May 1, 2008

Mr. Gene F. St. Pierre, Site Vice President
c/o James M. Peschel
FPL Energy Seabrook, LLC
P.O. Box 300
Seabrook, NH 03874

SUBJECT: SEABROOK STATION, UNIT NO. 1 – EVALUATION OF RELIEF REQUEST ALTERNATIVE TO INSTALL WELD OVERLAYS ON PRESSURIZER DISSIMILAR METAL WELDS (TAC NO. MD5933)

Dear Mr. St. Pierre:

By letter dated July 3, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML071990104), as supplemented by letter dated February 13, 2008, (ADAMS Accession No. ML080500146), FPL Energy Seabrook, LLC (the licensee) submitted a proposed alternative to the requirements of the American Society of Mechanical Engineers *Boiler and Pressure Vessel Code*, Section XI (ASME Code) for U.S. Nuclear Regulatory Commission (NRC) staff review and approval. The licensee's proposed alternative is designed for the installation of preemptive full structural weld overlays on dissimilar metal welds of the surge, spray and safety line welds for pressurizer nozzles at the Seabrook Station Unit 1 (Seabrook).

To support the repair schedule, verbal authorization of the subject relief was granted on April 1, 2008.

Based on the information provided in the licensee's submittal, the NRC staff concludes that pursuant to Title 10 of the *Code of Federal Regulations*, Section 50.55a(a)(3)(ii), the licensee's proposed alternative to the ASME to be acceptable. The NRC's safety evaluation supporting this conclusion is enclosed.

If you have any questions, please contact the Seabrook Project Manager, Mr. G. Edward Miller, at 301-415-2481.

Sincerely,

/ra/

Harold K. Chernoff, Chief
Plant Licensing Branch 1-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-443

Enclosure: As stated

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

PRESSURIZER NOZZLE DISSIMILAR METAL WELD OVERLAYS

FPL ENERGY SEABROOK, LLC

SEABROOK STATION, UNIT NO. 1

DOCKET NO. 50-443

1.0 INTRODUCTION

By letter dated July 3, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML071990104), as supplemented by letter dated February 13, 2008, (ADAMS Accession No. ML080500146), FPL Energy Seabrook, LLC (FPLE or the licensee) submitted a proposed alternative to the requirements of the American Society of Mechanical Engineers *Boiler and Pressure Vessel Code*, Section XI (ASME Code) for U.S. Nuclear Regulatory Commission (NRC) staff review and approval. The licensee's proposed alternative is designed for the installation of preemptive full structural weld overlays on dissimilar metal welds (DMW) of the surge, spray and safety line welds for pressurizer nozzles at the Seabrook Station Unit 1 (Seabrook). The weld overlay will also be installed on the similar metal welds that are located adjacent to the DMWs to facilitate ultrasonic examination of the DMWs. The licensee proposed the alternative for the 12th refueling outage (12RFO) for Seabrook.

A DMW is a weld that joins two pieces of metal that are not of the same material. In the proposed alternative, the dissimilar metal weld joins the ferritic (i.e., carbon steel) nozzle to the austenitic stainless steel safe end or piping. The DMW itself is made of nickel-based Alloy 82/182. The proposed preemptive weld overlay is a process by which weld filler metal that is resistant to stress corrosion cracking is deposited on the outside surface of the susceptible pipe weld material including the original pipe.

2.0 REGULATORY EVALUATION

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), paragraph 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

ENCLOSURE

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.

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 alternatives provide an acceptable level of quality and safety; or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The code of record for the current second ISI interval is the 1995 Edition through the 1996 Addenda of the ASME Code, Section XI. In addition, as required by 10 CFR 50.55a, the licensee will use Appendix VIII, "Performance Demonstration for Ultrasonic Examinations," of the 1995 Edition through 1996 Addenda of the ASME Code, Section XI, for ultrasonic examination of the weld overlay.

3.0 LICENSEE'S PROPOSED ALTERNATIVE

3.1 ASME Code Components Affected

FPLE proposes to install a preemptive full structural weld overlay on the following DMWs: RC E-10 SP-SE, RC E-10 B-SE, RC E-10 A-SE, RC E-10 C-SE, RC E-10 D-SE, and RC E-10 S-SE. The weld overlay will also be installed on similar metal welds: RC 0048-03 06, RC 0800-01 01, RC 0074-01 01, RC 0075-01 01, RC 0076-01 01, and RC 0049-01 05.

Nozzle	Weld Designation	
	DMW	SS Weld
Pressurizer Spray Nozzle	RC E-10 SP-SE	RC 0048-03 06
Pressurizer Relief Nozzle B	RC E-10 B-SE	RC 0080-01 01
Pressurizer Relief Nozzle A	RC E-10 A-SE	RC 0074-01 01
Pressurizer Relief Nozzle C	RC E-10 C-SE	RC 0075-01 01
Pressurizer Relief Nozzle D	RC E-10 D-SE	RC 0076-01 01
Pressurizer Surge Nozzle	RC E-10 S-SE	RC 0049-01 05

3.2 Code Requirements

The applicable Code requirement for which the relief is requested is ASME Code Section XI, 1995 Edition including Addenda through 1996, IWA-4410, IWA-4611 and Appendix VIII, Supplement 11.

IWA-4410(a) states:

"Repair/replacement activities shall be performed in accordance with the Owner's Requirements and the original Construction Code of the component or system, except as provided in IWA-4410(b), (c), and (d)."

IWA-4410(c) states, in part:

"Alternatively, the applicable requirements of IWA-4600 may be used for welding..."

IWA-4611.1 (a) states, in part:

"Defects shall be removed or reduced in size in accordance with this Paragraph."

IWA-4611.1 (b) states:

“The original defect shall be removed.”

IWA-4611.1 (b)(2) states:

"When welding is required in accordance with IWA-4630 or IWA-4640 and the defect penetrates the base material."

IWA-4611.4(a) states, in part:

"After final grinding, the affected surfaces, including surfaces of cavities prepared for welding, shall be examined by the magnetic particle or liquid penetrant method to ensure that the indication has been reduced to an acceptable size in accordance with IWA-3000…"

Appendix VIII, Supplement 11 of the ASME Code, Section XI, specifies performance demonstration requirements for ultrasonic examination of weld overlays.

3.3 Proposed Alternative

Pursuant to 10 CFR 50.55a(a)(3)(i), FPLE proposed to install preemptive full structural weld overlays in accordance with the proposed alternatives specified in Enclosure 2[1] of the licensee’s submittal. The proposed alternatives are applicable to the six (6) DMWs and adjacent stainless steel welds identified in Section 3.1 above.

These alternatives are based on the methodology of ASME Code, Section XI, Code Case N-740-1, “Dissimilar Metal Weld Overlay for Repair of Class 1, 2, and 3 Items, Section XI, Division 1.” The alternative to design, fabrication, examination, pressure testing, and ISI of preemptive full structural weld overlays is described in Enclosure 2 of the licensee’s submittal. The alternative applicable to ambient temperature temper bead welding is described in Mandatory Appendix I of Enclosure 2. The ambient temperature temper bead welding will be applied to the welds as an alternative to the post-weld heat treatment requirements of the ASME Code, Section III.

FPLE stated that ultrasonic examinations of the proposed preemptive full structural weld overlays in accordance with Appendix VIII, Supplement 11 of the 1995 Edition through 1996 Addenda of ASME Code, Section XI, except as modified by the Performance Demonstration Initiative (PDI) Program will be performed. The proposed PDI alternatives to Appendix VIII, Supplement 11 are specified in Enclosure 1[2] of the February 13, 2008, submittal.

[1] Enclosure 2, “Alternative Requirements for Dissimilar Metal Weld Overlays,” to FPL’s letter dated February 13, 2008. (ADAMS Accession No. ML080500146)
[2] Enclosure 1, “PDI Program Modifications to ASME Code, Appendix VIII, Supplement 11,” to FPL’s letter dated February 13, 2008. (ADAMS Accession No. ML080500146)

3.4 Duration Of the Alternative

FPLE stated that the proposed alternative is applicable to the second 10-Year Interval at Seabrook. The licensee intends to implement the request during the twelfth refueling outage (12RFO), which began April 2008. Authorization of the alternative to perform the weld overlay would be applicable for the life of the overlay. The ISI requirements for the weld overlays specified in Enclosure 2[3] would be applicable for the remainder of the second 10-year interval.

4.0 NRC STAFF EVALUATION

The licensee's proposed alternative is based on Code Case N-740. Code Case N-740-1 combines most of the requirements in Code Case N-504-2, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping Section XI, Division 1," and N-638-1, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW [gas tungsten arc welding] Temper Bead Technique Section XI, Division 1." The staff has endorsed Code Cases N-504-3 and N-638-1 in Regulatory Guide 1.147, Revision 15, but has not endorsed Code Case N-740-1. Regulatory Guide 1.147 requires that Appendix Q to the ASME Code, Section XI, be used when using N-504-3. The staff evaluated the acceptability of the licensee's proposed alternative based on the requirements of Code Case N-504-3 and N-638-1. The staff endorsed the use of N-504-3 in Regulatory Guide 1.147, Revision 15, *"Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1,"* during the same time period it was reviewing the licensee's submittal. Therefore, some of the issues that the staff raised during the review of the licensee's submittal were based on N-504-3 and the discussion below will contain references to N-504-2 as well.

The NRC staff has been involved in the ASME Code review process for Code Case N-740 and its revisions, N-740-1 and N-740-2. The NRC staff concerns regarding the general application and acceptance of the latest version of this code case remain ongoing. However, on a plant-specific basis, the NRC has approved versions of this code case for use, notably for Joseph M. Farley Nuclear Plant and Vogtle Electric Generating Plan. The licensee, being aware of NRC staff items of concerns for general approval, has satisfactorily addressed many technical issues related to the design, analysis, and examination of the weld overlay that the NRC staff identified in previous reviews. The staff evaluated herein the following technical issues as they relate to the plant-specific case of Seabrook. This safety evaluation should not be considered as a general acceptance of N-740 or any of its various versions for use by the general pressurized water reactor fleet.

4.1 General Requirements

Section 1.0, "General Requirements," of Enclosure 2 to the licensee's submittal provides requirements for the specification of the base metal (carbon steel, stainless steel, and Alloy 82/182) and weld overlay filler metal (Alloy 52M), surface condition of the base metal, and chromium content of the weld overlay deposits. The proposed alternative is consistent with N-504-3; N-638-1; and Appendix Q to the ASME Code, Section X with the exception that the licensee's proposed alternative states that a buffer layer of austenitic stainless steel filler metal (EN309L) will be applied across the austenitic stainless steel base metal to prevent a form of fabrication cracking in the weld overlay material. Paragraph (e) of Code Case N-504-3 requires specific delta ferrite content in the weld layer when austenitic stainless steel weld metal is used. Paragraph (e) of N-504-3 requires weld reinforcement layers to have a deposited delta ferrite content of at least 7.5 ferrite number (FN, also expressed in percentages). This delta ferrite

[3] Enclosure 2, "Alternative Requirements for Dissimilar Metal Weld Overlays," to FPL's letter dated February 13, 2008. (ADAMS Accession No. ML080500146)

requirement is applicable to stainless steel weld overlays that are subject to intergranular stress corrosion cracking (IGSCC).

The staff notes that IGSCC is a credible degradation mechanism for austenitic stainless steels in oxidizing boiling water reactor environments. However, there is no industry experience to suggest that IGSCC is a concern for pressurized water reactors as the case for Seabrook. In general, adverse environmental conditions in pressurized water reactors have been reduced and are not conducive for IGSCC.

Further, the staff notes that the applied austenitic stainless steel buffer layer will not be included in the structural weld overlay thickness. The delta ferrite requirements of Code Case N-504-3, paragraph (e) only apply to the structural layers of a weld overlay. They do not apply to nonstructural weld layers. Conversely, paragraphs (c) and (d) of the code case do apply to nonstructural weld layers but do not include any delta ferrite requirements. Therefore, if nonstructural layers for a weld overlay subject to IGSCC do not require delta ferrite testing, then a nonstructural stainless steel buffer layer (for an Alloy 52M weld overlay) that is not subject to IGSCC does not require delta ferrite testing.

The staff finds that the minimum delta ferrite requirement of N-504-3, paragraph (e), is not applicable to the applied austenitic stainless steel buffer layer. The staff also finds that the licensee will deposit the buffer layer on the pipe and perform examination in accordance with the requirements of the ASME Code and N-504-3.

4.2 Crack Growth Considerations and Design

Section 2, “Crack Growth Considerations and Design,” of Enclosure 2 to the licensee’s submittal, provides the requirements for weld overlay design, design-basis flaw size, and the crack-growth calculation. The crack-growth calculation assures that the growth of the crack in the base metal will be mitigated or minimized by the installation of the weld overlay. The significant issues are discussed below.

The licensee stated that the design basis for full structural weld overlays is to maintain the original design margins with no credit taken for the underlying PWSCC-susceptible weldments. The assumed design-basis flaw for the purpose of sizing the weld overlays is based on the limiting case applied with consideration of either a postulated flaw 360 degree, 100 percent through the original wall thickness of the DMWs or a postulated flaw 100 percent through-wall flaw for 1.5-inches or the combined width of the weld plus buttering, whichever is greater, in the axial direction.

Regarding the crack-growth analysis for the preemptive full structural weld overlay, a flaw originating from the inside diameter with a depth of 75 percent and a circumference of 360° will be assumed. A 75-percent through-wall flaw is the largest flaw that could remain undetected in the base metal. A preservice volumetric examination will be performed after application of the weld overlay using an ASME Section XI, Appendix VIII (as implemented through PDI) examination procedure. This examination will verify that there is no cracking in the upper 25 percent of the base material. The preservice examination will also demonstrate that the assumption of a 75-percent through-wall crack is conservative. The PDI procedure is not qualified to examine the lower 75 percent of the pipe wall thickness. Therefore, a conservative approach is that a 75-percent through-wall crack is assumed to exist in the lower 75 percent of the pipe wall thickness. The licensee stated that if no flaws were identified in the upper 25 percent of the original weld, the flaw depth for crack-growth calculation would be 75 percent through-wall in the original weld. If any crack-like flaws are found during the preservice examination in the upper 25 percent of the

original weld or base metal, an analyzed flaw (the postulated 75 percent through-wall flaw plus the portion of the as-found flaw in the upper 25 percent) would be used for the crack-growth calculation. The staff finds that the proposed flaw size for the crack-growth calculation is conservative and, therefore, is acceptable.

As part of the weld overlay design, the licensee will perform the following analyses. The effects of any changes in applied loads, as a result of weld shrinkage from the entire overlay, on other items in the piping system (e.g., support loads and clearances, nozzle loads, and changes in system flexibility and weight due to the weld overlay) shall be evaluated. Existing flaws previously accepted by analytical evaluation shall be evaluated in accordance with IWB-3640, IWC-3640, or IWD-3640, as applicable. The staff finds that the licensee proposed analyses and shrinkage measurement are consistent with paragraph (g) of Code Case N-504-3 and are, therefore, acceptable.

The staff finds that the Section 2 requirements of Enclosure 2[4] of the licensee's submittal are consistent with or more conservative than ASME Code Case N-504-3 and Appendix Q to the ASME Code, Section XI.

4.3 Examination and Inspection

Section 3, "Examination and Inspection," of Enclosure 2 provides requirements for the acceptance examination, pre-service examination, and inservice examination after the weld overlay is installed. The length, surface finish, and flatness requirements of the weld overlay are specified in the weld overlay design to provide the required examination volume of the weld overlay as shown in Figures 1[5] and 2[6] of Enclosure 2.

4.3.1 Acceptance Examination

Section 3.0(a), "Acceptance Examination," of Enclosure 2 requires a surface and ultrasonic testing examination of an installed weld overlay. The requirements of the acceptance examination are acceptable because they are consistent with or more conservative than N-504-3 and Appendix Q to the ASME Code, Section XI, with one exception which is discussed in Section 4.4.2, 48 Hour Hold Time, of this safety evaluation as it pertains to the conditions for use of the temper bead welding technique.

4.3.2 Preservice Examination

Section 3.0(b), "Preservice Inspection," of Enclosure 2 requires an ultrasonic examination of the installed weld overlay and the upper (outer) 25 percent of the original pipe-wall thickness.

The required examination volume is defined in Figure 2 of Enclosure 2. The staff finds that the preservice examination requirements are acceptable because they are consistent with or more conservative than N-504-3 and the ASME Code, Section XI, Appendix Q.

4.3.3 Inservice Examination

Section 3.0(c), "Inservice Inspection," of Enclosure 2 requires inservice examination be conducted ultrasonically with the examination volume defined in Figure 2 of Enclosure 2. The frequency of

[4] Enclosure 2, "Alternative Requirements for Dissimilar Metal Weld Overlays," to FPL's letter dated February 13, 2008. (ADAMS Accession No. ML080500146)
[5] Enclosure 2, Figure 1, "Acceptance Examination Volume and Thickness Definitions."
[6] Enclosure 2, Figure 2, "Preservice and Inservice Examination Volume."

examination is consistent with the current industry mandatory guidelines of MRP-139 "Materials Reliability Program: Primary System Piping Butt Weld Inspection and Evaluation Guideline," dated July 14, 2005. This industry guideline goes beyond the current ASME Code inspection requirements for the Seabrook plant. The staff finds that the requirements in Section 3.0(c) of Enclosure 2[7] are consistent with or more conservative than the ASME Code, Section XI, Appendix Q.

However, the staff notes that revision of the ASME Code requirements is ongoing for dissimilar metal butt welds, including those mitigated by full weld structural overlays. Once the revised requirements are required by regulatory action, the licensee's proposed alternative inspection frequency may no longer be acceptable per regulatory requirements, and relief from the revised ASME Code requirements would be necessary to continue under the re-inspection schedule of the licensee's proposed alternative.

4.4 Proposed Ambient Temperature Temper Bead Welding

The requirements for the proposed ambient temperature temper bead welding are discussed in Mandatory Appendix I of Enclosure 2 and are based on Code Case N-638-1. The requirements of the licensee's proposed alternative are consistent with N-638-1, with two exceptions; limit of the maximum area of use for temper bead welding, and 48-hour hold time before performance of non-destructive examination (NDE).

4.4.1 Maximum Area of Coverage

Paragraph 1.0(a) of Code Case N-638-1 limits the maximum area of an individual weld to 100 square inches on the ferritic-base material using temper bead welding. However, Enclosure 2, Appendix I, Section I-1 allows the weld surface area up to 300 square inches on the ferritic-base material. The licensee stated that technical justification for allowing weld overlays on ferritic materials with surface areas up to 500 square inches is provided in the ASME white paper supporting the changes in ASME Code Case N-638-3 and Electric Power Research Institute Report (EPRI) Report 1011898, *"Justification for the Removal of the 100 Square Inch Temper Bead Weld Repair Limitation.*" The ASME white paper notes that the original limit of 100 square inches in Code Case N-638-1 was arbitrary. The white paper cites evaluations of a 12-inch diameter nozzle weld overlay to demonstrate adequate tempering of the weld heat affected zone, residual stress evaluations demonstrating acceptable residual stresses in weld overlays ranging from 100 to 500 square inches, and service history in which weld repairs exceeding 100 square inches were NRC approved and applied to DMW nozzles in several boiling-water reactor and pressurized-water reactor applications. Some of the cited repairs are greater than 15 years old, and have been inspected several times with no evidence of any continued degradation.

The above theoretical arguments and empirical data have been verified in practice by extensive field experience with temper bead weld overlays, with ferritic material coverage ranging from less than 10 square inches up to and including 325 square inches. It can be seen from the information above that the original DMW weld overlay was applied over 20 years ago, and weld overlays with low alloy steel coverage in the 100-square inch range have been in service for 5 to 15 years. Several overlays have been applied with low alloy steel coverage significantly greater than the 100 square inches. These overlays have been examined with PDI qualified techniques, in some cases multiple times, and none have shown any signs of new cracking or growth of existing cracks.

[7] Enclosure 2, "Alternative Requirements for Dissimilar Metal Weld Overlays," to FPL's letter dated February 13, 2008. (ADAMS Accession No. ML080500146)

The staff notes that the proposed 500-square-inch weld area has also been addressed in EPRI Report 1014351, *"Repair and Replacement Applications Center: Topical Report Supporting Expedited NRC Review of Code Cases for Dissimilar Metal Weld Overlay Repairs, December 2006.*" The technical basis for the 300-square-inch weld area was also presented in slides entitled, "*Bases for 500 Square Inch Weld Overlay Over Ferritic Material,*" in an NRC-ASME public meeting held on January 10, 2007 (ADAMS Accession No. ML070470565). Based on EPRI 1014351, the staff finds that the proposed 500-square inch weld area on the ferritic material is acceptable because the stress analysis presented in EPRI Report 1014351 shows that the structural integrity of ferritic material is not adversely affected by a 500-square-inch weld overlay area.

4.4.2 48 Hour Hold Time

ASME Code Case N-638-1 states, in part, that the final weld surface shall be examined using NDE methods when the completed weld has been at ambient temperature for at least 48 hours. The licensee's proposed alternative will allow performance of NDE of the final weld surface 48 hours after the third temper bead weld layer is completed without waiting for cooling to ambient temperatures.

This 48-hour delay, starting after the weld had cooled to ambient temperature, was provided to allow sufficient time for hydrogen cracking to occur (if it is to occur) in the heat affected zone (HAZ) of ferritic materials prior to performing examinations, to ensure detection of hydrogen cracking by NDE. However, based on research and industry experience, 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 their 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 NDEs performed after the 48-hour hold or by subsequent inservice inspections.

An ASME Technical Basis Paper (ADAMS Accession No. ML070790679), which 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.

Based on the above information, the staff finds that starting the 48-hour hold time following completion of the third weld layer is acceptable. The staff finds that the licensee has provided sufficient technical justification to show that hydrogen cracking in the weld overlay would not likely occur under the proposed alternative. A staff review of operational experience and research in this area has found no technical objection to the proposed alternative. Therefore, the staff finds that it is not necessary to wait until 48 hours after the completed overlay has reached ambient temperature, 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.

4.5 Performance Demonstration Initiative Program

Appendix VIII, Supplement 11 of the 1995 Edition through 1996 Addenda of ASME Code, Section XI, specifies requirements for performance demonstration of ultrasonic examination procedures, equipment, and personnel used to detect and size flaws in full structural overlays of wrought austenitic piping welds. Industry initiated the PDI Program as an alternative to satisfy the requirements of ASME Code, Section XI, Appendix VIII.

EPRI 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 maintained a performance demonstration program (the precursor to the PDI program) for weld overlay qualification under the Tri-party Agreement with the NRC, BWR Owner's Group, and EPRI, as discussed in the NRC letter dated July 3, 1984 (ADAMS Accession No. ML8407090122). Later, the NRC staff recognized the EPRI PDI program for weld overlay qualifications as an acceptable alternative to the Tri-party Agreement in its letter dated January 15, 2002, to the PDI Chairman (ADAMS Accession No. ML020160532).

The PDI program is routinely assessed by the staff for consistency with the current ASME Code and proposed changes. The PDI program does not fully comport with the existing requirements of Supplement 11. The PDI representatives presented the differences between Supplement 11 and the PDI program at public meetings in which the NRC participated:

- Memorandum from Donald G. Naujock to Terence Chan, "Summary of Public Meeting Held January 31 - February 2, 2002, with PDI Representatives," March 22, 2002 (ADAMS Accession No. ML010940402); and

- Memorandum from Donald G. Naujock to Terence Chan, "Summary of Public Meeting Held June 12 through June 14, 2001, with PDI Representatives," November 29, 2001 (ADAMS Accession No. ML013330156).

Based on the discussions at these public meetings, the staff determined that the industry's PDI program provides an acceptable level of quality and safety.

The licensee proposed to use the PDI program as indicated in Enclosure 1 of the February 13, 2008, submittal to satisfy the Appendix VIII, Supplement 11, qualification requirements. The PDI initiatives will be used for qualification of ultrasonic examinations to detect

and size flaws in the preemptive full structural weld overlays of this request. The NRC staff evaluated the differences between the PDI program and Supplement 11 as shown in Enclosure 1 of the licensee's proposed alternative. The NRC staff concludes that the justifications for the differences are acceptable and the PDI program provides an acceptable level of quality and safety. Therefore, the licensee's proposed alternative to implement the PDI program is acceptable for use in lieu of Supplement 11 of Appendix VIII to the ASME Code, Section XI for Seabrook.

4.6 Additional Licensee Actions

As part of the licensee's proposed alternative provided in the July 3, 2007, letter, the licensee will provide the preliminary ultrasonic examination results to the NRC within fourteen (14) days after completion of the ultrasonic examinations. Further, as part of the licensee's proposed alternative provided in the February 13, 2008, letter, the licensee stated that they will provide the final ultrasonic examination report within sixty (60) days after startup. Any flaws detected that exceed the acceptance standards of Table IWB-3514-2 will be reported to the NRC resident inspector within 48 hours. The final report will contain a discussion and reason for any structural weld overlay or base metal repairs. The structural weld overlay design analysis will be available at the plant for NRC review at the beginning of the twelfth refueling outage.

4.0 CONCLUSION

The NRC staff has reviewed the licensee's submittal and determined that the licensee's proposed alternative, as provided in letters dated July 3, 2007, and February 13, 2008, will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the use of the licensee's proposed alternative for the installation of full structural weld overlays on the dissimilar metal welds of the pressurizer surge, safety, relief and spray nozzles at Seabrook during the plant's twelfth refueling outage.

The staff finds the inservice inspection frequency identified in Section 3(c) of Enclosure 2 of the licensee's submittal is acceptable as it is based on current industry mandatory inservice inspection guidance and therefore pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the use of the licensee's proposed alternative for the second inservice inspection interval at Seabrook Station, Unit 1, which is scheduled to be complete in August 2010. However, the staff notes that revision of the ASME Code requirements is ongoing for dissimilar metal butt welds, including those mitigated by full weld structural overlays. Once the revised requirements are required by regulatory action, and if the licensee's proposed alternative inspection frequency is no longer acceptable per the revised regulatory requirements, the re-inspection schedule of the licensee's proposed alternative would no longer remain acceptable for the second inservice inspection interval at Seabrook Station, Unit 1.

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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Date: