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

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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
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Rockville, MD 20852

South Texas Project
Unit 1
Docket No. STN 50-498
Request for Relief from ASME Boiler and Pressure Vessel Code,
Section XI Requirements for the Essential Cooling Water System
(Relief Request RR-ENG-2-42)

In accordance with the provisions of 10 CFR 50.55a(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 Essential Cooling Water (ECW) 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.

Indication of through-wall dealloying has been found on a flange of the ECW return line from 150-ton Essential Chiller 11B. This chiller unit is abandoned in place, but the area of the flaw is exposed to normal ECW system operating pressure. Residue buildup near the flange weld suggests that seepage through the flaw is active. Evaluation of the flaw using fracture mechanics methodology provided by NRC Generic Letter 90-05 determined that the structural integrity of the ECW piping is not adversely affected.

The attached relief request addresses the present condition of the pipe section, and implementation of compensatory and corrective actions in accordance with the guidelines provided in Generic Letter 90-05. 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.

A list of commitments in the request is attached.

If there are any questions, please contact either Mr. P. L. Walker at (361) 972-8392 or me at (361) 972-8922.

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Acting Manager,
Design Engineering

PLW

Attachments: 1) Request for Relief from ASME Boiler and Pressure Vessel Code, Section XI Requirements for the Essential Cooling Water System (Relief Request RR-ENG-2-42)

2) List of Commitments

A047

STI No. 31929539

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SOUTH TEXAS PROJECT
UNIT 1
REQUEST FOR RELIEF FROM ASME BOILER AND PRESSURE VESSEL CODE, SECTION XI REQUIREMENTS FOR THE ESSENTIAL COOLING WATER SYSTEM (RELIEF REQUEST RR-ENG-2-42)

1. Component for Which Relief is Requested

   (a) Description:

   Unit 1 Train B Essential Cooling Water (ECW) System, 6-inch flange downstream from 150-ton Essential Chiller 11B

   (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 piping is a return line from 150-ton Essential Chiller 11B. This chiller unit is abandoned in place, but the area of the flaw is exposed to normal ECW system operating pressure.

   (c) Class:

   ASME Code Class 3

   (d) Description of the flaw:

   Indication of through-wall dealloying measuring 1-inch by 1/4-inch has been found on a flange of the ECW return line downstream from 150-ton Essential Chiller 11B. Residue buildup at a spot near the flange weld suggests that seepage through the flaw is active. The flawed area includes a potential linear indication 9/16-inch long. This indication appears to be a tight crack and any leakage is not readily measurable.

2. Applicable Code Edition and Addenda:

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

3. Applicable Code Requirement:

   Relief from the requirements of ASME Section XI IWA-5250(a)(3) is requested so that code repair of the through-wall flaw at this location may be deferred until the next outage of sufficient duration but not later than the next refueling outage provided the conditions of Generic Letter 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2 and 3 Piping," are met.

4. Flaw Detection

   The flaw was identified on July 27, 2005, during the periodic examination of Essential Cooling Water large bore piping. Unit 1 was in Mode 1 at 100% power.

5. Impracticality Determination

   As stated in Generic Letter 90-05, an ASME Code repair is required for Code Class 1, 2, and 3 piping unless specific written relief is granted by the NRC. Relief is appropriate when performing the repair at the time of discovery is determined to be impractical.

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 to complete 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, is not practical due to the amount of time required to implement the repair, and the potential for fit-up problems during repair. A plant shutdown may be necessary to complete the repair. Therefore, the South Texas Project requests this relief on the basis of impracticality.

6. Proposed Alternative and Basis for Use

6.1 Proposed Alternative

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. The next Unit 1 refueling outage is currently scheduled to begin in October 2006. Compensatory action has been implemented to detect changes in the condition of the flaw.

6.2 Basis for Use

6.2.1 Scope

Indication of through-wall dealloying measuring 1-inch by 1/4-inch has been found on a 6-inch flange of the ECW return line downstream from 150-ton Essential Chiller 11B. Residue buildup near the flange weld suggests that seepage through the flaw is active. The flawed area includes a potential linear indication 9/16-inch long. This indication appears to be a tight crack and any leakage is not readily measurable.

6.2.2 Specific Considerations

Consequences of potential system interactions, including flooding, spray on equipment, and loss of flow to the system, are addressed in Appendix 9A of the South Texas Project Updated Final Safety Analysis Report, "Assessment of the Potential Effects of Through-Wall Cracks in ECWS Piping".

The 150-ton Essential Chiller unit has been abandoned in place, but the flaw location is exposed to normal ECW system operating pressure. The ECW 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 this relief request.

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.

6.2.3 Root Cause Determination

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 similar to dealloying seen in other susceptible aluminum-bronze components. The process by which dealloying of aluminum-bronze occurs has been described in previous communications with the NRC (Reference 8.1).

6.2.4 Flaw Evaluation

In assessing the structural integrity of partially dealloyed aluminum-bronze piping components, a conservative evaluation has been performed to assure that adequate margins remain. This was accomplished by evaluating the condition where the dealloyed region is assumed to have lost its load carrying capacity and will behave like a crack-like flaw. Under these conditions, flaw evaluation procedures similar to Section XI of the ASME Code have been applied.

Unlike some carbon steels and low-alloy steels, aluminum bronze is inherently ductile and tough. This stems from its crystal structure which is like that of Type 304 stainless steel. Thus, the fracture resistance of aluminum bronze is expected to be high and the affected fittings will be relatively insensitive to material flaws such as cracks.

Aluminum-bronze is not expected to behave in a non-ductile manner; however, linear elastic fracture mechanics techniques (LEFM) have established the load carrying capacity of partially dealloyed fittings when treating the dealloyed region as a crack-like flaw. When LEFM principles are applied, flaw tolerance can be quantified in terms of applied stress, flaw size and shape, and the material fracture toughness. Selection of conservative values for fracture toughness, and a conservative representation of the size and extent of dealloying as a flaw, gives a conservative determination of the structural capacity.

The structural integrity of the flanged piping was assessed using the "through-wall flaw" evaluation approach provided in Section C.3.a of Enclosure 1 to NRC Generic Letter 90-05. This approach evaluates the flaw stability by LEFM methodology. To summarize the results:

s = predicted bending stress at the flaw location

s = 10.1 ksi

K = stress intensity factor

$K = 24\ \text{ksi-in}^{1/2}$

For flaw stability, this methodology specifies "K" should be less than the critical stress intensity factor which represents the fracture toughness of the material. The fracture toughness of the aluminum-bronze ranges from 63.5 to 95.1 $\text{ksi-in}^{1/2}$.

Stresses	Pressure + Dead Weight	Faulted	Thermal
Stress (psi)	942	3286	5349
Allowable Stress (psi)	18000	43200	27000
Safety Margin	19.1	13.14	5.04

The calculated safety margins are adequate for the various loading conditions

6.2.5 Augmented Inspection

Augmented monthly inspections have been implemented to detect changes in the size of the discolored area or leakage. 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.

6.2.6 Conclusion

The South Texas Project has analyzed through-wall flaws in Essential Cooling Water piping and found that degradation progresses slowly. Dealloying produces detectable leakage before flaws reach a limiting size that would affect the operability of the Essential Cooling Water System. Rapid or catastrophic failure due to dealloying defects is not a concern. Flaws are monitored and inspected to ensure detection of leakage. Continued inspection provides assurance that changes in the condition of the flaws will be identified and assessed for further action as needed. Evaluation of the flaw using fracture mechanics methodology provided by NRC Generic Letter 90-05 concluded that the structural integrity of the ECW piping is not adversely affected. 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.

7. Duration of Proposed Alternative

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. The next Unit 1 refueling outage is currently scheduled to begin in October 2006.

8. References:

8.1 Status of Corrective Actions in the ECW System, M. A. McBurnett to Document Control Desk, dated November 1, 1988 (ST-HL-AE-2748)

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.
Augmented monthly inspections have been implemented to detect changes in the size of the discolored area or leakage. 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.	11/10/2006	05-9622-6
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.	11/17/2006	05-9622-8