TUELECTRIC

Log # TXX-99139
File # 916 (3/4.3)
10010
Ref. # 10CFR50.90
10CFR50.36

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Senior Vice President
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June 14, 1999

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

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES)
DOCKET NOS. 50-445 AND 50-446
SUBMITTAL OF LICENSE AMENDMENT REQUEST 98-009
IMPLEMENTATION OF 1.0 VOLT REPAIR CRITERIA (TAC NO. MA4843)
REQUEST FOR ADDITIONAL INFORMATION

REF:
1) Generic Letter 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes affected by Outside Diameter Stress Corrosion Cracking," dated August 3, 1995

2) TXU Electric[1] letter logged TXX-99022 from C. L. Terry to the NRC dated February 12, 1999

By a letter dated February 12, 1999 (Reference 2), TXU Electric requested an amendment to the Comanche Peak Units 1 and 2 Technical Specifications (TS). The amendment request would permit implementation of voltage-based alternate repair criteria for steam generator (SG) tubes affected by outer diameter stress corrosion cracking (ODSCC) at Comanche Peak Unit 1. To continue with its review, the NRC staff requested additional information. The information requested and TXU Electric's responses are provided herein. These responses should supplement TXU Electric's previous submittal.

NRC Request:

1. ***The licensee has addressed guidelines in certain sections of Attachment 1 to generic letter (GL) 95-05 and has discussed exceptions to GL 95-05. However, there are certain guidelines in Attachment 1 to GL 95-05 that the licensee either did not address or did not address satisfactorily. The staff requests that the licensee address the following sections in Attachment 1 to GL 95-05:***

Section 1. Introduction ----- Address Sections 1.b.1, 1.b.2, 1.b.3; and 1.b.4

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1. TXU Electric was formerly TU Electric. A license amendment request (LAR 99-003) was submitted per TXX-99022, dated May 14, 1999, to revise the company name contained in the CPSES operating licenses.

TXU Electric Response to Request 1 for Section 1:

Subsection 1.b.1 is addressed in Attachment 2 to WPT- 15949 (which is Reference 2 of submittal TXX-99022) and is referred to in T.S. 4.0.6.4.a.10.d. markup.

Subsection 1.b.2 The repair criteria of GL 95-05 do not apply to tube-TSP intersections with dent signals exceeding 5.0 (bobbin) volts. Any indications confirmed by RPC will be repaired unless an NRC approved correlation between bobbin and RPC volts is available to infer bobbin voltages for tube repair decisions and inclusion of the indications in leak and burst analyses.

Subsection 1.b.3 and 1.b.4 are addressed in Section II subparagraph 5 of Reference 2. which states in part, "[A]ll intersections with interfering signals from copper deposits and intersections with large mixed residuals (i.e. mixed residuals with signal amplitudes > 1.0 volts) will be inspected with RPC." Therefore, the basis for repair will be based upon the RPC results and not the bobbin voltage.

Section 2. Tube Integrity Evaluation ---- The licensee stated that its tube integrity evaluation will be consistent with the methodology of Section 2 of Attachment 1 to GL 95-05. The licensee did not submit the methodology for staff review. Without reviewing the methodology, the staff is not clear whether the licensee's methodology is acceptable. However, the staff would find it acceptable if the licensee would commit to the methodology in a staff approved topical report or the methodology used by another nuclear plant which the staff has approved. The licensee should reference relevant documents to support the methodology that it will use.

TXU Electric Response to Request 1 for Section 2:

The methodology used for evaluation of tube integrity is consistent with the methodology identified in WCAP-14277 Revision 1. This methodology is consistent with the most recent evaluations performed for plants which have applied the criteria, and has not been previously supplied as an example in past license amendment requests. WCAP-14277 Revision 1 serves as the benchmark document for this analysis from which all other analyses have been patterned. The methodology of this document is in accordance with References 4, 5, and 9 of GL 95-05 Attachment 1, as supplemented based on subsequent NRC Staff comments. Additionally, similar methodology for South Texas project has been previously approved by the staff.

Section 3. Inspection Criteria ---- Address Section 3.b.3 in detail. Section 3.b.3 states, "that if circumferential cracking or primary water stress corrosion cracking indications are detected, it may be necessary to expand the rotating pancake coil (RPC) sampling plan to include dents less than 5.0 volts." The licensee needs to address its expansion plan and disposition criteria for the circumferential and primary water stress corrosion cracking indications found in dents that are less than 5.0 volts.

TXU Electric Response to Request 1 for Section 3:

Comanche Peak Unit 1 has not experienced operational denting related to corrosion of the tube support plate (TSP) with subsequent tube deformation. Any "dents" coincident with TSP intersections are believed to be remnants of manufacture which, by chance, occur coincident with TSP intersections. As such, these intersections would not be expected to experience tensile hoop stresses on the tube ID surface consistent with classic tube denting phenomena. Despite this fundamental difference between manufacturing related dents coincident with TSP intersections at Comanche Peak Unit 1 and those plants which have experienced primary water stress corrosion cracking (PWSCC) degradation at dented TSP intersections, TU Electric will follow an expansion program as identified below, in the event that PWSCC is detected at "dented" TSP intersections.

If circumferential cracking or primary water stress corrosion cracking are detected then the scope will be expanded as follows:

- Select a buffer zone population of tubes with 3 - 5 volt dents in each affected steam generator. The buffer zone population should be equal to no less than 20% of the tubes with greater than 5 volt dents, and be consistent with the EPRI Rev. 5 ISI guidelines related to critical area expansion. As the number of dents > 5 volts by bobbin, coincident with TSP intersections, may be small, a minimum of 20 intersections will be inspected using RPC if the value represented by 20% of the hot leg dents > 5 volts is less than 20. If there are no indications in the cold leg, the expansion would be limited to the hot leg.

- If additional circumferential cracking or primary water stress corrosion cracking is detected, then inspect all of the remaining dented intersections greater than 3 volts from the highest elevation that defects were detected and below in the hot leg, <u>or lowest elevation where the defects were detected and above in the cold leg.</u>

Section 4. Tube Removal and Examination/Testing ---- Address Sections 4.b.1; 4.b.2; 4.b.3 and 4.c.

TXU Electric Response to Request 1 for Section 4:

For Sections 4.b.1; 4.b.2; 4.b.3 and 4.c, TXU Electric wishes to clarify that the tubes selected for removal and their examination will conform to the guidance provided in Section 4 of the GL 95-05.

Section 5. Operational Leakage ---- Address Sections 5.b and 5.c. For Section 5.b, discuss the leakage monitoring system used in the plant.

TXU Electric Response to Request 1 for Section 5:

The Technical Specification operational leakage limit, LCO 3.4.5.2, will be changed from 1 gpm total for all steam generators (SGs), 500 gpd maximum in any SG, as currently defined, to 150 gpd (gpd at room temperature) maximum through each SG. SG tubes with known leaks will be repaired prior to returning the SG's to service, consistent with GL 95-05. Procedures and methods are in place to allow for the detection of primary to secondary leakage through the SG's. For a rapidly propagating leak, the Condenser Off Gas monitors and the Steam Generator Blowdown monitors will be used. For a slow propagating leak, the Condenser Off Gas Monitors and chemistry grab samples will be used. Main steam line N-16 detectors are currently scheduled to be installed by March 31, 2000.

Section 6. Reporting Requirements ---- Address Sections 6.a.1; 6.a.3; and 6.b.

TXU Electric Response to Request 1 for Section 6:

The reporting requirements will be in conformance with the requirements depicted in Section 6 of GL 95-05.

2. ***On the cover of the licensee's February 12, 1999 letter, the licensee referenced the EPRI report, NP-7480-L, Addendum 1, 1996 Update, which contains the database for ODSCC at the tube support plant intersections. On page 7 of Attachment 2 to the licensee's letter, the licensee stated that the most current NRC approved database, contained in EPRI NP-7480-L, Addendum 1, was used to establish the voltage limits for the tube support plate and flow distribution baffle plate intersections. The licensee also stated that once approved by the NRC, the industry protocol for updating the database will be followed.***

The staff wishes to clarify that it has approved the protocol for updating the database as documented in a letter to NEI dated January 20, 1998. The staff has also approved the database in "Steam Generator Tubing Outside Diameter Stress Corrosion Cracking at Tube Support Plates Database for Alternate Repair Limits,"

NP-7480-L, Addendum 2, 1998 Database Updated, April 1998, in a letter to NEI dated November 20, 1998. Therefore, Addendum 1 of NP 7480-L is not the current NRC approved database. Moreover, Addendum 2 of NP 7480-L may not be the latest available database because there may have been tube pull performed in 1998 and spring 1999 and whose data may have been incorporated into EPRI NP 7480-L. In light of the recent development in the ODSCC database, the licensee needs to clarify which database it will use to assess steam generator tube integrity.

TXU Electric Response to Request 2:

TXU Electric wishes to clarify that it will use the latest NRC approved database of EPRI NP-7480-L Addenda to assess steam generator tube integrity.

3. ***Comanche Peak Unit 1 uses Westinghouse SG model D4 which has a flow distribution baffle plate (FDBP) located about 8 inches above the top of the tubesheet. The licensee needs to address Section 2.a.3 of Attachment 1 GL 95-05 in light of several issues related to FDBP indications. First, one European nuclear plant and one domestic nuclear plant have experienced relatively high flaw growth rates at FDBP intersections. The high flaw growth rates were attributed to high copper concentrations, caustic crevice conditions, and misalignment of FDBP holes. Second, on page 7 of Attachment 2 to the licensee's letter, the licensee stated that the database in EPRI NP-7480-L, Addendum 1, was used to establish the upper voltage repair limit for the indications in FDBP intersections. The staff believes that EPRI NP-7480-L, Addendum 1, does not contain FDBP indication growth rate data; therefore, the staff is not clear how the database in Addendum 1 is applicable to the upper voltage repair limit for FDBP indications. The licensee needs to***

(1) address potential high flaw growth rates in light of experience of those two nuclear plants using past eddy current inspection results at FDBP intersections of Unit 1 SG, and

(2) confirm if there are any FDBP data in NP-7480-L, Addendum 1; and

(3) clarify how FDBP indications, if detected, would be analyzed in terms of condition monitoring and operational assessment in light of limited FDBP data.

TXU Electric Response to Request 3 item (1):

The following summary addresses the potential high flaw growth rates in light of experience of those two nuclear plants using past eddy current inspection results at FDBP intersections of Unit 1 SG.

Evaluation of Rapid Crack Growth Rates at Flow Distribution Baffles: 3/4" OD Tubing

Historical FDB High Growth Events

Two rapid crack growth events have occurred at flow distribution baffle (FDB) locations in 3/4" OD tubing. One event occurred in a European plant, and is attributed to the incomplete rinsing of the SG following the copper removal stage of a secondary side chemical cleaning process. In this event, the plant had a history of high copper concentrations on the secondary side. Chemical cleaning was used to remove the copper from the secondary side. The rinsing process was inadequate, and resulted in large amounts, up to 1" deep, of highly concentrated copper products to become deposited atop the FDB. After return to power, a primary to secondary leak was detected and the plant shutdown to address the leak. Axial ODSCC was observed immediately above the FDB by eddy current testing. Eddy current testing also provided evidence of the copper product concentration atop the FDB. Chemical cleaning has been performed at Comanche Peak Unit 1, however, the feedtrain at Comanche Peak Unit 1 contains no copper or copper alloys, and therefore, no copper species should be present on the secondary sides of the Comanche Peak Unit 1 SGs.

In the second event, large axial ODSCC signals were observed in tubes at the FDB in a U.S. plant with Model D3 SGs. The large growth indications were observed only in one SG, at the end of Cycle 7. Typical crack growth rates were observed at the TSPs during Cycle 6 and Cycle 7, with only a few indications reported at the FDB in Cycle 6.

The cause of the cracking was attributed to high copper concentrations, caustic crevice conditions, and FDB hole misalignment, the latter which lead to partial packing of the FDB holes via contact between the tube and FDB hole at operating conditions. The source of high copper ingress was believed to be attributed to ammonia breakthrough of the SG B demineralizer bed which supplied large quantities of ammonia and sodium species into the feedwater. The ammonia would accelerate the transport of copper species from the copper moisture separator reheater tubes to the SG. The sodium-chloride molar ratio was noted to be elevated for the major portion of Cycle 7, suggesting a caustic crevice condition. The demineralizer beds were not in operation during Cycle 6. Normal sodium-chloride molar ratio was recorded for Cycle 6.

Tube pull results indicated high copper concentrations in the tube OD oxides. Various methods were used to measure the elemental compositions of the crack face oxides and crevice deposits. The copper concentrations along the fracture face at a thin oxide region using energy-dispersive spectroscopy (EDS) ranged from 1.41 to 13.42 weight percent copper, while OD deposit copper concentrations in the tube OD thick deposits ranged from 0.62 to 2.82 weight percent copper. AES (Auger) analysis of crack face oxides gave typical values of 16 wt% copper at the surface of the oxide, with copper wt% values as high as 6 at about 3600 Angstroms deep. Copper acts as an oxidizer, thereby accelerating corrosion processes. With the potential for a caustic crevice due to

the sodium transport from the demineralizer bed and presence of an oxidizer, the potential existed for high crack growth rates at the FDB. The partially packed crevice conditions at the FDB, combined with the larger (than a TSP tube hole) elongated holes provided a large surface area for transport of copper and sodium from the bulk water into the OD deposits at the partially packed FDB crevices. Copper and sodium transport to the TSP crevices would be restricted by virtue that the TSP crevices were packed during the previous 6 cycles of operation.

EPRI TR-106048 gives an average typical sludge copper weight % of 21.41 for plants with copper in the feedtrain, compared to an average of about 1.08 wt% for plants without copper in the feedtrain. As noted, Comanche Peak Unit 1 has no copper in the feedtrain, and accelerated corrosion due to copper species in not expected.

FDB Misalignment Impact Upon Observed FDB Growth Rates

Possible FDB misalignment was also considered an influencing factor. If the FDB contacts the tube during operation, localized dryout conditions develop, leading to the development of OD deposits in the contact region. Additionally, but considered a lesser contributing factor, service induced hoop stress can be applied to the tube via the tube to FDB contact. Hoop stresses result in axial crack initiation potential to be increased.

The FDB hole design for Comanche Peak Unit 1 includes larger hole diameters compared to the other U.S. plant experience. For Comanche Peak Unit 1, the FDB hole is round, and is sized at 0.828" +0.000"/-0.015", resulting in a nominal tube to FDB radial gap of 0.039". The FDB design in the other U.S. plant with high FDB growths used an elongated hole design. In the elongated hole design, a 0.813 +0.015/-0.000" hole is produced at the tube location. This hole is then elongated radially outward from the center of the plate for a distance of 0.062" while the 0.813 diameter is maintained. The radial outward elongation is used to account for tube motion due to tubesheet bow. The nominal tube to FDB radial gap should have remained constant at 0.032". Numerous TSP indications were also observed at this plant, but the flaw voltages at the TSPs were significantly less than the FDB indications (three largest ranged from 6 to 22 volts). Per WCAP-13824, presented to the NRC, RPC eddy current data suggests that the tubes which experienced the high FDB growth rates were contacting the FDB at the time of the inspection, and had a high likelihood of contacting the FDB at operating conditions. Per WCAP-13824, OD crevice deposits were noted over approximately 80 to 160° arc on the tubes. The axial flaws were located within these deposit regions. Flaw morphology was characterized by a single axial macrocrack which developed formed by the linking of smaller, in-line axial crack initiation sites. This morphology is not typical of TSP ODSCC, in which multiple initiation sites are located around the tube circumference. The prevalence of a single macrocrack is similar to PWSCC indications at dented TSPs, in which flaws develop primarily as single axial flaws, driven primarily by stress conditions.

FDB hole size or misalignment potential was not an influencing factor in the European experience. FDB misalignment is not considered to represent a high probability of affecting large numbers of tubes. If a FDB hole misalignment issue were widespread, FDB indications would have been observed at Byron 1 and Braidwood 1, both D4 SGs which utilize a FDB. No reports of high FDB growth rates were reported at Byron 1 or Braidwood 1. These plants had widespread ODSCC attack at TSP locations. Both plants had over 3000 indications observed at TSP intersections which were permitted to remain in service by application of the voltage based plugging criteria. If FDB locations were susceptible to high ODSCC growth rates, it is reasonable to expect some population of large indications. No bobbin indications (DSIs) were reported at the Comanche Peak Unit 1 hot leg FDB for the most recent inspection. At the other plant which has received approval to apply the criteria to FDB intersections, no bobbin DSI indications were reported during the two most recent inspections. One bobbin indication was reported in the sister unit at the 1997 inspection. Subsequent re-analysis since the outage has determined this signal is not representative of a flaw-like indication. A total of 21 tubes were RPC inspected at the FDB for possible indications at various times in their histories at this plant. The RPC results from the database for these tubes were either NDD (no detectable degradation), NDF (no degradation found), MBMs (manufacturing buff marks), or PVN (permeability variation), and are not suggestive of crack-like indications. The RPC inspection of these tubes may or may not have been triggered by the bobbin coil inspection (i.e., some were the result of a random sampling).

Additionally, contact points were noted in the tube pull exam at the FDB in the U.S. plant with high FDB growth rates. At a plant with Model E2 SGs, it was reported that no such contact points were observed in the 6 tube pulls with FDB crevices. In this plants response to GL 97-06, visual inspection of the FDB holes indicate no contact with the tube.

Overall, it is concluded that the potential for large ODSCC growth rates at the FDB of Comanche Peak Unit 1 is negligible and comparable to any other TSP locations.

<u>TXU Electric Response to Request 3 item (2):</u>

EPRI NP-7480-L, Addendum 2, or the most recently approved database document, will be utilized for evaluation of the criteria application at Comanche Peak Unit 1, 1RF07 outage in the fall of 1999. The 3 FDB large growth rate indications from Plant S, R28 C41, R33 C20, and R42 C43, are utilized in the EPRI database. All three tubes are utilized in the probability of leakage and leak rate correlations. R28 C41 is not used in the burst pressure correlation due to incomplete burst test.

There are no FDB growth data in any of the EPRI database reports. The intended reference to the database addenda for the FDB voltage repair limits is to obtain the structural limit rather than the growth data.

TXU Electric Response to Request 3 item (3):

Analysis of FDB indications will be per GL 95-05. Based on the larger tube to plate gap inherent to the FDB design, such indications are evaluated using an upper voltage repair limit based on 3 times normal operating pressure differential as opposed to 1.4 times SLB pressure differential for TSP indications.

Since there is no basis to expect larger growth rates at the FDBs at Comanche Peak unit 1, the upper voltage repair limit for FDBs will utilize the larger of the average growth rate for TSP intersections or 30%/EFPY, per GL 95-05. When indications are found at the FDBs, the growth rates for those indications will be compared to that found at TSP intersections. If, unexpectedly, the FDB growth rates are significantly different and larger at the FDBs, a separate growth rate will be applied for FDB analysis.

4. ***NRC Information Notice (IN) 97-79, "Potential Inconsistency in the Assessment of the Radiological Consequences of a Main Steam Line Break Associated with the Implementation of Steam Generators Tube Voltage-Based Repair Criteria" provides information regarding discrepancy in temperature assumed in the projected end of cycle tube leakage calculation and the maximum allowable tube leakage calculation. The licensee needs to address its resolution of this discrepancy.***

TXU Electric Response to Request 4:

SG tube leakage in the steam line break evaluation, due to indications permitted to remain in service by virtue of application of the criteria are calculated on a room temperature volumetric leak rate basis (i.e., gpm). This is consistent with the ARC database. The maximum allowable SLB condition leak rate is calculated on a room temperature basis. This methodology is consistent with the current analysis for all other plants which have applied the GL 95-05 alternate repair criteria.

In accordance with 10CFR50.91(b), TU Electric is providing the State of Texas with a copy of this supplement to the proposed amendment.

Should you have any questions, please contact Mr. Obaid Bhatty at (254) 897-5839.

Sincerely,

C. L. Terry

By: Roger D. Walker
Roger D. Walker
Regulatory Affairs Manager

OAB/oab
Attachment: 1. Affidavit

cc: Mr. E. W. Merschoff, Region IV
Mr. D. H. Jaffe, NRR
Mr. J. I. Tapia, Region IV
Resident Inspectors, CPSES

Mr. Arthur C. Tate
Bureau of Radiation Control
Texas Department of Public Health
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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of	)		
	)		
TXU Electric Company	)	Docket Nos.	50-445
	)		50-446
(Comanche Peak Steam Electric	)	License Nos.	NPF-87
Station, Units 1 & 2)	)		NPF-89

AFFIDAVIT

Roger D. Walker being duly sworn, hereby deposes and says that he is the Regulatory Affairs Manager of TXU Electric, the licensee herein; that he is duly authorized to sign and file with the Nuclear Regulatory Commission this supplement to License Amendment Request 98-009; that he is familiar with the content thereof; and that the matters set forth therein are true and correct to the best of his knowledge, information and belief.

Roger D. Walker

Roger D. Walker
Regulatory Affairs Manager

STATE OF TEXAS)
)
COUNTY OF SOMERVELL)

Subscribed and sworn to before me, on this 14th day of June, 1999.

Gayle R. Peck Jespersen

Notary Public

NOTARY PUBLIC STATE OF TEXAS
Gayle R. Peck Jespersen
Notary Public, State of Texas
My Comm. Expires 03/16/02