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

South Texas Project
Unit 1
Docket No. STN 50-498
Special Report Regarding An Evaluation of
The Unit 1 Fifth Year Containment Tendon Surveillance

Pursuant to the South Texas Project Electric Generating Station Technical Specifications 3.6.1.6, Houston Lighting & Power submits the attached Special Report regarding an evaluation of the Unit 1 fifth year containment tendon surveillance.

If you should have any questions on this matter, please contact Mr. C. A. Ayala at (512) 972-8628 or me at (512) 972-7205.

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Technical Specification 4.6.1.6 requires that the structural integrity of the containment tendons be demonstrated at the end of 1, 3, and 5 years following the initial containment structural integrity test and at 5 year intervals thereafter. During the performance of the Unit 1 fifth year surveillance it was discovered that tendon filler grease voids in excess of the Surveillance Requirement 4.6.1.6.1d.2 maximum of 5 percent of net duct volume existed. Compliance with the associated action statement required restoration of containment structural integrity, which was not compromised by the voids, performance of an engineering evaluation and submittal of this Special Report. Note that refilling of grease is accomplished simultaneously with the discoveries of voids as a result of the inspection process used.

Ten Reactor Containment Building tendons are required to be inspected for the surveillance. At this time, the Unit 1 fifth year surveillance is not complete. To date, two containment tendon inspections have been completed with grease voids of 6.2% and 7.2%.

The main purpose for the sheathing filler material grease is to provide long-term corrosion protection for the tendon wires and anchorage components. Initial installation of the sheathing filler material involved pumping the heated grease into the tendon sheathing (duct) from one end of the horizontal tendon and continue pumping until the hot grease (temperature > congealing point) is ejected from the opposite end of the horizontal tendon with a continuous stream of hot grease flow, free of air bubbles and foreign substances. Additionally, for horizontal tendons routed above discontinuities such as a penetration, the sheathing was vented to release entrapped air during grease injection. Filling the vertical tendons is basically the same, except pumping is performed from both ends of the tendon until the hot grease is ejected from the high point vent located at the apex of the dome. This installation procedure assured that the tendon had been thoroughly coated with grease over its entire length including filling the grease caps, thus encasing the tendon-end anchorages. In addition, the tendon wires were coated with a temporary corrosion preventative Visconorust, 1601-Amber after fabrication for storage and handling of the tendon coil. Furthermore, the tendon wires were hand-coated with Visconorust 2090 P-4 (grease) during installation where the temporary corrosion preventative material had been scraped off and to lubricate the tendon for insertion into the duct. This insured that all of the tendon wires were coated with corrosion inhibitor at the time of installation and maintained corrosion-free through their entire service life.

Grease voids are expected in the tendon ducts. The percent voids can be in excess of the 5% limit for several reasons which are explained below:

1) Shrinkage of grease occurs since the grease was initially injected at a temperature between 150 and .50 degrees. The grease (Visconorust 2090 P-4) has a coefficient of expansion which yields an expansion of about 1% per 20°F. Initial installation temperatures are typically greater than 180°F. Depending on the ambient temperature, shrinkage can be in excess of 4%.

2) Spaces exist between the wires in the tendon bundle. The tendon is made up of 186 tightly wound wires. This condition makes it very difficult to fill all spaces between the wires during initial installation because the tendon is at ambient temperature. As the hot grease surrounded the tendon, it is possible that it worked its way into the middle spaces of the tendon bundle. These spaces make up a minimum of 3% of the net duct volume for a given tendon. In addition, this migration of grease may occur in areas where the tendon is in contact with the sheathing, which is not considered in the previous 3%.

3) The initial installation process took care to eliminate duct voids as much as possible; however, it does introduce air into the duct during the pumping of the grease. The process of pumping grease into the duct entrains air inside the grease. This entrained air can surface from suspension between the time the duct is filled and the surveillance is performed. Additionally, air becomes entrapped while the grease is pumped from one end of the sheathing to the other end, which can be as long as 600 feet. This introduction of entrained and entrapped air can account for a significant percentage of the additional grease pumped into the tendon duct during the surveillance.

Therefore, voids 20% or less are considered reasonable. There was no evidence of grease leakage as determined by performing a visual inspection of the accessible containment surfaces and by holding the pressure for one hour after replacing the grease. A visual examination of exposed anchorage components was performed at both ends of the tendons and there was no evidence of degradation.

. previously stated, the tendon wires and anchorage system were coated with storage or filler grease prior to installation and the ducts were completely filled with filler material from one end of the tendon to the other at initial installation. Special consideration was given to the formulation of the filler grease as the original specification required it to have a liquid vapor phase inhibitor for the prevention of corrosion within the voids. The filler material was also required to contain additives to enhance the corrosion-inhibiting and wetting properties, as well as to form a chemical bond with the tendon steel. Therefore, the corrosion protection for the tendons not included in this surveillance is maintained.

Previous surveillances at other plants which have similar installation of tendons have shown that the existence of grease voids in the ducts have not had adverse affects on the tendons. Additionally, the manufacturer of the grease has suggested against eliminating voids from the tendon duct due to the coefficient of expansion of the grease discussed in item 1 above, when the grease is installed while containment ambient temperature is below the upper operating range. The duct needs some void area to allow the grease to expand in order not to be detrimental to the tendon sheathing.

In conclusion, grease was initially installed throughout the entire length of the tendon ducts and grease coverage was assured. The grease will adhere to the tendon and protect the wires from corrosion. There is a vapor phase inhibitor in the Visconorust 2090 P-4 for the prevention of corrosion within voids as well as additives to enhance corrosion-inhibiting properties of the grease. The tendons which had voids have been filled and there is no evidence of grease leakage from the sheathing. The remaining tendons in the containment structure are adequate in their existing condition since minimum grease coverage still exists to provide corrosion protection for the post-tensioning system. Adequate grease coverage exists for the tendons to maintain corrosion protection and no grease leakage is evident, therefore, containment integrity is assured.

HL&P expects that the remaining tendon inspections will result in grease voids similar to the tendon voids experienced in previous surveillances. If it is determined that an abnormal degradation of the containment building exists, then additional information will be provided in a supplemental report to the Commission.