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

September 24, 1993
NOC-AE-000304
File No.: G02
10CFR50.36
STI: 30717663

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

South Texas Project
Units 1 & 2
Docket Nos.: STN 50-498, STN 50-499
Special Report Regarding an
Evaluation of Unit 1 and Unit 2 Containment Tendon Conditions

Pursuant to South Texas Project Technical Specifications 3.6.1.6 and 6.9.2, the STP Nuclear Operating Company submits the attached Special Report regarding an evaluation of Unit 1 and Unit 2 Containment tendon conditions.

There are no licensing commitments in this letter. If you have any questions on this matter, please contact Mr. K. J. Taplett at (512) 972-8416 or me at (512) 972-7162.

S. E. Thomas
Manager,
Design Engineering

KJT/

Attachment: Special Report Regarding an Evaluation of Unit 1 and Unit 2 Containment Tendon Conditions

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Ellis W. Merschoff
Regional Administrator, Region IV
U. S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

Thomas W. Alexion
Project Manager, Mail Code 13H3
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Cornelius F. O'Keefe
Sr. Resident Inspector
c/o U. S. Nuclear Regulatory Commission
P. O. Box 910
Bay City, TX 77404-0910

J. R. Newman, Esquire
Morgan, Lewis & Bockius
1800 M. Street, N.W.
Washington, DC 20036-5869

M. T. Hardt/W. C. Gunst
City Public Service
P. O. Box 1771
San Antonio, TX 78296

A. Ramirez/C. M. Canady
City of Austin
Electric Utility Department
721 Barton Springs Road
Austin, TX 78704

Jon C. Wood
Matthews & Branscomb
One Alamo Center
106 S. St. Mary's Street, Suite 700
San Antonio, TX 78205-3692

Institute of Nuclear Power
Operations - Records Center
700 Galleria Parkway
Atlanta, GA 30339-5957

Richard A. Ratliff
Bureau of Radiation Control
Texas Department of Health
1100 West 49th Street
Austin, TX 78756-3189

D. G. Tees/R. L. Balcom
Houston Lighting & Power Co.
P. O. Box 1700
Houston, TX 77251

Central Power and Light Company
ATTN: G. E. Vaughn/C. A. Johnson
P. O. Box 289, Mail Code: N5012
Wadsworth, TX 77483

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Washington, D.C. 20555-0001

Special Report Regarding an Evaluation of Unit 1 and Unit 2 Containment Tendon Conditions

Reference: South Texas Project Unit 1 Licensee Event Report 98-001 dated February 23, 1998 (NOC-AE-0083)

The referenced correspondence documents a reportable occurrence in performance of previous containment post-tensioning system surveillances. The occurrence (limited to the first year surveillance for Unit 2 and the fifth year surveillance for Unit 1) resulted in failure to perform additional liftoff testing required per Technical Specification Surveillance Requirement 4.6.1.6.1.a.(2). The South Texas Project committed to retest the affected tendon in each unit and their adjacent tendons by September 1998. During implementation of this commitment, it was discovered that tendon filler grease voids in excess of the Technical Specification Surveillance Requirement 4.6.1.6.1.d.(2) maximum of 5 percent of net duct volume existed. Technical Specification 3.6.1.6.b requires:

> With the indicated abnormal degradation of the structural integrity other than indicated by conditions in Specification 4.6.1.6.1.a.(4), at a level below the acceptance criteria of Specification 4.6.1.6, restore the containment(s) to the required level of integrity or verify that containment integrity is maintained within 15 days, perform an engineering evaluation of the containment(s) and provide a Special Report to the Nuclear Regulatory Commission within 30 days in accordance with Specification 6.9.2 or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

Grease voids in excess of 5% were present in two tendons in each unit. The voids for the four tendons ranged between 5.7% and 8.4%. Sheathing filler grease was added simultaneously with the discovery of the voids as a result of the inspection process to restore the affected tendons to the required level of integrity.

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 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 2090P-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 ensured 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 250 degrees F. The grease (Visconorust 2090P-4) has a coefficient of expansion which yields an expansion of about 1% per 20 degrees F. Initial installation temperatures are typically greater than 180 degrees 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 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 of 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 from the surveillance tendons as well as the wires removed from the detensioned tendons has shown no evidence of degradation.

As 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 is maintained.

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 2090P-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 significant grease leakage is evident, therefore, Containment integrity is assured.