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

March 3, 2004
NOC-AE-04001678
10CFR50.90

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

South Texas Project
Unit 1
Docket No. STN 50-498
Response to Request for Additional Information Regarding
Proposed Amendment to Technical Specification 4.4.5.3a

Reference: Letter, T. J. Jordan to NRC Document Control Desk, "Proposed Amendment to Technical Specification 4.4.5.3a," dated October 16, 2002 (NOC-AE-03001580)

The referenced letter requested an additional one-time change to TS 4.4.5.3a to extend the previously approved 40-month steam generator tube inspection interval to 44 months for Unit 1 only. Unit 1 was shut down for almost six months in 2003. As a result, the approved 40-month steam generator inspection interval will expire before the next Unit 1 refueling outage. The NRC staff has requested additional information to complete its review of the amendment request. The response to that request is attached to this letter.

It should be noted that STP Nuclear Operating Company is currently planning to submit a license amendment request in the Spring of 2004 to extend the inspection interval for both Unit 1 and Unit 2 to allow skipping two operating cycles (approximately 61 months) based on the approved V. C. Summer 58-month interval. However, approval of the 4-month interval extension currently being requested for Unit 1 is still necessary in case the future amendment request is not submitted or is not approved.

If there are any questions regarding this additional information, please contact Mr. Scott Head at (361) 972-7136 or me at (361) 972-7902.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on March 3, 2004

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jtc

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Response to Request for Additional Information
Proposed Amendment to Technical Specification 4.4.5.3a
South Texas Unit 1
Materials and Chemical Engineering Branch
Division of Engineering

RAI-1. Discuss the time line of the operation, inspection, and shutdown/wet lay-up of the Unit 1 steam generators from the last inspection to the planned 2005 refueling outage inspection.

Response

10/3/01 - 10/24/01 1RE10, which included 100% inspection of the tubes in all four steam generators (SGs). As reported in Reference 1, no tubes were plugged as a result of the inspection.

10/24/01 - 3/26/03 The SGs were operating.

3/27/03 - 4/20/03 1RE11. The SGs were in cold shutdown/wet lay-up conditions. No steam generator tube inspections were conducted during 1RE11 because the NRC approved a one-time 40-month inspection interval (from 1RE10) for Unit 1 only (Reference 2). SG 1D was drained down and opened to the atmosphere (without N_2 overpressure) on April 7 for a Foreign Object Search and Retrieval (FOSAR) entry. The FOSAR was conducted in accordance with industry practices. SG 1D was refilled from the auxiliary feedwater storage tank (AFWST) on April 16 and was placed in wet lay-up by April 17.

4/20/03 - 8/8/03 Evidence of boric acid leakage was found on two reactor pressure vessel bottom mounted instrument (BMI) penetrations on April 12, 2003. The plant remained shut down after 1RE11 for repair of the BMI penetrations and the SGs remained in cold shutdown/wet lay-up conditions until August 2003.

8/9/03 - Present The SGs have been operating and are expected to continue to operate until 1RE12, which is currently scheduled to begin in early March 2005.

RAI-2. In the October 16, 2003, letter, the licensee stated that during the shutdown period, the Unit 1 steam generators were in a cold shutdown/wet lay-up with chemistry being maintained in accordance with the EPRI Secondary Chemistry Guidelines as discussed in EPRI report, TR-102134-R5.

(1) Table 5-1 of EPRI TR-102134-R5 provides specific values for parameters in the steam generator bulk solution such as pH level, hydrazine, sodium, chloride, sulfate, boron (if boric acid was used), and dissolved oxygen. Discuss whether the values of these parameters have been followed in the Unit 1 steam generators during the wet lay-up. Provide justifications for any deviation from Table 5-1.

Response

The values of Table 5-1 of EPRI TR-102134-R5 were followed for pH level, hydrazine concentration, and chloride/sulfate/sodium concentration in the Unit 1 SGs during the periods of wet lay-up. Parameter values for all SGs remained in specification for the duration of the wet lay-up except for SG 1D hydrazine and pH readings, which were related to the FOSAR described above. Action was taken to correct the out of specification condition in a timely manner in accordance with EPRI TR-102134-R5.

Boric acid is not used in the secondary plant at STP.

EPRI TR-102134-R5 provides a limit on the oxygen concentration (≤100 ppb) in the SG fill source, which is the AFWST. The AFWST oxygen concentration was 10.5 ppb for the fill of the SGs on March 26, 2003 and the concentration was 0.67 ppb for the refill of SG 1D on April 16. These values are well within the limit of EPRI TR-102134-R5.

(2) EPRI recommends that the steam generator bulk solution is to be mixed and sampled three times per week (after parameters are in the normal range) until the parameters are stable, then mixed and sampled weekly. Discuss whether this procedure was followed for the Unit 1 steam generators during the wet lay-up.

Response

Procedures at STP require that the SG bulk solution be mixed and sampled three times per week (after parameters are in the normal range) until the parameters are stable, then mixed and sampled weekly. This sampling schedule was interrupted by maintenance work on the feedwater isolation valves, which removed SG lay-up chemistry sampling capability from March 29, 2003 until April 15. When sampling capability was returned, lay-up chemistry parameters were still in specification, except for SG 1D as described above. The sampling scheduled was then followed for the duration of the lay-up (until August 9, 2003 as described in RAI-1).

(3) Discuss whether alternate amines and oxygen scavengers e.g., carbohydrazide were used in place of ammonia and hydrazine in the steam generator bulk solution. If the alternatives were used, discuss whether they were qualified for the application.

Response

An alternative for hydrazine is not used at STP. The hydrazine concentration is usually sufficient to maintain the pH specification. A small amount of mono-ethanolamine (ETA) is added if additional pH adjustment is required. ETA has been qualified as an alternate pH control agent for the secondary plant by EPRI, STP, and many other PWR power plants, and has been in use for that purpose for over 10 years.

(4) Discuss whether a positive nitrogen overpressure was maintained during filling, draining, and cold shutdown to minimize oxygen ingress into the Unit 1 steam generators.

Response

A positive nitrogen overpressure was maintained per the EPRI Guidelines during filling, draining, and cold shutdown except during the FOSAR in SG 1D as described above.

RAI-3. In the October 16, 2003, letter, the licensee stated that "...[t]he operational assessment performed at 1RE10 found that the operational requirements for continued steam generator operation over the next three cycles (cycles 11, 12, and 13) are met without exceeding the structural integrity recommendations of draft Regulatory Guide 1.121..."

(1) Discuss whether the calendar year or effective full power year was used in the operational assessment for cycles 11, 12, and 13 and whether the operational assessment results would cover the 44-calendar month inspection interval.

Response

Three, eighteen-month cycles were evaluated for a total of 54 calendar months.

(2) Licensees perform operational assessments usually on a cycle-to-cycle basis using the results of the previous cycle inspection to predict/project degradation at the end of the following operation cycle with some degree of certainty and accuracy. STP's operational assessment is performed for three operating cycles, which brings to the question on the accuracy of its long term prediction. Discuss how the tube degradation (i.e., flaw growth rate and flaw population) is modeled and projected so as to obtain adequate and/or conservative results.

Response

No degraded tube condition or any amount of wall loss was experienced during 1RE10. The SG tube inspection plan for 1RE10 included:

- 100% of the tubes in each SG using the bobbin coil

- Motorized Rotating Pancake Coil (MRPC) inspection of all I-code bobbin signal locations not cleared by history review based on the pre-service inspection results. Pre-existing signals that exhibited significant change in magnitude were also inspected with MRPC.
- Special interest areas, as necessary (e.g., bounding loose parts, using MRPC)

(3) The performance criteria for the steam generators include structural integrity and leakage integrity as discussed in NUREG-1022, Revision 2, (section 3.2.4), or NEI 97-06. However, the leakage integrity criterion is not included in Regulatory Guide 1.121. The staff is not clear whether the licensee has performed assessment on the leakage integrity of the steam generator tubes. Therefore, the licensee needs to provide statements, based on its assessment, to confirm whether the STP Unit 1 steam generators will satisfy the performance criteria on structural integrity, accident-induced leakage, and operational leakage at the end of the 44-month inspection interval.

Response

STP has performed an assessment on the leakage integrity of the SG tubes. NEI 97-06 requires that an operational assessment be performed to assess if observed degradation mechanisms will continue to meet tube structural and leakage integrity requirements until the next inspection. No degradation mechanisms were observed in any SG, so projections of operational leakage or accident leakage were not applicable.

The only indication from the 1RE10 inspection that required a tube integrity analysis was one potential loose part (PLP) signal, which could not be visually investigated or retrieved due to its location deep in the tube bundle. Although no wear was observed in the vicinity of the potential loose part (SG 1D, R43C79), a bounding analysis assumed that such a loose part existed at the highest flow location (to excite the loose part) and further assumed that the most limiting calculated tube cyclic deflections observed anywhere in the bundle were coincident with the high flow and part location. An assumption was made as to the nature of the PLP based on the type of material removed by sludge lancing, i.e., small pieces of 321 stainless steel gasket material. Wear ranges were then calculated based on various orientations of the loose part to cause future wear assuming undetected 20% initial wall wear had occurred. The results were compared to a minimum wall thickness of 15 mils. The analysis showed that both leak integrity and structural integrity would be maintained for the next three operating cycles (54 calendar months).

STP employs a defense-in-depth design with power-compensated N-16 monitors on each SG providing control room readout capability of leak rates. This design feature provides assurance that in the unlikely event of operational leakage, it would be detected, trended, and monitored for appropriate action.

During the 1RE11 shutdown, it was discovered that a carbon steel wire rope stabilizer from a feedwater heater plugged tube became dislodged and was caught in the main feedwater

regulating valve of SG 1D. Small wire pieces from this stabilizer were retrieved during a thorough FOSAR of the main feedwater header, and from the flow distribution ring header and the top of the sludge collector within SG 1D. Parts small enough to escape from the feedring header would be smaller than the pitch of the tube bundle. Any potential wire pieces passing beyond the ring header and sludge collector would be expected to be carried into the tube bundle or deposited on the tubesheet under the flow distribution baffle central cutout. Wire pieces that may have been deposited in the tube bundle probably would not be seen by top-of-tubesheet visual inspection due to the fine powder sludge that settled during the plant shutdown.

Approximately 15 grams of wire remain unrecovered. Therefore, the potential for damage by the unrecovered wire was addressed by evaluating the characteristics of the unrecovered wire against the 1RE10 loose part bounding analysis. The factors that determined if the 1RE10 analysis is bounding included:

- The wear couple comparisons of stainless steel versus carbon steel for wearing Inconel tubing using EPRI Report 103506 (carbon steel forms a magnetite coating that provides a lubricating effect)
- Relative hardness of the softer carbon steel wire versus the previous analysis of 321 stainless steel gasket material
- Comparable wear interface dimensions of the wire pieces versus the previously analyzed gasket material

From the assessment of these variables, the existing 1RE10 analysis was found to be bounding for the unrecovered small wire pieces from this event.

Based on the fact that STP has not experienced any tube wear from initial operation of the replacement SGs through 1RE10, combined with the analysis of loose part wear, STP is confident that the Delta 94 SGs will satisfy the performance criteria on structural integrity, accident-induced leakage, and operational leakage at the end of the 44-month inspection interval.

References

1. Letter, T.J. Jordan to NRC Document Control Desk, "Special Report - 1RE10 Refueling Outage Inservice Inspection Results for Steam Generator Tubing," dated January 22, 2002 (NOC-AE-02001254)

2. Letter, J.L. Minns to W.T. Cottle, "South Texas Project, Unit 1 - Issuance of Amendment on Steam Generator Surveillance Requirements (TAC No. MB3963)," dated July 31, 2002 (AE-NOC-02000974)