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February 10, 1997
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File No.: G09.16
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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

South Texas Project
Unit 2
Docket No. STN 50-499
Request for Relief from ASME Boiler and Pressure Vessel Code,
Section XI Requirements (Relief Request RR-ENG-17)

In accordance with the provisions of 10 CFR 50.55a(g), the South Texas Project requests relief from IWA 5250 of Section XI of the ASME Boiler and Pressure Vessel Code (ASME XI) in order to defer permanent repair of a flaw recently identified in the Essential Cooling Water System piping. The South Texas Project intends to perform a code repair of the flaw in Unit 2 in the next Unit 2 refueling outage, scheduled to begin on February 8, 1997.

The South Texas Project has evaluated the Essential Cooling Water System flaws and determined that the operability and functionality of the system have been maintained and that deferring repair of the flaws will not affect the health and safety of the public.

The South Texas Project has evaluated the condition of the Essential Cooling Water System piping in accordance with the guidance of Generic Letter 90-05. Attached is an evaluation providing the basis for the requested relief.

If there are any questions, please contact Mr. A. W. Harrison at (512) 972-7298 or me at (512) 972-7162.

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Manager,
Design Engineering

PLW/
Attachment: Request for Relief from ASME Boiler and Pressure Vessel Code, Section XI Requirements (Relief Request RR-ENG-17)

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Project Manager on Behalf of the Participants in the South Texas Project

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SOUTH TEXAS PROJECT UNIT 2
REQUEST FOR RELIEF FROM ASME BOILER AND PRESSURE VESSEL CODE, SECTION XI REQUIREMENTS
(RELIEF REQUEST RR-ENG-17)

References:

1. Letter to NRC dated November 1, 1988, with attached Bechtel National/Aptech report 8804-06FA Rev. 3 (ST-HL-AE-2748)

2. Engineering Report #91-201-12 Revision 0, "ECW System Failures and Their Analysis".

3. Bechtel Calculation RC9890, Revision 0, "Stress Summary for Large Bore ECW Piping (2 ½" and Above)".

Reference Code: ASME Boiler and Pressure Vessel Code, Section XI
1983 Edition through Summer 1983 Addenda

A. Introduction

A1. Components For Which Exemption Is Requested:

(a) Name and Identification Number: Class 3, moderate energy piping in the Essential Cooling Water system:

Unit 2 Essential Cooling Water line 10"-EW-2306-KK

(b) Function: The Essential Cooling Water system is designed to supply cooling water to various safety-related systems for normal plant operation as well as normal shutdown and during and after postulated Design Basis Accidents. See Section 9.2.1.2 of the South Texas Project Updated Final Safety Analysis Report for additional information.

(c) Class: ASME Code Class 3

(d) Description of the problem:

A small spot of dealloying was found in a 10"x10"x6" cast tee joint. The dealloying is on the bottom side of the tee joint.

A2. Code Requirement From Which Relief is Requested:

Relief is requested from IWA-5250 of ASME Section XI in order to defer repair or replacement of Essential Cooling Water piping containing through-wall flaws.

A3. Basis for Relief Request:

The South Texas Project has analyzed the effect of through-wall flaws in Essential Cooling Water piping and found that, since the degradation is slow, rapid or catastrophic failure is not a consideration, and determined that the leakage can be detected before the flaw reaches a limiting size that would affect the operability of the Essential Cooling Water System. A monitoring and inspection program provides confidence in the ability to detect the leakage. Additional discussion is provided in South Texas Project Updated Final Safety Analysis Report Appendix 9A, "Assessment of the Potential Effects of Through-Wall Cracks in ECWS Piping."

This relief request is submitted in accordance with NRC Generic Letter 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping", which observes that required code repairs may be impractical for a flaw detected during plant operation unless the facility is shut down, and that relief may be granted pursuant to 10CFR50.55a(g)(i). The following information and justification is provided in accordance with the guidelines of Parts B and C of Enclosure 1 to GL 90-05.

This relief request is similar to South Texas Project Relief Request RR-ENG-14 submitted by letter ST-HL-AE-5377 on May 31, 1996. The corresponding NRC Safety Evaluation for Relief Request RR-ENG-14 was dated December 11, 1996.

B. Scope, Limitations and Specific Considerations

B1. Scope

This scope includes a dealloyed spot on the Unit 2 10"X10"X6" cast tee on piping spool 10"-EW-2306-KK. The cast tee is ASME SB 271 CA952. Volumetric ultrasonic examination of the affected area revealed no linear indications of cracking. The discovered through-wall flaw is the result of a previously analyzed dealloying process in aluminum-bronze cast fittings.

The problem of dealloying of castings has been described in previous communications with the NRC (Reference 1). The South Texas Project has also performed laboratory analyses, calculations, and proof testing on cast aluminum

bronze material to address cracking in dealloyed aluminum bronze castings. Flaw evaluation is addressed in paragraph C3.

B2. Limitations

During scheduled Essential Cooling Water System visual inspections of Unit 2 to detect leakage, corrosion deposits consistent with dealloying were found on the 10"x10"x6" cast tee. Under this relief request, the defects will be permitted to leak, based on existing evaluations of structural integrity and consequences of leakage. The South Texas Project intends to perform a code repair of the flaw in Unit 2 in the next Unit 2 refueling outage, scheduled to begin on February 8, 1997.

B3. Specific Considerations

System interactions, including consequences of flooding and spray on equipment as well as potential significance of 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 structural integrity of piping with dealloying has been evaluated for all design loading conditions, including dead weight, pressure, thermal expansion, and seismic loads. Flaw evaluation is addressed in Paragraph C3.

The structural integrity is monitored by the following methods:

- Weekly monitoring for qualitative assessment of leakage (quantitative if measurable leaks are observed; currently there is no measurable leakage).

- Continuation of the Essential Cooling Water System monthly walkdown. This walkdown is a regularly scheduled VT-2 examination of the Essential Cooling Water System including all cast components. This 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 (Reference 2).

Significant changes found during this monitoring will be followed by a reevaluation of structural integrity and the monitoring frequency.

The temporary non-Code repair consists of leaving the identified flaw as is until permanent Code repairs can be made in the next Unit 2 refueling outage, which is scheduled to begin on February 8, 1997, subject to monitoring as described above,

and subject to meeting the criteria for consequences and for structural integrity as described above.

C. Evaluation

C1. Flaw Detection During Plant Operation and Impracticality Determination

The flaws were detected during plant operation. Code repairs are intended to be performed in the next Unit 2 refueling outage, scheduled to begin on February 8, 1997. Performance of Code repairs with assurance of completion within the time period permitted by the limiting condition for operation may not be practical due to a number of factors including:

- Potential for fit-up problems during repair, which may extend the schedule beyond the limiting condition for operation time;
- Potential need for access to the inside surface, which may require disassembly of additional equipment;
- Extended time required for draining these portions of the Essential Cooling Water System.

The South Texas Project prefers to perform the Code repairs under controlled conditions during a scheduled outage longer than allowed by a limiting condition of operation, provided the structural integrity is assured in the interim.

C2. Root Cause Determination and Flaw Characterization

The root cause of dealloying has been studied in several previous laboratory failure analyses. The dealloying process normally initiates from a crevice such as a backing ring, a fabrication-induced flaw, or a casting flaw. A dealloying area may include cracks. Failure analysis indicates that the crack propagation occurred by a process of dealloying along the crack front. Previous examples of such cracks were found to have initiated from pre-existing flaws exposed to Essential Cooling Water.

The flaws were measured by visual inspection. The Unit 2 6-inch tee to flange joint was found to have one dealloyed spot. Radiographic inspection of the Unit 2 6-inch tee to flange joint found no linear indications. Indications found were consistent with casting defects which most likely were the initiation point for dealloying.

C3. Flaw Evaluation

A previous evaluation of a Unit 2 6-inch tee to flange joint by Bechtel assumed that 100% of the joint had been dealloyed. In the evaluation, Bechtel used lower allowables which were obtained by actual tensile tests of dealloyed samples. Since dealloying was only visible in two spots in that case, and in only one spot in this case, assuming 100% dealloying conservatively envelopes this situation. With this conservative assumption, the analysis of the Unit 2 10"X10"X6" cast tee is bounded by the Bechtel calculation and demonstrates that there is an acceptable margin to meet ASME Section III requirements . (Reference 3).

C4. Augmented Inspection

The South Texas Project has analyzed the effects of cracking/dealloying in castings and found that the degradation is slow so that rapid or catastrophic failure is not a consideration, and determined that the leakage can be detected before the flaw reaches a limiting size that would affect the operability of the Essential Cooling Water System. In addition, 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. As a result, the severe failure consequences associated with high energy lines are not applicable for the Essential Cooling Water System.

The Essential Cooling Water System is inspected monthly for leaks or indications of dealloying including all cast fittings. As demonstrated in this particular instance, the periodic visual inspection monitoring technique has identified problems well in advance of any structural concerns for the Essential Cooling Water System. Numerous destructive laboratory analyses have provided augmented inspection information on cracking and dealloying in castings.

Weekly inspections of the identified through-wall flaw will be conducted to verify the slow rate of dealloying and measure any leakage.

The identical tees in the other five diesel generator trains will be inspected for similar indications of through-wall dealloying. This special inspection is scheduled for February, 1997.