to an area of restriction in possible flaw location for the mockup. Similar to the Supplement 11 requirement, the base material flaw continues to be restricted from being used as part of the overlay grading unit. The NRC staff finds that the PDI program also provided clarification by the addition of the term "flaws" for "cracks" and the addition of "fabrication" to "overlay grading unit." The NRC staff concludes that the PDI program alternative provides clarification and conservatism and therefore, is acceptable.

8. Paragraph 1.1(e)(2)(a)(3) requires that for unflawed base grading units, at least 1 inch of unflawed overlaid weld and base metal shall exist on either side of the base grading unit.

   This requirement is to minimize the number of false identifications of extraneous reflectors. The PDI program stipulates that unflawed overlaid weld and base metal exists on all sides of the grading unit and that flawed grading units must be free of interfering reflections from adjacent flaws; this stipulation addresses the same concerns as the ASME Code requirement. Based on this, the NRC staff concludes that the licensee's PDI program alternative application of the variable flaw-free area adjacent to the grading unit is acceptable.

9. Paragraph 1.1(e)(2)(b)(1) requires that an overlay grading unit include the overlay material and a base metal-to-overlay interface of at least 6 square inches. The overlay grading unit shall be rectangular, with minimum dimensions of 2 inches.

   The PDI program reduces the base metal-to-overlay interface to at least 1 inch (in lieu of a minimum of 2 inches) and eliminates the minimum rectangular dimension. This alternative criterion is necessary to allow use of existing examination specimens that were fabricated in order to meet NRC Generic Letter 88-01 (the Tri-Party Agreement, in the NRC letter dated July 3, 1984). This criterion may be more challenging than the ASME Code requirement because of the variability associated with the shape of the grading unit. Based on this, the NRC staff concludes that the licensee's PDI program alternative application of the grading unit is acceptable.

10. Paragraph 1.1(e)(2)(b)(2) requires that unflawed overlay grading units be surrounded by unflawed overlay material and unflawed base metal-to-overlay interface for at least 1 inch around its entire perimeter.

    The PDI program redefines the area by noting that unflawed overlay fabrication grading units shall be separated by at least 1 inch of unflawed material at both ends and sufficient area on both sides to preclude interfering reflections from adjacent flaws. The modification reduces the requirement for the 1-inch area

around the flaw perimeter to a more narrow area of 1-inch from both ends of the flaw. This modification is conservative such that in a blind test, the qualifying individual is not alerted to an area of restriction in possible flaw location for the mockup, while still ensuring no interfering reflections. This modification allows for a more challenging demonstration. Therefore, the NRC staff concludes that the PDI program's application is an acceptable alternative to the Supplement 11 requirements.

11. Paragraph 1.1(e)(2)(b)(3) requirements are retained in the PDI program.

    In addition, the PDI program requires that initial procedure qualification contain three times the number of flaws required for a personnel qualification. To qualify new values of essential variables, the equivalent of at least one personnel qualification set is required. The NRC staff concludes that the PDI program's addition enhances the ASME Code requirements by providing for a more stringent qualification criteria, and the PDI alternative is, therefore, acceptable.

12. Paragraph 1.1(f)(1) requirements are retained in the PDI program, with the clarifying substitution of the term "flaws" for "cracks."

    In addition, the PDI program includes the requirements that sizing sets shall contain a distribution of flaw dimensions to verify sizing capabilities. The PDI program also requires that initial procedure qualification contain equivalent of three personnel qualification sets [three times the number of flaws required for a personnel qualification]. To qualify new values of essential variables, the equivalent of at least one personnel qualification set is required. The NRC staff concludes that the PDI program's addition enhances the ASME Code requirements because it provides a more stringent qualification criteria and is, therefore, acceptable.

13-14. Paragraphs 1.1(f)(3) and 1.1(f)(4) requirements are clarified by the PDI program by replacing the term "cracking" with "flaws" because of the use of alternative flaw mechanisms.

    The term "flaw," as a replacement for the term "crack," is a modification by the licensee to add clarity by using a more defined term. The NRC staff concludes that this clarification in the PDI program meets the intent of the ASME Code requirement and is acceptable.

15. Paragraph 2.0, "Conduct of Performance Demonstration," in Supplement 11 is clarified in PDI by the addition of the sentence, "[T]he overlay fabrication flaw test and the base metal flaw test may be performed separately."

    The NRC staff concludes that this addition in the PDI program does not change the intent of the ASME Code but only provides additional clarification. Therefore, this alternative in PDI is acceptable.

16. Paragraph 2.3 requires that, for depth sizing tests, 80 percent of the flaws shall be sized at a specific location on the surface of the specimen identified to the candidate. This requires detection and sizing tests to be separate.

The PDI program revised the weld overlay program to allow sizing to be conducted either in conjunction with, or separately from, the flaw detection test. If performed in conjunction with detection, and if the detected flaws do not meet the Supplement 11 range criteria, additional specimens will be presented to the candidate with the regions containing flaws identified. Each candidate will be required to determine the maximum depth of flaw in each region. For separate sizing tests, the regions of interest will also be identified and the maximum depth and length of each flaw in five of the regions will similarly be determined. In addition, the PDI program states that grading units are not applicable to sizing tests, and that each sizing region will be large enough to contain the target flaw, but small enough that candidates will not attempt to size a different flaw. The above clarification provides a basis for implementing sizing tests in a systematic, consistent manner that meets the intent of Supplement 11. Therefore, this method is acceptable to the NRC staff.

17. Paragraphs 3.1 and 3.2 of Supplement 11 require that procedures, equipment, and personnel [as a complete ultrasonic system] be qualified for detection or sizing of flaws, as applicable, when certain criteria are met.

The PDI program allows procedure qualification to be performed separately from personnel and equipment qualification. Historical data indicate that, if UT detection or sizing procedures are thoroughly tested, personnel and equipment using those procedures have a higher probability of successfully passing a qualification test. In an effort to increase this passing rate, the PDI program has elected to perform procedure qualifications separately in order to assess and modify essential variables that may affect overall system capabilities. For a procedure to be qualified, the PDI program requires three times as many flaws to be detected (or sized) as shown in Supplement 11 for the entire ultrasonic system. The personnel and equipment are still required to meet Supplement 11. Therefore, because it exceeds ASME Code requirements for personnel, procedures, and equipment qualification, the NRC staff concludes that use of this method in the licensee's PDI program alternative is acceptable.

18. Paragraph 3.2(b) requires that all extensions of base metal cracking into the overlay material by at least 0.10 inches be reported as being intrusions into the overlay material.

The PDI program omits this criterion because of the difficulty in actually fabricating a flaw with a 0.10-inch minimum extension into the overlay, while still knowing the true state of the flaw dimensions; however, the PDI program requires that cracks be depth-sized to the tolerance of 0.125 inches as specified in the ASME Code. Since the ASME Code tolerance is close to the 0.10-inch value of paragraph 3.2(b) of Supplement 11, any crack extending beyond 0.10 inches into the overlay material would be identified as such from the characterized dimensions. The reporting of an extension in the overlay material is redundant for

performance demonstration testing because of the flaw sizing tolerance. Therefore, the NRC staff concludes that the licensee's PDI program alternative omission of highlighting a crack extending beyond 0.10 inches into the overlay material is acceptable.

Based on the evaluation of the differences between the PDI program alternative and the requirements in Supplement 11, the NRC staff concludes that use of the PDI program provides an acceptable level of quality and safety and, therefore, the alternatives to Supplement 11 are acceptable for CPSES, Unit 2.

4.0 REGULATORY COMMITMENT

The licensee has made the following Regulatory Commitment:

> A summary of the results will be submitted to NRC within 14 days from completion of the last ultrasonic examination of the weld overlays for CPSES, Unit 2.

5.0 CONCLUSION

Based on the discussion above, the NRC staff concludes that the modifications proposed to Code Cases N-504-2 and N-638-1 in Relief Request B-4, for the preemptive full-structural overlays of the CPSES, Unit 2 welds listed in Section 3.1 above, will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the proposed modifications to install the weld overlay for the remaining service life of the subject welds.

The NRC staff also concludes that the alternatives to ASME Code, Section XI, Appendix VIII, Supplement 11, will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the proposed alternatives for inspection of the subject welds using the PDI program for the remainder of the second 10-year ISI interval at CPSES, Unit 2.

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.

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