Nuclear Operating Company

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

June 18, 2008
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File No.: G25
10 CFR 50.55a

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

South Texas Project
Unit 1
Docket No. STN 50-498
Summary Assessment of Pressurizer Nozzle Safe End Weld Overlays:
Shrinkage and Fatigue Crack Growth (RR-ENG-2-43) (TAC Nos. MD1414-1423)

References: 1) Letter dated November 29, 2006, from M. J. Berg, STPNOC, to NRC Document Control Desk, "Summary Assessment of Pressurizer Surge Line Weld Overlay: Shrinkage and Fatigue Crack Growth (RR-ENG-2-43) (TAC Nos. MD1414-1423)" (ML063450122)

2) Letter dated September 28, 2006, from David W. Rencurrel, STPNOC, to NRC Document Control Desk, "Response to 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)" (ML062850090)

Pursuant to 10 CFR 50.55a(a)(3)(i), the STP Nuclear Operating Company (STPNOC) requested approval to use an alternative to the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI for the structural weld overlays on the South Texas Project Unit 1 and Unit 2 pressurizer spray, relief, safety, and surge nozzle safe-ends. NRC approval to perform the structural weld overlays in Unit 1 was given April 2, 2007. The surge nozzle weld overlay was performed during Unit 1 refueling outage 1RE13, and shrinkage and fatigue crack growth are addressed in Reference 1. The pressurizer spray, relief, and safety nozzle safe-end overlays were performed during the April 2008 Unit 1 refueling outage (1RE14).

STPNOC completed a stress analysis of the pressurizer spray, relief, and safety nozzle safe-ends pre-emptive weld overlays prior to restart of Unit 1. A summary of the results is attached. The stress analysis results support the conclusion that structural weld overlays are a suitable pre-emptive measure for anticipated flaw development.

This supplement to the request fulfills commitments made in Reference 2. Mitigative weld overlays for the pressurizer nozzle safe ends in Unit 1 and Unit 2 are complete.

There are no commitments in this submittal.

STI: 32326414

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NRR

If there are any questions, please contact either Mr. Philip L. Walker at (361) 972-8392 or me at (361) 972-7431.

Brandon L. Jenewein
Manager,
Testing/Programs

PLW
Attachment: Summary Assessment of Pressurizer Spray, Relief, and Safety Nozzle Safe-End Weld Overlays: Shrinkage and Fatigue Crack Growth

cc:
(paper copy)

Regional Administrator, Region IV
U. S. Nuclear Regulatory Commission
612 East Lamar Blvd., Suite 400
Arlington, Texas 76011-4125

Mohan C. Thadani
Senior Project Manager
U.S. Nuclear Regulatory Commission
One White Flint North (MS 7 D1)
11555 Rockville Pike
Rockville MD 20852

Richard A. Ratliff
Bureau of Radiation Control
Texas Department of State Health Services
1100 West 49th Street
Austin, TX 78756-3189

C. M. Canady
City of Austin
Electric Utility Department
721 Barton Springs Road
Austin, TX 78704

Senior Resident Inspector
U. S. Nuclear Regulatory Commission
P. O. Box 289, Mail Code: MN116
Wadsworth, TX 77483

(electronic copy)

Thad Hill
Catherine Callaway
Jim von Suskil
NRG South Texas LP

A. H. Gutterman, Esquire
Morgan, Lewis & Bockius LLP

Mohan C. Thadani
U. S. Nuclear Regulatory Commission

J. J. Nesrsta
R. K. Temple
K. M. Pollo
E. Alarcon
City Public Service

C. Kirksey
City of Austin

Jon C. Wood
Cox Smith Matthews

South Texas Project
Unit 1
Summary Assessment of Pressurizer Spray, Relief, and Safety Nozzle Safe-End Weld Overlays:
Shrinkage and Fatigue Crack Growth

Shrinkage Assessment:

Calculated

Limits on design stress due to shrinkage were determined prior to completing the weld overlay. The limits were calculated using WESTDYN 7.1, a program acceptable for use in piping analysis, with an assumed pipe temperature of 70°F. A displacement of 0.25-inch was applied to the pressurizer safe end as cold spring loading for the spray nozzle. This displacement is assumed as the main loading input to represent shrinkage due to the nozzle weld overlay.

The resulting bending stress for the spray nozzle as determined by computer calculations is 13,089 psi. The code allowable stress for this piping at 70°F is 2Sm = 32,000 psi. Consequently, the piping qualifies under code stress requirements where shrinkage does not exceed 0.25-inch.

Actual

Actual shrinkage measured at 90° intervals around the circumference of the spray nozzle weld overlay is 0.203 inch. This shrinkage results in an applied stress of 10,628 psi compared to the Code allowable of 32,000 psi.

The maximum shrinkage measured at 90° increments around the circumference of the three Safety nozzles and the Relief nozzle following the overlay is 0.263-inch on safety nozzle N3. The highest applied bending stress experienced due to shrinkage is 30,589 psi on safety nozzle N4B, compared to the code allowable stress 2Sm = 40,000 psi for this piping at 70°F. Therefore, the three Safety nozzles and the Relief Valve Inlet piping meet the allowable code stresses.

Pressurizer Nozzle	Maximum Shrinkage	Applied Stress	Code Allowable
Spray Nozzle N2	0.203 inch	10,628 psi*	32,000 psi
Safety Nozzle N3	0.263 inch	21,190 psi	40,000 psi
Relief Nozzle N4A	0.181 inch	16,653 psi	40,000 psi
Safety Nozzle N4B	0.219 inch	30,593 psi	40,000 psi
Safety Nozzle N4C	0.248 inch	21,559 psi	40,000 psi

*This stress value was determined as a ratio of the actual shrinkage to the assumed shrinkage (0.25-inch).

In addition, the calculated stress in the unreinforced fabricated tee in the Relief piping determined by applying a Stress Intensification Factor (SIF) is 23,057 psi. The code allowable stress for this piping at 70°F is 2Sm = 28,200 psi. Therefore, the code stress limitation is not exceeded.

The design pressure and normal operating pressure are 2,485 psig and 2,235 psig, respectively. With the additional stress provided by the structural weld overlay, the total stresses remain significantly below the code allowable stress. Because the piping is designed for significantly more shrinkage and still satisfy code design requirements, the actual shrinkage experienced results in even greater safety margin.

Fatigue crack growth assessment:

WCAP-16611-P, "South Texas Units 1 and 2 Pressurizer Safety/Relief, Spray, and Surge Nozzles Structural Weld Overlay Qualification," August 2006, addresses the issue of fatigue crack growth. If an assumed flaw in the piping extends through 75% of the pipe thickness, more than 19 years can be expected to pass before the flaw grows through the base metal. A table below provides the specific nozzle and an expected service life relative to the ratio of assumed initial flaw depth to the original wall thickness.

Pressurizer Safe End	Expected Service Life
Spray Nozzle N2	19 Years
Safety Nozzle N3	40 Years
Relief Nozzle N4A	40 Years
Safety Nozzle N4B	40 Years
Safety Nozzle N4C	40 Years

Consequently, such a flaw would not grow through-wall before the next inservice inspection. There is additional assurance in that post-weld overlay inspection did not identify any flaws in the inspectable volume of the base metal for the pressurizer spray, relief, and safety nozzle safe-end weld overlays.