

December 20, 2002

Mr. William T. Cottle  
President and Chief Executive Officer  
STP Nuclear Operating Company  
South Texas Project Electric  
Generating Station  
P. O. Box 289  
Wadsworth, TX 77483

SUBJECT: SOUTH TEXAS PROJECT (STP), UNIT 1- RE: REQUEST FOR RELIEF FROM  
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) AND  
PRESSURE VESSEL CODE SECTION XI REQUIREMENT (RELIEF REQUEST  
RR-ENG-2-26) (TAC NO. MB3841)

Dear Mr. Cottle:

By letter dated December 26, 2001, STP Nuclear Operating Company (STPNOC), submitted a request for relief from the ASME Code, Section XI requirements. Specifically, the licensee requested a deferral of Code repair of flaws recently identified in the service water Class 3 piping in the STP Unit 1 Essential Cooling Water Intake Structure. The licensee provided clarifying information for Relief Request RR-ENG-2-26 by electronic communications on August 22, 2002 (ML023120232) and October 8, 2002 (ML023120236).

The U. S. Nuclear Regulatory Commission (NRC) staff concludes that it is impractical to comply with the Code requirements, and that the licensee proposed alternative to the Code requirements will provide reasonable assurance of the structural integrity of the subject components. Therefore, the STPNOC's proposed relief for the STP, Unit 1 (Relief Request RR-ENG-2-26) is authorized pursuant to 10 CFR 50.55a(g)(6)(i) until the next scheduled refueling (March 2003) or an outage of sufficient duration if earlier to perform the repair.

The NRC staff's safety evaluation is enclosed.

Sincerely,

*/RA/*

Robert A. Gramm, Chief, Section 1  
Project Directorate IV  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-498

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
REQUEST FOR RELIEF FROM THE ASME CODE REPAIRS REQUIREMENTS  
FOR ASME CODE CLASS 3 PIPING  
STP NUCLEAR OPERATING COMPANY  
SOUTH TEXAS PROJECT, UNIT 1

DOCKET NO. 50-498

1.0 INTRODUCTION

By letters dated December 26, 2001, STP Nuclear Operating Company, submitted a request for relief from the ASME Code, Section XI requirements. Specifically, the licensee requested a deferral of Code repair of flaws recently identified in the service water Class 3 piping in the South Texas Project (STP), Unit 1 Essential Cooling Water Intake Structure. The licensee provided clarifying information for Relief Request RR-ENG-2-26 by electronic communications on August 22, 2002 (ML023120232) and October 8, 2002 (ML023120236).

2.0 REGULATORY EVALUATION

Section 10 CFR 50.55a(g) requires nuclear power facility piping and components to meet the applicable requirements of Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (hereafter referred to as the Code). Section XI of the Code specifies Code-acceptable repair methods for flaws that exceed Code acceptance limits in piping that is in-service. A Code repair is required to restore the structural integrity of flawed Code piping, independent of the operational mode of the plant when the flaw is detected.

A licensee may submit requests for relief from certain Code requirements when a licensee has determined that conformance with a Code requirement is impractical for its facility [10 CFR 50.55a(g)(5)(iii)]. Pursuant to 10 CFR 50.55a(g)(6)(i), the Commission will evaluate determinations of impracticality. The Commission may grant relief and may impose alternative requirements "as it determines is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility" 10 CFR 50.55a(g)(6)(i).

Generic Letter (GL) 90-05, entitled "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2 and 3 Piping," dated June 15, 1990, provides guidance for the NRC staff in evaluating relief requests submitted by licensees for temporary non-Code repairs of

Code Class 3 piping. For the purpose of this letter, impracticality exists if the flaw detected during plant operation is in a section of Class 3 piping that cannot be isolated for a Code repair within the time period permitted by the limiting condition for operation of the affected system as specified in the plant's technical specifications (TSs), and performance of a Code repair necessitates a plant shutdown.

### 3.0 TECHNICAL EVALUATION

During plant operation in the current fuel cycle, the licensee discovered a flaw on the outside diameter surface of a 3-inch flange located in the Essential Cooling Water Screen Wash System, Train C of STP, Unit 1. The discovered flaw is a recurring discoloration of four small areas at a 3-inch flange near a flange-to-pipe weld. The flange is made of aluminum-bronze casting material. The discoloration was determined by the licensee to be due to de-alloying that has initiated from the interior of the component and indicates a through-wall defect. However, the small size of the discolored areas suggests the de-alloying is relatively minor. There is currently no visible leakage or accumulation of moisture at the flaw location. By letter dated December 26, 2001, the licensee requested relief from the ASME Code, Section XI repair or replacement requirements under the provisions of 10 CFR 50.55a(g). Clarifying information to supplement the licensee's submittal was obtained in two conference calls with the licensee which were held on August 21, and September 30, 2002, respectively. The licensee's relief request is supported by a root cause determination and flaw characterization, a flaw evaluation, an augmented inspection program, a schedule for effecting a code repair, and discussion of some specific considerations.

The Essential Cooling Water System (ECWS) 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. During Unit 1's last operating cycle, similar recurring discoloration was found on a 3-inch flange in Train B and a 30-inch by 30-inch by 14-inch pipe tee in Train 1A of the Essential Cooling Water Screen Wash System. The licensee submitted relief requests to defer Code repairs of those degraded components. The relief requests were approved by the NRC in a safety evaluation dated August 15, 2001.

### 4.0 LICENSEE'S RELIEF REQUESTS

#### 4.1 Component for Which Relief is Requested

A 3-inch flange (ASME Code Class 3) at the flange-to-pipe weld (weld FW 2085 and Spool EW-1005-C) in Train C of the Essential Cooling Water Screen Wash System at STP, Unit 1.

#### 4.2 ASME Section XI Edition for South Texas Project, Unit 1

ASME Boiler and Pressure Vessel Code Section XI, 1989 Edition with no addenda.

#### 4.3 Relief from ASME Section XI Code Requirement

The ASME Code Section XI requires that repairs or replacement of ASME Code Class components be performed in accordance with rules delineated in the code. Relief is requested from the requirements of IWA-5250(a)(3) of ASME Section XI so that Code repairs of the through-wall flaw in Essential Cooling Water Piping may be deferred until the next Unit 1

refueling outage. Specifically, relief is sought from performing a Code repair or replacement of a 3-inch flange at the flange-to-pipe weld (weld FW 2085 and Spool EW-1005-C) in the ECWS at STP, Unit 1. The upcoming Unit 1 refueling outage is currently scheduled to begin in March 2003.

#### 4.4 Bases for Relief

The licensee has determined that it is impractical to perform the Code repair of the referenced component within the time frame allowed by the limiting condition for operation (LCO) as specified in the plant's TS. This is due to the potential fit-up problems which the licensee may encounter during repair and that these problems may not be resolved within the time frame allowed by the TS LCO. If the Code repair could not be completed within the time frame allowed by the LCO, a plant shutdown would be necessary.

GL 90-05 provides evaluation guidelines for temporary non-Code repairs of Code Class 3 piping in moderate energy systems. The licensee performed an evaluation of the flawed component in accordance with the guideline provided in GL 90-05. The results of the licensee's evaluation showed that the flaw in the 3-inch flange component satisfies the acceptance criteria provided in GL 90-05 for non-code repairs.

#### 4.5 Licensee's Alternative Program

In lieu of a Code repair, the licensee proposed to perform the following alternative inspection to ensure the structural integrity of the flawed component and other components susceptible to de-alloying in the ECWS:

- (1) Monthly monitoring for qualitative assessment of leakage (quantitative if measurable leaks are observed). Currently there is no measurable leakage. In addition, the change in the size of the discoloration will also be monitored.
- (2) Continuation of ECWS large bore piping periodic walk-downs. These walk-downs are regularly scheduled (twice every year) and performed by VT-2 examination.

### 5.0 STAFF'S EVALUATION AND CONCLUSION

#### 5.1 Impracticality Determination

In GL 90-05, impracticality is defined to exist if the flaw detected during plant operation is in a section of Class 3 piping that cannot be isolated and the performance of a code repair may require a plant shutdown, if it cannot be completed within the time period permitted by the LCO as specified in the plant's TSs.

The flaw (de-alloying) at the 3-inch flange was found during normal STP, Unit 1 plant operations while performing the periodic examination of Essential Cooling Water (ECW) large bore piping. The licensee has a concern about immediately performing a Code repair because the plant would have to shut down if the potential fit-up problem cannot be resolved within the time frame allowed by the LCO in the TS. The licensee's concern is reasonable as the unanticipated plant shutdown would result in a burden upon the licensee's operation of the plant. In addition the discovered de-alloying was very minor and would not have any impact on

the operability of the ECW system. The unanticipated plant shutdown will create transients in the operating plant. These transients resulting from cool down and heat up of the plant are not desirable, because they can challenge the integrity of the reactor vessels as well as the safety related piping. Furthermore, the additional cycles of plant cool down and heat up will reduce the margins to the allowable fatigue usage factors of those components. Therefore, based on a comparison of potential failure consequences, an unanticipated plant shutdown resulting from a code repair could have a much larger safety impact on the plant operation than that resulting from a non-Code repair of a Class 3 piping weld. Because immediate performance of the subject Code repair will not provide an overall compensating increase in the level of quality and safety, the resulting burden is not justified. Therefore, the NRC staff has determined that the licensee's impracticality determination is acceptable, because the bases of the determination are consistent with those defined in GL 90-05.

## 5.2 Root Cause Analysis and Flaw Characterization

The licensee has determined that the root cause of the detected flaw in the 3-inch flange is due to de-alloying. The 3-inch flange is made of aluminum-bronze cast material and is susceptible to de-alloying. The de-alloying is normally caused by the presence of a crevice condition in a susceptible material. A crevice condition could be created in an area with the presence of a backing ring, a fabrication-induced flaw, or a casting flaw. In 1988, the licensee performed a metallurgical failure analysis and structural integrity evaluation of some leaking small bore (2-inch diameter and smaller) aluminum-bronze cast valve bodies and fittings in the ECW system at the STP, Unit 1. The metallurgical failure analysis showed that the de-alloying is a slow degradation process which can produce detectable leakage. The leakage may have the potential of affecting the operability of ECWS if not mitigated in a timely manner.

Recurring discoloration was found at four locations on a 3-inch aluminum-bronze cast flange near the flange-to-pipe weld. Discoloration on the outside-diameter surface of the flange indicates a through-wall defect because the de-alloying was initiated from the inside-diameter surface of the component. Since the areas of discoloration are very small, the extent of de-alloying is expected to be relatively minor. Furthermore, there is currently no leakage or surface accumulation of moisture at the areas of discoloration.

## 5.3 Code Piping Classification

The licensee stated that the ECWS in STP, Unit 1 is a low-pressure system with a normal operating pressure of approximately 50 psig and a design pressure of 120 psig. The operating temperature of the ECW system varies from 45 °F to 95 °F and the design temperature is 150 °F. Furthermore, in the TS, the ECW intake temperature is limited to 99 °F. In accordance with GL 90-05, the piping in this system is qualified as code Class 3 piping in moderate energy systems. For code Class 3 piping in moderate energy systems, temporary non-code repairs may be considered when the acceptance criteria provided in GL 90-05 are met.

## 5.4 Structural Integrity Evaluation

For the structural integrity evaluation, the fracture analysis (limit load and fracture mechanics analysis) was performed using the methodology of ASME Code, Section XI. The evaluation of piping structural integrity considered all design loading conditions including dead weight, pressure, thermal expansion, and seismic loads. The critical bending stress for de-alloyed

aluminum-bronze castings with cracks and without cracks (only de-alloying) were calculated. Because the reported areas of de-alloying in through-wall extent are very minor, the results of the flaw evaluation found that the subject flaws satisfy the acceptance criteria of the “through-wall” approach as prescribed in GL 90-05.

Based on a review of the licensee’s flaw evaluation, the NRC staff has determined that there is reasonable assurance that the structural integrity of the subject 3-inch flange will be maintained when the flaw is left as-is. Therefore, immediate code repair of the subject flange is not necessary.

#### 5.5 System Operability and System Interactions

The flaw found at the 3-inch flange is very minor and showed no sign of leakage. Therefore, it is not expected to have any impact on the operability of ECWS in the short term. However, the extent of de-alloying will grow with time which may lead to leakage. Since de-alloying is a slow degradation process, it is reasonable to expect that the leakage prior to impacting the operability of ECWS will be detected by the augmented inspection. The augmented inspection is implemented during the current cycle to ensure structural integrity of the degraded component which is discussed in Section 5.6.

The licensee has evaluated the potential system interactions such as the consequences of flooding and spraying water on equipment and loss of flow to the system. The consequences are bounded by Appendix 9A of the STP Updated Final Safety Analysis Report.

Since the degradation by de-alloying in the aluminum-zinc alloy materials is a slow process, rapid or catastrophic failure due to de-alloying is not a credible event. In addition, any leakage or increased extent of degradation developed in the future will be detected and monitored by the augmented inspection program implemented in the current fuel cycle. Therefore, significant system interactions and loss of flow to the system are not likely to occur during the remainder of the current fuel cycle.

#### 5.6 Augmented Inspection

To ensure the structural integrity of the degraded flange, the licensee has implemented a monthly monitoring program for qualitative assessment of leakage (quantitative if measurable leaks are observed) and the extent of degradation due to de-alloying at the subject flange. The licensee will re-evaluate the structural integrity of the flange and the monitoring frequency when significant changes in the condition of the de-alloyed areas or leakage are found. In addition, the periodic walk-downs of the ECWS large bore piping will continue to be performed to ensure timely detection of de-alloying in other components in ECWS. Because de-alloying is a slow process and will produce detectable leakage prior to reaching the critical flaw size, the NRC staff has determined that the augmented inspection program will provide reasonable assurance that the structural integrity of the degraded flange will be maintained.

#### 5.7 Temporary Non-Code Repair

GL 90-05 provides guidance for temporary non-code repair of Code Class 3 piping in moderate energy systems. The guidance, in part, allows the flaws in the degraded component to be left as-is if there is no leakage and the flaws are found acceptable by the “through-wall flaw”

approach in GL 90-05. As discussed above, the licensee's flaw evaluation and proposed augmented inspection program are consistent with the guidance provided in GL 90-05; therefore, the licensee's proposed alternative to code repair of the subject flange is acceptable. In addition, the licensee will repair the flaw during the next scheduled refueling outage (March 2003) or an outage of sufficient duration, if earlier.

#### 6.0 Staff Conclusions

The NRC's staff has determined that the licensee's evaluation is consistent with the guidance provided in GL 90-05 and the results of the evaluation meet the acceptance criteria for temporary non-Code repairs. Specifically, the NRC staff finds the licensee's structural integrity evaluation to be acceptable. In addition, the licensee's augmented inspection program to monitor the degraded flange on a monthly basis is an acceptable alternative to a Code repair, because it will provide reasonable assurance that the structural integrity of the degraded flange will be maintained. Therefore, the NRC staff concludes that it is impractical to comply with the Code requirements for repair, and that the licensee's proposed alternative to the Code requirements is authorized pursuant to 10 CFR 50.55a(g)(6)(i) until the next scheduled refueling outage (March 2002) or an outage of sufficient duration if earlier, to perform the repair. The granting of relief pursuant to 10 CFR 50.55a(6)(g)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

Principal Contributors: William Koo  
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Date: December 20, 2002