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

January 26, 2001
NOC-AE-01001221
STI-31383430
10CFR50.55a

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

South Texas Project
Unit 1
Docket No. STN 50-498
Request for Relief from ASME Boiler and Pressure Vessel Code,
Section XI Requirements (Relief Request RR-ENG-2-26)

In accordance with the provisions of 10CFR50.55a(g)(5)(iii), the South Texas Project requests relief from IWA-5250 of Section XI of the ASME Boiler and Pressure Vessel Code. Approval will allow deferral of code repair of a flaw recently identified in the service water Class 3 piping. Repair of the flaw with a code repair at this time is impractical. In accordance with the guidance provided in Generic Letter 90-05 and subject to Nuclear Regulatory Commission approval, code repairs will be implemented no later than the next scheduled Unit 1 refueling outage.

The flaw is a discoloration at four small areas on the exterior of a 3-inch flange located in the Unit 1 Essential Cooling Water Intake Structure. The flange is part of the Essential Cooling Water Screen Wash System, Train C. The discoloration is due to dealloying that has propagated from an interior weld or casting defect. There is currently no visible leakage. Operability and functionality of the system have been maintained, and deferring repair of the flaw will not affect the health and safety of the public.

The attached relief request addresses the present condition of the flange, compensatory actions, and opportunities for effecting code repairs in accordance with the guidelines provided in Generic Letter 90-05.

If there are any questions, please contact either Mr. P. L. Walker at (361) 972-8392 or me at (361) 972-7902.

T. J. Jordan
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KRC/PLW

Attachment: Request for Relief from ASME Boiler and Pressure Vessel Code, Section XI Requirements (Relief Request RR-ENG-2-26)

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SOUTH TEXAS PROJECT
UNIT 1
REQUEST FOR RELIEF FROM ASME BOILER AND PRESSURE VESSEL CODE SECTION XI REQUIREMENTS
(RELIEF REQUEST RR-ENG-2-26)

References:

1. Status of Corrective Actions in the ECW System, M. A. McBurnett to Document Control Desk, dated November 1, 1988(ST-HL-AE-2748)
2. Request for Relief from ASME Boiler and Pressure Vessel Code Section XI Requirements (Dealloying) (Relief Request RR-ENG-35) (Supplement 2), with attached "Calculation of Critical Bending Stress for Dealloyed Aluminum-Bronze Castings in the ECW System," AES-C-1964-1, T. J. Jordan to NRC Document Control Desk, dated August 10, 2000 (NOC-AE-00000816)
3. South Texas Project, Unit 1 – Relief Requests RR-ENG-2-24 and RR-ENG-2-25 (TAC Nos. MB1405 and MB1404), NRC to William T. Cottle, dated August 15, 2001

Reference Code: ASME Boiler and Pressure Vessel Code, Section XI, 1989 Edition

A. Introduction

A1. Component for Which Relief is Requested

(a) Identification: Essential Cooling Water System, Train C Essential Cooling Water screen wash booster pump suction flow orifice 3-inch flange-to-pipe, weld FW 2085, Spool EW-1005-C.

(b) Function: The Essential Cooling Water System is designed to supply cooling water to various safety-related systems for normal plant operation, normal shutdown, and during and after postulated design-basis accidents. The subject flange-to-pipe weld is part of the Train C Intake Screen Wash System.

(c) Class: ASME Code Class 3

(d) Description of the flaw: Areas of recurring discoloration on aluminum-bronze piping have been found at four locations on a 3-inch flange at the flange-to-pipe weld. Discoloration of aluminum-bronze welds indicates a through-wall dealloying defect. However, the small size of the discolored areas indicates the dealloying is relatively minor. There is currently no leakage or surface accumulation of moisture at this location.

A2. Code Requirements From Which Relief is Requested

Relief is requested from the requirements of IWA-5250(a)(3) of ASME Section XI so that code repair of the through-wall flaw in Essential Cooling Water piping may be deferred until the next Unit 1 outage of sufficient duration.

A3. Basis for Relief Request

As stated in Generic Letter 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2 and 3 Piping," a repair is considered to be impractical

if the flaw detected during plant operation is in a section of Class 3 piping that cannot be isolated for completing a code repair within the time period permitted by the limiting condition for operation of the affected system as specified in the plant Technical Specifications, and performance of code repair necessitates a plant shutdown. Performance of code repairs within the allowed outage time for the Essential Cooling Water System at the South Texas Project, as permitted by the limiting condition for operation, may not be practical due to the potential for fit-up problems during repair. Therefore, the South Texas Project requests this relief on the basis of impracticality.

B. Scope, Limitations, and Specific Considerations

B1. Scope

The scope of this relief request covers minor dealloying on a 3-inch flange at the flange-to-pipe weld. The flange is part of the Train C Essential Cooling Water Screen Wash System.

B2. Limitations

Repair of the defect will be deferred until adequate time is available for the repair, but no later than the next Unit 1 refueling outage, provided the condition continues to meet the acceptance criteria of Generic Letter 90-05 and is enveloped by previous studies as described in C3 of this relief request. Compensatory action has been implemented to detect any changes in the condition of the flaw. The next Unit 1 refueling outage is currently scheduled to begin in March, 2003.

B3. Specific Considerations

Consequences of potential system interactions, including flooding, spray on equipment, and loss of flow to the system, have been evaluated and are bounded by Appendix 9A of the South Texas Project Updated Final Safety Analysis Report.

The Essential Cooling Water System is a low-pressure system with normal operating pressures of approximately 50 psig and a design pressure of 120 psig. Therefore, the consequences associated with failure of high-energy lines are not applicable to the Essential Cooling Water System. Flaw evaluation is addressed in paragraph C3.

The structural integrity of piping with dealloying has been evaluated for all design loading conditions including dead weight, pressure, thermal expansion, and seismic loads. The structural integrity is monitored by the following methods:

- Monthly monitoring for qualitative assessment of leakage (quantitative if measurable leaks are observed). Currently there is no measurable leakage.
- Continuation of Essential Cooling Water System large bore piping periodic walkdowns. These walkdowns are regularly scheduled VT-2 examinations. The inspection technique has proven to be an effective means of identifying dealloyed/cracked components prior to deterioration of structural integrity margins below ASME Section XI requirements.

Structural integrity and the monitoring frequency will be re-evaluated if significant changes in the condition of the dealloyed area are found during this monitoring.

Additional discussion is provided in the South Texas Project Updated Final Safety Analysis Report, Appendix 9A, "Assessment of the Potential Effects of Through-Wall Cracks in ECWS Piping".

C. Evaluation

C1. Flaw Detection During Plant Operation and Impracticality Determination

The flaw was identified on November 26, 2001, during normal Unit 1 plant operations while performing the periodic examination of Essential Cooling Water large bore piping.

Performance of code repairs within the time allowed by the limiting condition for operation may not be practical due to the potential for fit-up problems during repair. The South Texas Project prefers to perform the code repair under controlled conditions during a scheduled outage that is long enough for the necessary repairs to be made as long as the specific considerations listed above are met.

C2. Root Cause Determination and Flaw Characterization

The root cause of dealloying is a combination of corrosion and stress. The dealloying process normally initiates from a crevice such as the area behind a backing ring, a fabrication-induced flaw, or a casting flaw. Dealloying in this case is believed to be the result of a combination of an existing crevice and susceptible material. The South Texas Project has performed laboratory analyses, calculations, and proof testing on welded aluminum-bronze material to address dealloying and cracking in dealloyed aluminum-bronze welds.

Areas of recurring discoloration on aluminum-bronze piping have been found at four locations on a 3-inch flange at the flange-to-pipe weld. Discoloration of aluminum-bronze welds indicates a through-wall dealloying defect. However, the small size of the discolored areas indicates the dealloying is relatively minor. There is currently no leakage or surface accumulation of moisture at this location.

C3. Stress and Fracture Evaluation

The South Texas Project has performed laboratory analyses, calculations, and proof-testing on welded aluminum-bronze material to address dealloying and cracking in dealloyed material. The process of dealloying of aluminum-bronze has been described in previous communications with the NRC (Reference 1).

The South Texas Project has analyzed through-wall flaws in Essential Cooling Water piping and found that degradation progresses slowly. Rapid or catastrophic failure due to dealloying defects is not a concern. Dealloying produces detectable leakage before flaws reach a limiting size that would affect the operability of the Essential Cooling Water System. The flaws are monitored and inspected to ensure detection of leakage. These compensatory actions taken following discovery of this condition provide assurance that changes in the condition will be monitored and analyzed for further action as needed.

Previous stress evaluations of flanges by Bechtel assumed 100% of the joint material had been dealloyed. In the evaluation, Bechtel used lower material strengths obtained by actual tensile tests of dealloyed samples. ASME Code stress allowable is verified using the lower dealloyed material strength. Since dealloying was only visible at four small locations on the 3-inch flange to the flange-to-pipe weld, the analysis assuming 100% dealloying conservatively envelopes this condition and demonstrates an acceptable margin with respect to ASME Section III requirements.

For fracture analysis, limit load and fracture mechanics analyses were performed using the methodology of ASME Code, Section XI. These are also similar to methods

approved by NRC in Code Case N-513. For this analysis, the dealloyed area is modeled conservatively as a through-wall circumferential crack and then analyzed for fracture. Fracture mechanics analyses correlating critical bending stress versus crack size were performed for all flange sizes (Reference 2). Flanges have been the majority of dealloyed components exhibiting leaks. The Code requirements for margin of safety have been maintained in the case of flanges previously cut out and analyzed.

The subject flaw is similar to a flaw previously identified in the Train B Essential Cooling Water screen wash booster pump flow orifice 3-inch flange-to-pipe, weld FW 2068, Spool EW-1003-B. The earlier flaw was addressed in relief request RR-ENG-2-25 which was approved by the NRC in reference 3. The two flaws were found on identical flanges in the same general location and are of about the same magnitude. Therefore, the justification for relief previously accepted by the NRC is applicable to the subject flaw.

C4. Augmented Inspection

Augmented monthly inspections have been implemented to detect any changes in the size of the discolored area or leakage. A significant change in the flaw will require additional engineering attention to confirm that the technical justification of this relief request remains valid.