Nuclear Operating Company
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December 09, 2009
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10CFR50.55a

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2746

South Texas Project
Unit 2
Docket No. STN 50-499
Amended Request for Relief from ASME Boiler and Pressure Vessel Code
Section XI Requirements for the Essential Cooling Water System
(Relief Request RR-ENG-2-52) (TAC ME0899)

Reference: Correspondence from G. T. Powell, STP Nuclear Operating Company, to NRC Document Control Desk, "Request for Relief from ASME Boiler and Pressure Vessel Code Section XI Requirements for the Essential Cooling Water System (Relief Request RR-ENG-2-52)," dated March 12, 2009 (ML090830517)

In accordance with the provisions of 10 CFR 50.55a(g)(5)(iii), the South Texas Project requested relief from IWA-5250 of Section XI of the ASME Boiler and Pressure Vessel Code as described in the referenced correspondence to defer code repair of a flaw identified in the Unit 2 Essential Cooling Water (ECW) Class 3 piping. This supplement is in response to a request from the NRC reviewer for additional information. Changes from the referenced correspondence are indicated in the margins.

An indication of a through-wall flaw was identified on the downstream flange of ECW return throttle valve 2-EW-1004 from Essential Chiller 22B. Repair of the flaw with a code repair at the time of discovery was impractical. However, the flaw has since been repaired in accordance with the ASME Code.

Operability and functionality of the system have been maintained, and deferring repair of the flaw did not affect the health and safety of the public.

There are no open commitments associated with this relief request.

If there are any questions, please contact either Mr. P. L. Walker at (361) 972-8392 or me at (361) 972-7904.

Marco Ruvalcaba
Manager,
Testing and Programs Engineering

PLW

Attachments:

1) Amended Request for Relief from ASME Boiler and Pressure Vessel Code Section XI Requirements for the Essential Cooling Water System (Relief Request RR-ENG-2-52)
2) Response to Request for Additional Information

STI: 32578558

A047
NRR

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SOUTH TEXAS PROJECT
UNIT 2
AMENDED REQUEST FOR RELIEF FROM ASME BOILER AND PRESSURE VESSEL CODE SECTION XI REQUIREMENTS FOR THE ESSENTIAL COOLING WATER SYSTEM (RELIEF REQUEST RR-ENG-2-52)

1. Component for Which Relief is Requested

(a) Description:

Aluminum-bronze flange downstream of Essential Cooling Water (ECW) return throttle valve 2-EW-1004 from Essential Chiller 22B

(b) Function:

The ECW 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. Valve 2-EW-1004 provides manual throttling capability and is locked in place to control the fluid flow rate through the Essential Chiller.

(c) Class:

ASME Code Class 3

(d) Description of the flaw:

An indication of a through-wall flaw was found on the downstream flange of Essential Chiller 22B ECW return throttle valve 2-EW-1004. Leakage residue buildup in a line parallel to the circumferential weld was found at the weld on the downstream flange of the valve, with an underlying flaw of approximately 3/8-inch in length. The flaw appears to be a tight crack as leakage is not readily measurable. The attached pictures show the location (Figure 1) and the appearance (Figure 2) of the residue buildup. Nominal pipe diameter is 8 inches, with a pipe wall thickness of 0.322 inch.

2. Applicable Code Edition and Addenda:

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

3. Applicable Code Requirement:

ASME Section XI, IWA-5250(a)(3) requires that the source of leakage be evaluated for repair or replacement in accordance with IWA-4000 or IWA-7000. Relief from the requirements of IWA-5250(a)(3) is requested for deferral of code repair of the through-wall flaw at this location until the following 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 December 2, 2008, during periodic examination of ECW large bore piping. No other flaws were found.

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 from ASME Code requirements is appropriate when performing the repair at the time of discovery is determined to be impractical.

Generic Letter 90-05 defines a repair as being 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.

STPNOC applies risk-managed Technical Specifications in accordance with the Configuration Risk Management Program. If there is a need to extend the allowed outage time for the affected ECW loop, risk analysis techniques are applied that take into account real-time plant status to keep overall risk below 1.0E-5 up to a maximum of 30 days. However, taking an otherwise operable ECW loop out of service while at power not only increases overall risk to the plant, but also limits flexibility in dealing with other plant equipment issues that may arise in the interim.

Isolating the subject pipe for a code repair makes the affected ECW train unavailable for service for the duration of the repair. Assigning a specific amount of time to complete a flaw repair when a flaw is first identified and using that as a criterion for initiating a train outage is not appropriate. At the time of discovery of a flaw, an estimate of the amount of time needed to complete the repair would be a rough approximation. Flaw repairs are added to the tasks to be performed during a scheduled train outage of sufficient duration to accommodate the repairs with minimal impact on plant operations. Lengthening or initiating a train outage to perform repairs when it has not already been scheduled may conflict with other train outages or disrupt the schedule for activities such as surveillances that must be performed at set intervals. Delays in the preparation process if a train has already been taken out of service may result in a train outage that exceeds the limiting condition for operation defined in the Technical Specifications. Prior to the train outage scheduled for the repair, preparations prior to the actual repair would be put in place while the train is in service. Preparation activities are not necessarily performed in series, and may be performed in parallel, and the time to be used for preparation would be determined by the train outage schedule.

In this instance, a replacement flange was ordered. A purchase order was issued January 29, 2009, with a due date of April 17, 2009.

Performance of code repairs within the allowed outage time for the ECW system, 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, relief is requested on the basis of impracticality.

6. Proposed Alternative and Basis for Use

6.1 Proposed Alternative

Repair of the defect would be performed when adequate time is available for the repair, but no later than the following Unit 2 refueling outage. The next Unit 2 refueling outage is currently scheduled to begin in March 2010 (2RE14). Compensatory actions were implemented to detect changes in the condition of the flaw until a repair could be implemented.

6.2 Basis for Use

6.2.1 Scope

Evidence of a through-wall flaw was identified on an 8-inch flange of Essential Cooling Water (ECW) return line from the essential chiller 3V112VCH005. A residue buildup provided a linear indication located on the flange side of the flange-to-pipe weld. The flaw appeared to be a tight crack approximately 3/8-inch long. This portion of pipe is subjected to normal operating pressure of the ECW system. The residue buildup suggested ongoing seepage through the flaw, although the leakage was not readily measurable.

6.2.2 Specific Considerations

ASME Section XI, IWA-5250, requires that leakage be evaluated for corrective action and implies that any component with through-wall leakage must be repaired or replaced regardless of the leakage rate. The expectation of ASME Section XI is that through-wall leaks are repaired at the time of discovery. The process for repair of the affected piping requires that the affected ECW loop be made inoperable. However, repairs could not be initiated immediately upon discovery of a flaw due to time required for obtaining parts, staging materials, and repair crew preparation, with the time for actual repair beyond that. The amount of time needed for resolution will vary depending upon individual circumstances.

As stated in the South Texas Project Technical Specifications, the three independent ECW loops shall be operable in Modes 1, 2, 3, and 4. With only two of the essential cooling water loops operable, all three are to be operable within seven days. If only one loop remains in service, one loop is to be returned to service within one hour. If these requirements are not met, the affected unit is to be in Hot Standby within the next six hours, or the requirements of the Configuration Risk Management Program are to be applied.

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 assessment assumes the effects of spray from a moderate energy line (10-inch diameter). Safety-related equipment is either designed to operate in a spray environment, or protected if sensitive to spray. Flooding in a given area due to the ECW system is enveloped by worst case flow from an opening in a local pipe due to a "critical crack," with an area equivalent to a rectangle of length one-half the pipe diameter and a width equal to one-half the pipe wall thickness. This assessment is bounding for the condition under consideration. The potential for flooding due to the ECW system was reviewed by NRC inspectors during an inspection conducted January 25 through February 12, 1999. This is documented in NRC

Inspection Report No. 50-498/98-19; 50-499/98-19, dated March 26, 1999. Flooding is addressed in Updated Final Safety Analysis Report Appendix 9A.

Flooding calculations indicate a potential flooding rate of approximately 14.5 cu ft/min through a postulated crack in the ECW pipe. However, this is enveloped by the maximum flood rate of approximately 80 cu ft/min due to a postulated crack in the Component Cooling Water line in Mechanical Auxiliary Building room 067E, the location of the flawed ECW pipe. There is no effect on nearby safe shutdown equipment by postulated leakage/spray effects. The ECW pumps and the cooling reservoir have adequate design margin and make-up capability to account for postulated leakage and are therefore fully capable of fulfilling the design-basis functions and mission times during a design-basis accident. Conservatism in the assumed seepage losses from the Essential Cooling Pond (ECP) and ECP inventory margin bounds water loss that would occur due to a crack 15 inches by 1/8 inch.

Leakage from ECW piping in this location would end up at the Mechanical Auxiliary Building (MAB) sumps. Sump level alarms are available to warn operators if leakage exceeds the sump pump capacity.

The ECW system is a low-pressure system with normal operating pressures of approximately 50 psig and a design pressure of 120 psig. Normal system temperature is 47 to 100 degrees F. Temperature following a design-basis accident is not expected to exceed 120 degrees F. 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). There is no measurable leakage at this time.
- Continuation of large bore ECW piping periodic walkdowns. Walkdowns of all ECW train piping are regularly scheduled VT-2 examinations at six–month intervals to identify areas of dealloying. These inspections have proven to be an effective means of identifying flaws in ECW components prior to deterioration of structural integrity margins below ASME Section XI requirements. The dealloying process proceeds very slowly. Despite the increased frequency of inspection following identification of a flaw, changes observed in flaw conditions over a period of months have been inconsequential or non-existent. Dealloying flaws are only detectable by visual examination once they have reached the piping surface. Dealloying flaws are addressed under the station condition reporting program.

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

6.2.3 Root Cause Determination

The flaw was due to dealloying. 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

The structural integrity of the flanged piping was assessed using the through-wall flaw evaluation approach in Section C-3a of NRC Generic Letter 90-05. This approach assumes a through-wall flaw and evaluates the flaw stability using Linear Elastic Fracture Mechanics (LEFM). Enclosure 1 to NRC Generic Letter 90-05 details this methodology.

To summarize the results:

s = Predicted bending stress

s = 11.5 ksi

K = Stress intensity factor

K = 32.239 Ksi-in$^{1/2}$

For flaw stability, this methodology specifies "K" should be less than the critical stress intensity factor representing the fracture toughness of the material. Fracture toughness for this material ranges from 63.5 to 95.1 ksi-in$^{1/2}$.

STRESSES	PRESSURE + DEAD WEIGHT	FAULTED	THERMAL
STRESS (psi)	1090	4703	4804
ALLOWABLE STRESS (psi)	18000	43200	27000
SAFETY MARGIN	16.5	9.18	5.62

The calculated safety margins are adequate for the various loading conditions.

6.2.5 Augmented Inspection

Normally, walkdowns of ECW piping are performed at intervals of six months. In the event a flawed area is discovered, augmented monthly inspections are performed to monitor the flaw to detect changes in the size of the discolored area or leakage rate. A flaw caused by dealloying is not detectable by either ultrasonic testing or radiography. The extent of the linear indication was determined by use of dye penetrant.

Inspectors look for: change from residue buildup to active dripping; new indication at a different area on the component; or, a substantial change (about 2x or more) in the area of the original indication. Periodic monitoring and inspection by STPNOC provide confidence in the ability to detect changes in the leakage rate before leakage becomes a safety issue. Structural integrity and the monitoring frequency are re-evaluated if monitoring identifies significant changes in the condition of the flawed area.

By the time of the repair, there were no changes evident in the flaw compared to its appearance at the time of discovery. No dealloyed area has shown sufficient change from the time of discovery to warrant accelerated implementation of corrective measures.

The experience at the South Texas Project is that the dealloying process progresses very slowly. Changes observed in flaw conditions over a period of months have been inconsequential or non-existent. Any changes in flaw parameters would be identified well before the affected ECW train would be put at risk. Consequently, monthly inspections are appropriate.

6.2.6 Conclusion

The South Texas Project has analyzed through-wall flaws in ECW piping and found that degradation progresses slowly. Detectable leakage is produced before flaws reach a limiting size that would affect the operability of the Essential Cooling Water System. Rapid or catastrophic failure 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 concludes that the structural integrity of the ECW piping was not adversely affected. Operability and functionality of the system have been maintained, and deferring repair of the flaw did not affect the health and safety of the public.

7. Duration of Proposed Alternative

Rework of the defect to restore the flange to its design condition was deferred until sufficient time was available. The flange was replaced in accordance with the ASME Code on April 24, 2009.

8. Reference:

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

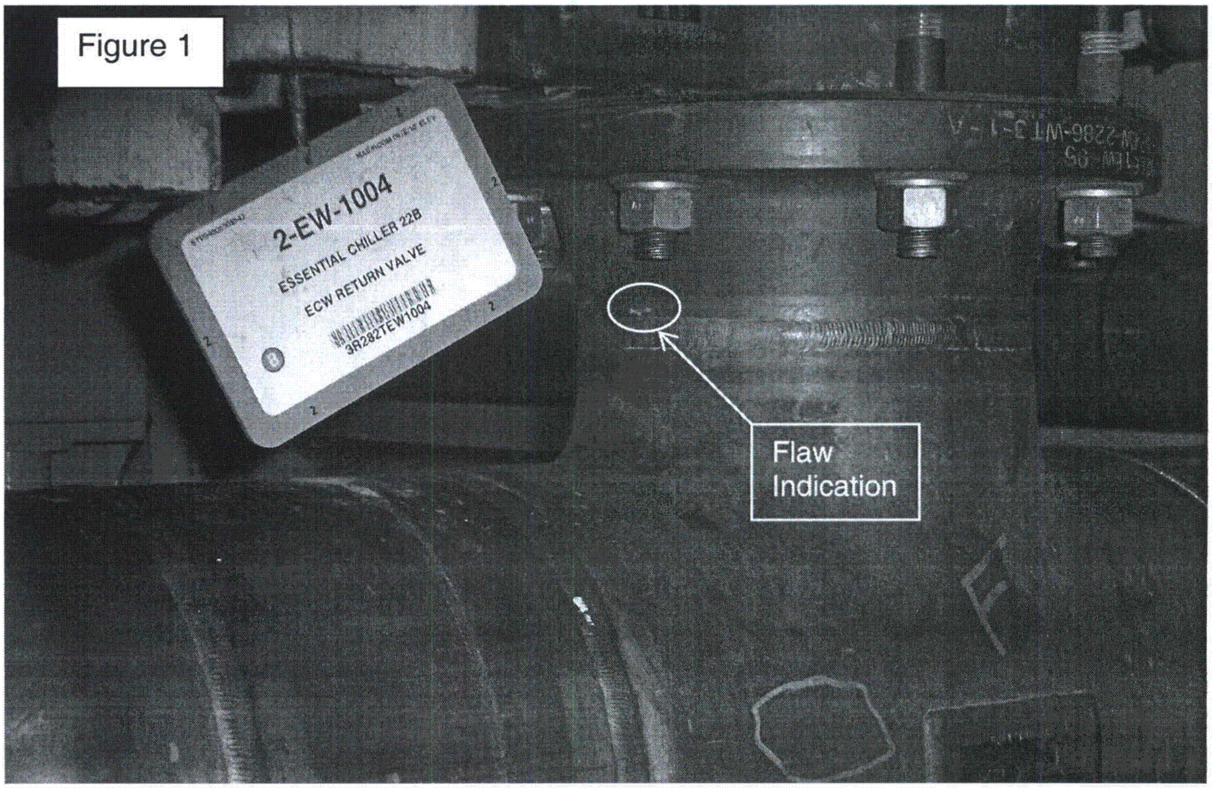
Figure 1
2-EW-1004
ESSENTIAL CHILLER 22B
ECW RETURN VALVE
3R282TEW1004
Flaw Indication

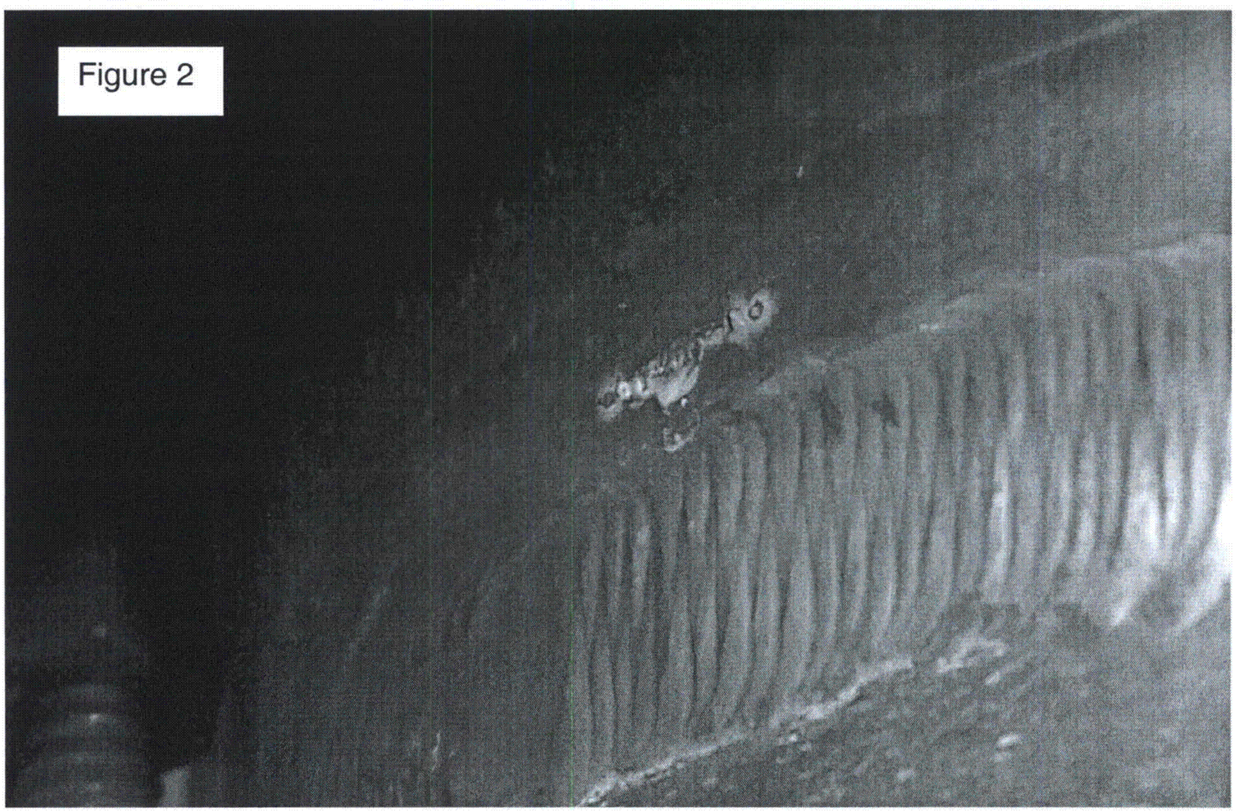
Figure 2

RELIEF REQUEST RR-ENG-2-52:
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1. Discuss the time required to repair the subject degraded flange at return throttle valve 2-EW-1004 in the ECW system. The total repair time should include time to obtain parts, stage necessary materials, repair crew preparation, and time to complete the actual repair.

RESPONSE

See Section 5.

2(a) Provide the flaw size that would cause a leak rate such that the ECW system could not provide sufficient make-up to fulfill the intended function of the ECW system.

RESPONSE

See Section 6.2.2.

2(b) Demonstrate that the detected flaw at the flange will not grow to the aforementioned flaw size prior to the scheduled repair in March 2010.

RESPONSE

This is not relevant based on the response to 2(a).

2(c) Provide the flaw analysis that was used to assess the through wall flaw in the degraded flange.

RESPONSE

The flaw analysis is provided in paragraph 6.2.4.

2(d) Discuss whether the flaw is in the circumferential or axial direction.

RESPONSE

The circumferential orientation of the flaw can be seen in Figures 1 and 2. The circumferential orientation is also stated in paragraph 1(d) of the original submittal.

2(e) Provide the nominal diameter and pipe wall thickness of the degraded pipe/flange.

RESPONSE

Piping dimensions are given in Section 1(d).

2(f) Discuss whether the detected flaw in the subject flange can be characterized as "wall thinning" or as a "planar flaw".

RESPONSE

The flaw is neither "wall thinning" nor "planer". The flaw is due to dealloying.

3. In its Commitment as shown in Attachment 2 to the March 12, 2009 letter, the licensee stated that "...Perform monthly walkdowns of dealloying location to detect changes in size of the discolored area or leakage until a code repair is performed. 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..."

   (a) The proposed monthly walkdown is contrary to the recommended frequency in NRC Generic Letter 90-05 which recommends that weekly walkdowns be performed to determine any degradation of structural integrity of the affected component. In light of GL 90-05 recommended weekly walkdowns, justify the monthly walkdown inspection. Also, demonstrate that the proposed augmented inspection schedule will provide reasonable assurance that the operator has sufficient time to take corrective actions prior to the flaw in the flange growing uncontrollably to challenging operability of the affected ECW train.

   RESPONSE

   See Section 6.2.5.

   (b) The ASME Code, Section XI, Code Case N-513-2, *Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1*, paragraph (f) requires that for through wall leaking flaws, leakage shall be observed by daily walkdowns to confirm the analysis conditions used in the evaluation remain valid. Discuss whether a daily walkdown will be performed if the subject flaw starts to leak. If a daily walkdown is not planned for a leaking flaw, discuss the examination frequency that will be used and justify the validity of the proposed examination frequency.

   RESPONSE

   The ASME Section XI Code of record for the South Texas Project is the 1989 Edition. Code Case N-513 is applicable to the 1998 Edition. Code Case N-513-2 is applicable to the 2004 Edition. Consequently, this code case is not applicable to the South Texas Project.

   See Section 2 and 6.2.5.

4. In its Commitment in Attachment 2 to the March 12, 2009 letter, the licensee stated that "...Rework of the defect will be deferred until adequate time is available for the repair, but no later than the next Unit 2 refueling outage, 2RE14..." This statement is inadequate because it is vague and non-descriptive.

   (a) Clarify the meaning of "Rework of the defect".

   RESPONSE

   Clarification is provided in Section 7.

(b) Identify the affected component in the Commitment.

RESPONSE

There is only the one component addressed in the relief request. There are no remaining open commitments associated with this relief request.

(c) Confirm that the degraded flange which is located downstream of Essential Cooling Water return throttle valve 2-EW-1004 from Essential Chiller 22B will be repaired in accordance with the ASME Code, Section XI, IWA-5250(a)(3), no later than May 5, 2010.

RESPONSE

The degraded flange was replaced in accordance with the ASME Code, Section XI, on April 24, 2009.

5. In Section 4 of Attachment 1 to the March 12, 2009 letter, the licensee stated that the flaw was identified on December 2, 2008.

(a) Discuss the changes to the flaw since the discovery in terms of flaw dimensions and leakage, if any.

RESPONSE

See Section 6.2.5.

(b) Discuss whether examinations were performed on all other ECW trains to identify similar flaws. Provide the results of the sample examinations. If sample examinations were not performed, provide the justification.

RESPONSE

See Section 4.

6. In Section 5 of Attachment 1 to the March 12, 2009 letter, the licensee used impracticality defined in Generic Letter 90-05 as the basis for the relief request. Generic Letter 90-05 defines impracticality as that the pipe cannot be isolated to complete a code repair within the time period permitted by the limiting condition for operation in the technical specification and a plant shutdown may be necessary to complete the code repair.

(a) Discuss why the subject pipe cannot be isolated to complete a code repair.

RESPONSE

See Section 5.

(b) It seems that it is not impractical to shut down the plant to repair the degraded flange. Shut down of the plant may result in hardship, but not impracticality. Explain why it is impractical to shut down the plant to repair the degraded flange.

RESPONSE

See Section 5.

7. In Section 6.2.2 (page 3) of Attachment 1 to the March 12, 2009, letter, the licensee stated that "...The condition of the ECW piping and the leakage is monitored by operator/personnel rounds. Sump level alarms are available to warm operators if unanticipated, sudden leakage were to develop..."

(a) Discuss how often is the personnel rounds and whether the purpose of the personnel rounds is specifically geared toward examining flaws in the ECW piping.

RESPONSE

See Section 6.2.2.

(b) Describe the sensitivity of the sump level alarms (i.e., how low of a leak rate would the alarm annunciate) and at what leak rate will the operator take corrective actions.

RESPONSE

See Section 6.2.2.

8. In Section 6.2.2 (page 4) of Attachment 1 to the March 12, 2009, letter, the licensee stated that the VT-2 examinations at six-month intervals have proven to be an effective means of identifying flaws in ECW components. Given the existence of a through wall flaw in the subject flange, the staff believes that an examination frequency of every six month is inadequate and ineffective because by the time the VT-2 examination was performed the flaw had already initiated and grown through wall. Based on the operating experience of dealloying at the plant, the licensee needs to shorten the six-month examination interval for future ECW inspections or justify the adequacy of the six-month frequency for the VT-2 examination.

RESPONSE

See Section 6.2.2.

9. Enclosure 1, Section 3, of GL 90-05 specifies that the integrity of the temporary non-code repair of code class 3 piping should be assessed at least every 3 months by either ultrasonic testing (UT) or radiographic testing (RT). Discuss why these inspection methods were not specified in the proposed relief request.

RESPONSE

See Section 6.2.5.