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

December 16, 1999
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File No.: G09.16
10CFR50.55a

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

South Texas Project
Unit 1
Docket No. STN 50-498
Evaluation Analysis for a Through-Wall
Leak in the Unit 1 Refueling Water Storage Tank

Reference: Request for Relief from ASME Boiler and Pressure Code Section XI Requirements (Relief Request RR-ENG-33), dated November 29, 1999 (NOC-AE-000694)

The referenced letter requests relief from the requirement of Section XI code IWA-5250(a) for repair of a small, through-wall leak in the South Texas Project Unit 1 Refueling Water Storage Tank. In support of this relief request, the South Texas Project submits the attached evaluation analysis of examination results to the Nuclear Regulatory Commission in accordance with Section XI code requirement IWB-3144(b), 1989 Edition.

If there are any questions, please contact either Mr. C. A. Murry at (361) 972-8285 or me at (361) 972-7902.

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PLW/
Attachment: IWB 3142.4 Evaluation of Baseplate Indication on Unit 1 Refueling Water Storage Tank 2N121NTF101A

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IWB 3142.4 EVALUATION OF BASEPLATE INDICATION ON UNIT 1 REFUELING WATER STORAGE TANK 2N121NTF101A RELIEF REQUEST RR-ENG-33

CONDITION REPORT 97-16031

SUMMARY:

This evaluation discusses the background and technical evaluation of the indication found on the RWST base and concludes that monitoring the indication via a preventive maintenance activity is acceptable. This is the subject of relief request RR-ENG-33.

BACKGROUND:

On 9/18/97, the Refueling Water Storage Tank (RWST), 2N121NTF101A, was observed to have a spot of rust and traces of moisture on the baseplate weld (Reference Condition Report 97-14680). In the Condition Report, the description of the finding was quantified as approximately 2 milliliters (ml) of moisture, a rust nodule approximately ½ x ½ x ½ inch, and evidence of Chromium (CR-51) and Cobalt (CO-58). Subsequent swipes of the area indicated radioactivity below threshold values and the presence of boron. In the ensuing days, the indication area was inspected by a VT-2 Inspector, Design, Systems, and Licensing Engineers, Welding Supervision, and Engineering Management.

There were no signs of visible leakage reported. During that period, several informational liquid penetrant tests (PT) were performed to determine the integrity of the weld. This testing indicated the presence of a flaw in the tank baseplate, perpendicular to the baseplate weld. VT-2 examinations revealed surface indications in the outer perimeter of the baseplate with no weld inclusions noted. Since 9/25/97, the tank has been refilled to its normal operating level. On 9/30/97, evidence of extremely minor seepage from the baseplate/weld interface was observed. It is important to note that no moisture was present at the weld or the baseplate, however a small circular nodule approximately 1/8" diameter was identified. The seepage was minute and moisture carry-over (which is not evident) evaporated without a trace leaving only residual constituents.

System Engineering has subsequently initiated regular walkdowns of this condition and observed the following:

- Approximately four drops of water accumulates in a nodule.
- The leakage and corrosion products contain radioactive Chromium (CR-51), Cobalt (CO-58), and Cesium (CS-137 and 134).
- There is a crack in the baseplate which is visible when dye penetrant solution is applied,
- Leakage in 1997 was quantified as approximately 2 milliliters. The current leakage is quantified as 4 drops.

EVALUATION:

Through-wall leakage in ASME Class 2 tanks requires an engineering evaluation or a repair (References, 1983 IWA-5250 and 1989 IWB-3142).

IWB-3142.4, "Acceptance by Analytical Evaluation", states:

> Components containing relevant conditions shall be acceptable for continued service if an analytical evaluation demonstrates the component's acceptability. The evaluation analysis and evaluation acceptance criteria shall be specified by the Owner. Components accepted for continued service based on analytical evaluation shall be subsequently examine in accordance with IWB-2420 (b) and (c).

EVALUATION ANALYSIS:

The analysis will perform the following:

- Characterize the flaw.
- Examine the significance of a baseplate flaw to the structural qualification of the RWST.
- Establish the leakage detection capability for the RWST.

EVALUATION ACCEPTANCE CRITERIA:

Acceptance criteria for the analysis are:

- Structural significance of this baseplate flaw is small.
- Reliable leakage detection capability is available for RWST operations.

There is no acceptance criterion for the flaw character. The flaw is the subject of the acceptance by evaluation.

ANALYSIS:

Flaw Character

The flaw is characterized as most pronounced at the outer radius of the baseplate and tapers to minor separate indications towards the toe of the outer tank fillet weld. Inspection of the area around the indication, and considering its orientation perpendicular to the weld, it was concluded that the indication is unlikely to have been service induced and may have been present since construction. Given the presence of buffing in the general weld area, the past presence of microbiologically induced corrosion (MIC) on this tank which required significant rework during construction, and the significant shrinkage associated with multiple welds on stainless steel parts (full penetration and inner and outer fillet welds), it may be surmised that some porosity in the toe of the weld area combined with warpage of the baseplate has provided a minor leak path from within the tank.

The flaw can be characterized as a tight and irregular sub-surface flaw of varying depth which, given its orientation, has relieved weld-induced stresses in the baseplate and now has no method for propagation.

Structural Significance

Examination of the design report for the Unit 1 RWST shows that the loading conditions for the tank are borne primarily by the tank vertical shell (for example, hoop stress) and by the tank anchorage supports (for example, horizontal acceleration moment). The tank anchorage supports are twenty-four gusset plate located about the perimeter of the tank.

The only credit given to the baseplate for loading conditions is sliding resistance to horizontal acceleration forces. In this loading condition, approximately fifty-five percent of the tank's predicted sliding resistance capability (friction) is needed to offset the horizontal acceleration force prediction.

The structural significance of the baseplate flaw is therefore is considered small.

Leakage Detection Capability

Should a leak of sufficient volume develop, plant personnel should easily acknowledge it since the area is near a walk way and readily accessible. There is a Control Room alarm for RWST high sump level and a Technical Specification minimum RWST level alarm of 458,000 gallons to alert Operations. The tank is also equipped with three level transmitters and alarms are provided with readouts on the Main Control Board to 1) prevent overflow, 2) maintain a nominal operating level, 3) initiate automatic switchover from the injection to recirculation phase, and 4) indicate when the tank is empty. These level transmitters can be used to monitor for tank leakage and/or catastrophic failure.

The Control Room alarm for RWST high sump level receives its input from redundant, non-safety related instrument loops. Reliability exists here from the redundant nature of the inputs.

The three level transmitters and alarms providing readouts on the Main Control Board are safety-related. Reliability exists here from the three redundant, independent, and functionally qualified instrument loops.

Reliable leakage detection capability is therefore available for RWST operations.

REGULATORY AND ADMINISTRATIVE CONSIDERATIONS:

Guidance for the disposition of this indication is provided in various sections of the ASME Boiler and Pressure Vessel Code, Section XI (1983 Edition) and Generic Letters (GL) 90-05 and 91-18. GL 90-05 provides guidance for the timeliness of effecting permanent code repairs to flawed ASME Code Class 1, 2, and 3 piping. GL 90-05 also gives guidance for evaluating flaws and maintains that its objective is "to maintain structural integrity of repaired ASME Code piping." The guidance given however is not applicable to this condition (flaw in an atmospheric tank) since GL 90-05 specifically excludes "pumps, valves, heat exchangers and components other than

piping" from its scope. Although not specifically applicable to this condition, GL 90-05 recognizes two important points that are germane: (i) A non-Code repair or non-Code condition is temporarily acceptable if structural integrity can be assured and maintained and (ii) Licensees should have a reasonable time period with which to adequately plan and effect a Code repair/replacement.

GL 91-18 provides further guidance for resolving degraded and nonconforming conditions and Operability. In addition, guidance for flaw evaluation is given by reference to the acceptance standards of ASME Code Articles IWC-3500 and IWA-5250. It is clear from the subsequent text of GL 91-18 that references to pressure boundaries ("i.e. pipe wall, valve body, pump casing, etc.") apply to pressure retaining, integral components. This is further reinforced by the reference to IWC-3500 which is not applicable to atmospheric tanks. The rules and requirements for inservice inspection of Class 2 atmospheric tanks are governed by Article IWC-1000. This Article, however, specifically exempts atmospheric tanks from inservice examination under IWC-1221(c) which states, "Vessels, piping, pumps, valves, other components and component connections of any size in statically pressurized, passive (i.e., no pumps) safety injection systems of pressurized water reactors" are exempt. Since the RWST is exempt from inservice examination requirements, there are no applicable Articles with attendant equations and/or tables under the Code with which to evaluate flaws. Guidance for flaw evaluation in atmospheric tanks should therefore be derived from Article IWA-5000, System Pressure Tests, since the tank is literally undergoing a constant hydrostatic test. Specifically, Article IWA-5250, Corrective Action, states that, "The detection of boric acid residues on ferritic steel components (later changed to include all components), the leakage source and the areas of general corrosion shall be located. Components with local areas of general corrosion that reduce the wall thickness by more than 10% shall be evaluated to determine whether the component may be acceptable for continued service, or whether repair or replacement is required." This position is consistent with STP surveillance procedures which required the performance of an inservice pressure test and VT-2 inspection of the RWST every 3 ½ years (in excess of Code requirements). The acceptance criteria for the VT-2 examination require that all relevant conditions be documented on a Condition Report. Procedures require that relevant conditions be considered unacceptable or determined acceptable through supplemental examination, correction measures or repairs, analytical evaluation, or replacement. This is consistent with Article IWA-5250 which requires evaluation, repair, or replacement of flawed components.

CONCLUSIONS:

Based on the evaluation it is concluded that the structural integrity of the RWST is intact. The most prudent course of action is to monitor the leak for stability. If the leakage rate increases, this evaluation would be updated based on new data.

REFERENCES:

1) Technical Specification 3/4.5.5, 3/4.4.10(b), 4.05
2) STPEGS UFSAR Sections 6.2.1.1, 6.3.2.2, 6.3.5.4, Table 6.3-1
3) GLs 90-05 and 91-18
4) ASME Boiler and Pressure Vessel Code, Section XI, 1983 Edition
5) Correspondence NOC-AE-694 dated November 29, 1999, "Request for Relief from ASME Boiler and Pressure Vessel Code Section XI Requirements (Relief Request RR-ENG-33)