Nuclear Operating Company
South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

August 22, 2006
NOC-AE-06002055
File No.: G25
10 CFR 50.55a

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
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South Texas Project
Units 1 and 2
Docket No. STN 50-498, STN 50-499
Response to NRC Request for Additional Information on Proposed
Alternative to ASME Section XI Requirements for Application of a Weld Overlay
(RR-ENG-2-43) (TAC Nos. MD1414-1423)

Reference: Letter dated May 1, 2006, from M. J. Berg, STPNOC, to NRC Document Control Desk, "Proposed Alternative to ASME Section XI Requirements for Application of a Weld Overlay (RR-ENG-2-43)" (NOC-AE-06002000) (ML061280504)

In the referenced correspondence, the STP Nuclear Operating Company (STPNOC) requested NRC approval of an alternative approach to the requirements of ASME Boiler and Pressure Vessel Code Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components." Approval will allow application of full structural weld overlays in pressurizer nozzle safe end welds which diverge from the requirements of the ASME Section XI code.

The proposed structural weld overlays are intended as a preventive measure against flaw development or to repair flaws similar to those that have occurred at other nuclear power facilities. The overlay will be applied during the South Texas Project Unit 1 Fall 2006 and Unit 2 Spring 2007 refueling outages.

The NRC Project Manager provided STPNOC with a request for additional information from the reviewer regarding the STPNOC relief request. The questions and responses are attached, followed by a list of the commitments specified in the responses.

If there are any questions, please contact either Mr. P. L. Walker at (361) 972-8392 or me at (361) 972-7030.

M. J. Berg
Manager
Testing/Programs

PLW

Attachment: Response to Request for Additional Information on Proposed Alternative to ASME Section XI Requirements for Application of a Weld Overlay (Relief Request RR-ENG-2-43)

A047

STI: 32038437

cc:

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SOUTH TEXAS PROJECT

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION ON PROPOSED ALTERNATIVE TO ASME SECTION XI REQUIREMENTS FOR APPLICATION OF A WELD OVERLAY (RELIEF REQUEST RR-ENG-2-43)

1. **In your submittal dated May 1, 2006, your cover letter states that a preemptive full structural weld overlay is proposed for each Alloy 82/182 nozzle-to-safe end weld. Please indicate what types of nondestructive examinations (NDE) will be performed prior to the full structural weld overlay installation. If pre-welding NDE is not to be performed, please confirm that in all cases, a full structural overlay will be installed and expand your justification for not performing the NDE prior to welding.**

   STP Response: As required by ASME Section XI Code Case N-504-2 (Paragraph c) and Nonmandatory Appendix Q (Article 2000, Paragraph b), the surface on which the weld overlay (WOL) is to be deposited will be examined by the liquid penetrant method. In all cases, a full structural WOL will be installed. The structural WOL design assumes there is no contribution to structural integrity from the original section of pipe. Hence, flaws in the original section of pipe do not reduce the structural integrity of the completed configuration.

2. **Please discuss your repair strategy as a result of NDE. The cover letter indicates that full structural overlays will be performed both as a preemptive application, or if a flaw is found that requires a repair. If a flaw is detected in the weld by NDE prior to weld overlay, confirm that a full-structural weld overlay is applied, and confirm that the weld overlay thickness calculation is based on the worst case flaw.**

   STP Response: The strategy for repair would be in accordance with Code Case N-504-2 (Paragraph c) and Nonmandatory Appendix Q (Article 2000, Paragraph b). Indications larger than 1/16-inch will be removed, reduced in size, or sealed with one or more layers of weld metal prior to application of the full structural WOL. The structural WOL design assumes there is no contribution to structural integrity from the original section of pipe. Hence, flaws in the original section of pipe do not reduce the structural integrity of the completed configuration.

3. **Please discuss in detail your strategy for expansion of examinations if an unacceptable flaw is found by NDE under a portion of the weld overlay that was not scheduled for an inservice examination that outage.**

   STP Response: Inservice examination would normally involve ultrasonic examination (UT) of the safe ends and the adjacent welds if scheduled in accordance with the Inservice Inspection (ISI) program. However, the area to be covered by the WOL will be examined by liquid penetrant prior to application of the WOL. Following application of the WOL, UT will be applied to the entire WOL. Consequently, UT will assess regions covered by the WOL beyond the safe end welds. For flaws present in the region under the WOL, the WOL is expected to blunt or stop their potential for propagation.

   Unacceptable flaws found under the WOL will receive an engineering evaluation. This evaluation will include determination of the extent of the condition. Remaining areas identified as susceptible will be examined for unacceptable flaws. No additional examinations will be performed if no areas are identified as being susceptible to the same cause of the condition. This is consistent with Code Case N-586, "Alternative Additional Examination Requirements for Class 1, 2, and 3 Piping, Components, and Supports."

4. **Please identify when the flaw evaluations and shrinkage stress effects analyses required under Code Case N-504-2(g), Items 2, and 3, will be performed. If the evaluations are to be performed after placing the weld overlays into service, please provide justification why it is acceptable to place these welded components into service without completing the analyses pursuant to 10 CFR 50.55a(a)(3)(ii).**

   STP Response: Flaw evaluations and shrinkage stress effects analyses will be performed before the weld overlays begin, ensuring that the overlays are in compliance with the requirements of Code Case N-504-2 and Appendix Q. The shrinkage assessment and the fatigue crack growth assessment portions of the evaluation will not be fully completed before the pre-weld overlay examinations and the weld overlays are completed. A preliminary shrinkage assessment will be performed using conservative shrinkage estimates based on past experience and shrinkage studies. Shrinkage measurements will be taken after the overlays are completed and will be reconciled with the preliminary shrinkage assessment before the weld overlays are placed in service. Fatigue crack growth curves will allow flaw sizes from the pre-weld overlay examinations to be quickly assessed before the weld overlays are placed in service. The final shrinkage assessment and fatigue crack growth assessments will be included in a final evaluation report after weld overlays are placed in service.

5. **On page 3 of your submittal, you indicate that "the surge line weld overlay area may not exceed 200 in2." A portion of your basis for acceptability is EPRI Technical Report 1003616 which accepts up to 500 in2. If the staff has accepted this topical report through the standard process of review and issuance of a safety evaluation report, please reference the letter accepting this topical report. If the staff has not accepted this topical report by safety evaluation, your discussion should include similarities between your plant(s) and those listed in your precedents section of the submittal and why the resultant overlay(s) will not prevent the component from performing its design function.**

   STP Response: The NRC has not published a safety evaluation specifically accepting EPRI Technical Report 1003616.

   The original relief request included a list of plants that have received NRC approval for a weld overlay on their pressurizer piping. However, not all have asked for the same relief from the 100 in^2 limitation on WOL surface area specified in Code Case N-638-1.

   - Three Mile Island Unit 1 - Three Mile Island was approved by the NRC for a WOL area of 163 in^2 for a 10-inch diameter pipe.
   - Millstone - Millstone Unit 3 did not request relief from the 100 in^2 restriction.
   - Donald C. Cook - As originally approved (December 1, 2005), D. C. Cook Unit 1 did not ask for approval of an alternative to the 100 in^2 limitation. D. C Cook Unit 2 (December 21, 2005) initially asked for as much as 500 in^2, subsequently changing to 300 in^2 (March 1, 2006). A subsequent request from D. C. Cook Unit 1 (June 9, 2006) also asks for an overlay area up to 300 in^2.

   The NRC approved a structural WOL with a 300 in^2 surface for the Susquehanna Steam Electric Station (Accession No. ML051220568) (June 22, 2005). NRC acceptance of the Susquehanna relief request was not based on specific design and stresses but on industry work demonstrating the acceptability of larger areas of ambient temperature temper bead welding. As noted in the NRC acceptance of the Susquehanna application, laboratory

testing and field experience document qualification of the temper bead weld overlay repair for nozzle-to-safe-end welds. This experience demonstrates that the remedy provides a sound joint repair. The NRC staff concluded in the acceptance that the nozzle-to-safe-end weld overlay repairs discussed in the Susquehanna relief requests can be applied to these nozzles without detrimental effects.

Similarly, the NRC has approved a WOL area greater than 100 in^2 for Calvert Cliffs Units 1 and 2 (June 28, 2006). In support of its request, Calvert Cliffs submitted a white paper "Relaxation of the 100 Square Inch Size Limitation-Code Case N-638." The white paper describes analytical and experimental programs that indicate residual stress distributions for weld overlay repairs of 100 in^2 up to 500 in^2 are comparable. The staff has approved requests for some licensees to perform weld overlays that cover more than 100 in^2. Operational experience has shown that these larger weld overlay areas provide reasonable assurance of structural integrity. Based on operational experience with structural weld overlays and the information provided by the licensee, the NRC staff concluded that the licensee's alternative to perform full structural weld overlay on areas up to 500 in^2 provides reasonable assurance of structural integrity of repaired welds.

No clear basis has been documented by the ASME Code Working Group on Welding and Special Repair Processes (the group responsible for CC N-638) for the 100 in^2 area limitation. The ASME Code committees have recognized that the 100 in^2 restriction on the overlay surface area may be excessive and draft code case N-638-3 is currently in development to increase the area limit to 500 in^2. The EPRI report supporting the draft code case examined the issue of residual stresses and cracking associated with the weld overlay application and concludes that the residual stresses are not detrimentally changed and that the tempering effects of the repair are not affected by the size of the overlay.

Only the STP surge line nozzles (16-inch diameter) are impacted by the 100 in^2 limitation on weld surface area. The WOL surface area over ferritic material is expected to be approximately 144 in^2. The surge line nozzle weld area can be assumed to not exceed 200 in^2. For comparison with plants previously approved:

PLANT	SUBMITTED TO NRC	APPROVED BY NRC	PIPE DIAMETER	OVERLAY AREA (in^2)
South Texas Project	05/01/2006	NA	16 in	< 200
Calvert Cliffs	01/18/2006	06/28/2006	12 in	> 100
Three Mile Island	11/03/2003	07/21/2004	10 in	163
Susquehanna	03/26/2004	06/22/2005	30-3/32 in	300

As shown, the South Texas Project WOL is bracketed by the WOL design characteristics of the listed plants for which the NRC has granted approval.

Since the nozzle-to-safe-end welds and 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 low alloy steel material in the nozzle, 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 nozzle is expected to protect against any cracking and limit any distortion that might occur in the nozzle. Laboratory testing and field experience have been documented qualifying the temper bead weld overlay repair for nozzle-to-safe-end welds and these efforts and experience have demonstrated that the remedy provides a quality, sound repair that maintains structural integrity, thus demonstrating an acceptable level of quality and safety. The overlays will not prevent the system from performing its design function. Instead, the overlays will ensure the structural integrity of the piping will continue to be sufficient to support the design function.

6. **On page 6 of your submittal, you state that the alternative is needed during the remainder of the current inspection interval. You go on to state that the duration of the proposed alternative is the remaining service life of the affected components. The staff agrees that the weld overlay(s) will remain in service indefinitely but the Inservice Inspection requirements may change each interval. Please revise your duration accordingly.**

   STP Response:

   This proposed alternative is for application during the current inspection interval which ends September 24, 2010 for Unit 1 and October 8, 2010 for Unit 2. This will allow application of weld overlays at these nozzle safe ends until the requirements of the subsequent interval become effective. The duration of the proposed alternative as implemented is the remaining service life of the affected components. Thus, the installed weld overlays will remain in service for the design life of the affected components. Inservice examination practices will be updated as necessary as inservice inspection requirements change with subsequent inspection intervals.

7. **The submittal requests that Code Case N-416-2 be used as an alternative to the hydrostatic testing requirement under Code Case N-504-2. Is Code Case N-416-2 listed in your current Inservice Inspection Program Plan?**

   STP Response: Code Case N-416-2 is listed in Table 4.1.2 of the current South Texas Project 10-year Inservice Inspection Program Plan.

LIST OF COMMITMENTS

The following table identifies the actions in this document to which the STP Nuclear Operating Company has committed. Statements in this submittal with the exception of those in the table below are provided for information purposes and are not considered commitments. Please direct questions regarding these commitments to Philip Walker at (361) 972-8392.

Commitment	Expected Completion Date	CR Action No.
Flaw evaluations and shrinkage stress effects analyses will be performed before the weld overlays begin, ensuring that the overlays are in compliance with the requirements of Code Case N-504-2 and Appendix Q. The shrinkage assessment and the fatigue crack growth assessment portions of the evaluation will not be fully completed before the pre-weld overlay examinations and the weld overlays are completed. A preliminary shrinkage assessment will be performed using conservative shrinkage estimates based on past experience and shrinkage studies. Shrinkage measurements will be taken after the overlays are completed and will be reconciled with the preliminary shrinkage assessment before the weld overlays are placed in service. (#4)	11/30/2006 (Unit 1) 04/30/2007 (Unit 2)	05-15744-31 05-15744-33
The final shrinkage assessment and fatigue crack growth assessments will be included in a final evaluation report after weld overlays are placed in service. (#4)	12/30/2006 (Unit 1) 05/31/2007 (Unit 2)	05-15744-32 05-15744-34