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

June 7, 2001
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File No.: G04.02

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

South Texas Project
Unit 2
Docket No. STN 50-499
Steam Generator Tube Burst and Accident Leakage Information Requested by NRC

Reference: NRC letter, "Summary of Meeting with STPNOC/Westinghouse Regarding Results of Steam Generator Tube Inspections and In Situ Tube Pressure Tests Conducted During End-of-Cycle 8 Refueling Outage for South Texas Project Unit 2," dated May 15, 2001 (AE-NOC-01000812)

During a public meeting held on April 19, 2001, and in the meeting summary referenced above, the NRC requested that STP Nuclear Operating Company provide certain information regarding the Unit 2 steam generators. The specific information requested for each steam generator was the probability of tube burst and the accident-induced leakage at main steam line break conditions at the end of Cycle 8. The accident-induced leakage values were requested as mean values and 95/95 values from the Monte Carlo analyses, with and without consideration of restriction against burst by the support plates.

The requested information is provided in the attachment to this letter. If there are any questions regarding this information, please contact either Mr. Mark Kanavos at (361) 972-7181 or me at (361) 972-7902.

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jtc

Attachment: Response to Information Request

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Response to Information Request

NRC Information Request

> The specific information requested for each SG was the probability of tube burst and the accident-induced leakage at main steam line break conditions at the end of cycle 8. The accident-induced leakage values were requested as mean values and 95/95 values from the Monte Carlo analyses, with and without consideration of restriction against burst by the support plates.

Response

The leak rate information and probability of burst values available from the Monte Carlo simulations are provided in Tables 1 and 2. The simulations considered two cases:

(1) indications not restrained from burst, i.e., indications located above tube support plate (TSP) 4H, and

(2) indications restrained from burst (IRBs), i.e., indications located at TSP 2H through 4H, inclusive.

In the first case, all leak rates were calculated as freespan values; while in the second case, IRBs were assigned a conservative leak rate of 5 gpm regardless of the freespan value.

Table 1 provides the results when all TSP elevations are considered to be freespan. Table 2 provides the combined results from the IRB analysis for TSPs 2H through 4H and the freespan analysis for TSPs above plate 4H.

The consideration of IRBs was restricted to indications at the elevations of the second, third, and fourth TSPs on the hot legs of the steam generators (SGs) because the TSP axial motion is considered to be limited for those plates.

Probability of Burst Information

The probability of burst for IRBs at TSPs 2H through 4H is essentially zero and the freespan burst probabilities for indications above TSP 4H are also very small. Since the burst probabilities for the actual SG conditions are negligible, burst probabilities obtained by postulating that all indications are freespan are not meaningful.

The probability of a freespan burst during a postulated steam line break (SLB) event for all of the Unit 2 SGs was calculated to be in the range of 0.027 to 0.065 using the standard evaluation techniques (see Table 1). These values exceed the threshold value of 0.01 stipulated in reference 2.

The condition monitoring evaluation of reference 3 notes that analyses have shown that TSPs 2H through 4H undergo limited displacement during a postulated SLB event. Therefore, it is appropriate to assign a probability of burst of 10^{-5} for outside diameter stress corrosion cracking (ODSCC) indications at those plates because they are restrained from burst.

The expected probability of burst values are recorded in Table 2, which shows that the probabilities of tube burst for each of the four Unit 2 SGs are within the NRC guideline of 10^{-2}.

Accident-Induced Leak Rate Information

The requested accident-induced (SLB) leakage values without consideration of IRBs are given in Table 1 and the values with consideration of IRBs are given in Table 2. The median values for Table 2 were obtained by considering the joint average of the logarithm of the leak rates.

Comparison of the predicted leak rates during a postulated SLB event to those experienced during the last few days of operation prior to the refueling outage is of specific interest. During discussions with the NRC staff, reference was made to SG "D" where the normal operating leak rate just prior to the outage was 9 gpd. The predicted 95/95 leak rate during a postulated SLB event was preliminarily reported to be on the order of 4 gpm. Using this information, it was postulated that if the normal operating leak rate were on the order of 36 gpd, then the leak rate during a postulated SLB event might be expected to be 16 gpm. This would exceed the allowable leak rate of 15.4 gpm for such an event (reference 3).

STPNOC and the NRC staff discussed their differing opinions on the validity of such comparisons. STPNOC agreed to develop and present similar information for all of the Unit 2 SGs, including the median and expected leak rates in addition to the 95/95 leak rate. On average across the four Unit 2 SGs, the ratio of the median and the average leak rates (gpm) during a SLB event is about 1/10 to 1/16 of the leak rate (gpd) during normal operation. Following the NRC's lead in making the comparisons, if the allowable accident-induced leak rate is on the order of 15.3 gpm, then the corresponding normal operating leak rate would be on the order of 153 to 245 gpd.

References

1. NRC letter, "Summary of Meeting with STPNOC/Westinghouse Regarding Results of Steam Generator Tube Inspections and In Situ Tube Pressure Tests Conducted During End-of-Cycle 8 Refueling Outage for South Texas Project Unit 2," dated May 15, 2001, (AE-NOC-01000812)

2. NRC Generic Letter 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking," August 3,1995

3. SG-01-03-004, Revision 0, "South Texas Project Unit 2 2RE08 Refueling Outage Condition Monitoring and Preliminary Operational Assessment," Westinghouse Electric Company, March 2001

Table 1

End of Cycle 8 Simulation Results

Comparison with Normal Operation Leak Rate
(Standard simulation without consideration of restriction against burst)

SG	Number of Indications	Normal Operation Leak Rate (gpd)	Median Simulated SLB Leak Rate (gpm)	Mean Simulated SLB Leak Rate (gpm)	Simulated SLB 95/95 Leak Rate (gpm)	Ratio Median SLB/NOP Leak Rate (gpm/gpd)	Freespan Probability of Burst
A	611	10.5	0.458	0.580	1.40	0.044	0.027 (1)
B	1229	7.5	0.428	0.568	1.43	0.057	0.029 (1)
C	972	8.0	0.561	0.708	1.69	0.070	0.035 (1)
D	768	9.0	0.974	1.220	2.87	0.108	0.065 (1)

Note:
(1) The probability of burst is reported for information only since the displacement at TSPs 2H through 4H is severely limited during a SLB event. Appropriate numbers are reported in Table 2.

Table 2

End of Cycle 8 Simulation Results

Comparison with Normal Operation Leak Rate
(Special simulations with consideration of IRBs at TSPs 2H, 3H and 4H.)

SG	Number of Indications	Normal Operation Leak Rate (gpd)	Median Simulated SLB Leak Rate (gpm)	Mean Simulated SLB Leak Rate (gpm)	Simulated SLB 95/95 Leak Rate (gpm)	Ratio Median SLB/NOP Leak Rate (gpm/gpd)	Freespan Probability of Burst
A	611	10.5	0.476	0.637	1.91	0.045	1.00E-05
B	1229	7.5	0.345	0.605	2.07	0.046	1.03E-03
C	972	8.0	0.501	0.753	2.62	0.063	2.90E-05
D	768	9.0	0.888	1.375	5.13	0.099	7.28E-05