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From: "Philip Walker" <plwalker@stpegs.com>
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Date: 7/25/02 5:22PM
Subject: Relief Request for Containment Tendon Surveillance

Attached is the revised relief request that I mentioned in my telephone message of July 25. It is in draft format for your reviewers to look at as an alternative approach to that which we sent in September 26, 2001. I will be out the last week of July, so if you have any questions, please contact Scott Head. Otherwise, we can schedule a telephone call to discuss it further.

Thanks.

Philip Walker

CC: "Scott Head" <smhead.GWPO_NASSUR.GWDOM_STP@stpegs.com>

Nuclear Operating Company

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

DRAFT

NOC-AE-
File No.: G25
10CFR50.55a

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
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South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Revised Request for Approval of an Alternative Approach for
Containment Tendon Surveillances (RR-ENG-37)

Reference: Letter, T. J. Jordan to NRC Document Control Desk, "Request for Approval of an Alternative Approach for Containment Tendon Surveillances (RR-ENG-37)

In accordance with the provisions of 10CFR50.55a(a)(3)(i), the South Texas Project requests approval of an alternative to ASME Section XI, paragraph IWL-2421, which specifies the intervals between inspections of containment concrete and unbonded post-tensioning systems. This request supercedes a previous submittal (Reference 1). Change bars have been added in the margin to denote the differences between the submittals.

The proposed alternative surveillance will require liftoff testing at 10-year intervals, beginning in the 15th year, of two horizontal tendons chosen to address the Commission's concern with steel relaxation (NRC Information Notice 99-10, "Degradation of Prestressing Tendon Systems in Prestressed Concrete," October 7, 1999). This alternative examination will occur only in years 15, 25, and 35. The regular examination will take place in years 20 and 30. This represents a revision to the previous submittal, which proposed no liftoff testing in years 15, 25, and 35.

This request applies to the current surveillance interval, which ends September 8, 2008. This surveillance interval includes the 15th year and 20th year tendon surveillances.

Reduced requirements for the Unit 1 and Unit 2 reactor containment examinations will not present an undue risk to the public health and safety, and provides an acceptable level of quality and safety.

The South Texas Project requests Nuclear Regulatory Commission approval of this proposed schedule by _____, 2002, to facilitate scheduling for subsequent inspections of containment concrete and unbonded post-tensioning systems. Although this request is neither exigent nor an emergency, prompt review by the Nuclear Regulatory Commission is requested.

If there are any questions, please contact either Mr. R. L. Engen at (361) 972-7363 or me at (361) 972-7902.

T. J. Jordan
Vice President,
Engineering & Technical Services

PLW

Attachments: 1) Revised Request for Approval of an Alternative Approach for Containment Tendon Surveillances (RR-ENG-37)
2) Current Test Schedule
3) Proposed Test Schedule

cc:
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ATTACHMENT 1

REVISED REQUEST FOR APPROVAL OF AN ALTERNATIVE APPROACH FOR CONTAINMENT TENDON SURVEILLANCES (RR-ENG-37)

SOUTH TEXAS PROJECT
UNITS 1 AND 2
Revised Request for Approval of an Alternative Approach for Containment Tendon Surveillances (RR-ENG-37)

A. Components for Which Exemption is Requested

Component: Reactor Containment Concrete and Unbonded Post-Tensioning Systems

Function: The components support continued containment structural integrity in the event of a loss of coolant or steam line break accident.

Class: ASME Code Class CC

B. Applicable Code

ASME Boiler & Pressure Vessel Code, Section XI, 1992 Edition

C. Code Requirements from Which Relief is Requested

The South Texas Project is a two-unit facility:

- Both Containment structures use the same pre-stressing system and are essentially identical in design;
- Post-tensioning operations were completed less than two years apart; and
- Both Containment structures are similarly exposed to the outside environment.

IWL-2421 (b) describes the inservice inspection schedule to be followed for examination of containment concrete and unbonded post-tensioning systems for sites with two plants:

(1) For the containment with the first Structural Integrity Test, all examinations required by IWL-2500 shall be performed at 1, 3, 10, 20, and 30 years. Only the examinations required by IWL-2524 and IWL-2525 need be performed at 5, 15, 25, and 35 years.

(2) For the containment with the second Structural Integrity Test, all examinations required by IWL-2500 shall be performed at 1, 5, 15, 25, and 35 years. Only the examinations required by IWL-2524 and IWL-2525 need be performed at 3, 10, 20, and 30 years.

IWL-2500 describes requirements for examination of concrete and unbonded post-tensioning systems. IWL-2524 addresses examination of tendon anchorage areas, and IWL-2525 covers examination of corrosion protection medium and free water.

D. Basis for Relief from Code Requirements

Based on the inspection results from previous cycles, there is little value to be gained by conducting a full inspection every five years. Given the expected rate of change in the material condition of the reactor containment structure, inspections at the specified intervals are not needed, and result in unnecessary expense and risk to workers performing the inspections.

E. Proposed Alternate Examination

The South Texas Project requests approval to apply a revised inspection protocol as an alternative to that specified in ASME Section XI, Subsection IWL-2421 (b), for performing the containment Structural Integrity Test.

The alternate surveillance will require liftoff testing of two horizontal tendons at selected intervals, rather than three horizontal and three vertical tendons at each inspection. The two will be specifically chosen (rather than randomly chosen), with one of the two adjacent to the main steam penetration (tendon 2H039). The other will be randomly chosen from a group of five horizontal tendons anchored at buttress 2. Buttress 2 is accessible by using an on-site crane. Buttresses 1 and 3 are surrounded by buildings and structures, and will require a large rental crane to access.

If either of the two tested tendons does not meet the acceptance standards, STP will perform additional evaluation per IWL-3310.

The surveillance is currently performed every five years, alternating between Unit 1 and Unit 2. As proposed, the currently applicable surveillance will be implemented in years 20 and 30 in Unit 2 and Unit 1, respectively. The alternative surveillance will be performed in years 15, 25, and 35, occurring in Units 1, 2, and 1, respectively.

This request applies to the current 10-year surveillance interval, which ends September 8, 2008. This surveillance interval includes the 15th year and 20th year tendon surveillances.

Current tendon surveillance schedule for liftoff testing:

YEAR	UNIT 1	UNIT 2
15		REGULAR
20	REGULAR	
25		REGULAR
30	REGULAR	
35		REGULAR

Proposed alternative surveillance schedule:

YEAR	UNIT 1	UNIT 2
15	ALTERNATIVE	
20		REGULAR
25		ALTERNATIVE
30	REGULAR	

35	ALTERNATIVE	

F. Basis for Alternative

Containment Structural Design

The purpose of the containment post-tensioning system is to provide strength to resist internal pressure during postulated design basis accidents. The reinforced concrete containment structure is designed to resist loads imposed by external events such as wind, seismic activity, and tornadoes.

The South Texas Project containment structure is a post-tensioned concrete cylinder with steel liner plates, hemispherical top and flat bottom. The cylindrical portion and the hemispherical dome of the Containment are pre-stressed by a post-tensioning system consisting of horizontal and vertical tendons.

Three buttresses equally spaced around the Containment provide anchor points for the horizontal tendons. The cylinder and the lower half of the dome are pre-stressed by horizontal tendons with anchors separated 360 degrees around the structure, bypassing the intermediate buttresses. Anchorage for each successive hoop is progressively offset 120 degrees from the one beneath it.

The vertical inverted U-shaped tendons are continuous over the dome, forming a two-way post-tensioning system for the dome. These tendons are anchored in a continuous gallery beneath the base slab, which provides for installation and inspection of the vertical tendons.

Margin of Safety

The South Texas Project containment structure includes a substantial design margin for

pressure. The design pressure for the building is 56.5 psig, but the calculated maximum pressure that could occur following a design basis accident is 41.2 psig. The resulting design margin is 37% [56.5/41.2 = 1.37]. This exceeds the 10% design margin discussed in Chapter 6 of NUREG-0800, "Standard Review Plan."

Previous Examination Results

Examinations have been conducted at one, three, five, and ten years following the initial post-tensioning operations for Unit 1, and for Unit 2.

The containment concrete surface, including coated areas, has been visually examined for areas of large spalling, severe scaling, D-cracking in an area of 25 ft^2 or more, other surface deterioration or disintegration, or significant grease leakage. No damage or degradation of the concrete surfaces was identified during the examinations.

The condition of unbonded post-tensioning systems has been determined by:

- Tendon force measurements;

Test results are summarized in Table 1.

- Tendon wire and strand sample examination and testing;

At each surveillance that included liftoff testing, one wire was removed from each of two tendons (one horizontal and one vertical) along with the anchorage hardware and inspected for deterioration or corrosion. The tendon wires and anchorage hardware were free of corrosion with no signs of cracking.

- Examination of tendon anchorage areas;

The anchor components were inspected after end-cap removal for corrosion protection medium coverage. All were properly covered.

The concrete surface surrounding the bearing plates was visually inspected for evidence of cracks greater than 0.01-inch in width. The only cracks identified were minor surface shrinkage cracks, a normal characteristic of concrete.

- Examination of corrosion protection medium and free water;

Samples of the corrosion protection medium were tested for water content, reserve alkalinity, concentrations of water-soluble chlorides, nitrates, and sulfides. The values were well below the acceptable limits as specified in Table IWL-2525-1.

- Addition of corrosion protection medium.

Grease additions have been evaluated and found acceptable. No evidence of internal grease leakage has been found.

Trend Analysis

Results from previous tendon examinations show that the progression of tendon pre-stress loss is close to the predicted behavior. The IWL-3221.1(b) limit for acceptability is 95% of the predicted value. Using regression analysis (NRC Information Notice 99-10, "Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments," October 7, 1999), the trend lines for the four tendon groups indicate that pre-stress loss will remain in the acceptable range for the life of the plant. The trend

data are summarized in Table 2 and Figure 1. The worst-case trend is for Unit 1 horizontal tendons, which are trending toward 96.5% of predicted lift-off force at year 40 of plant life (i.e., predicted value minus 3.5%).

Figure 1 reflects the belief (supported both theoretically and by experience) that pre-stress loss should occur linearly with the logarithm of time, but nonlinearly on a linear time scale. A consequence of the non-linearity is that the majority of the lifetime loss is expected to occur during the first ten years. Even though data points are available only for the first ten years of plant life, this period covers the majority of the expected pre-stress losses. Therefore, ten-year data provides a high confidence that the projected lifetime trend lines are reasonably representative of actual lifetime behavior.

NRC Information Notice 99-10

Information Notice IEN 99-10 addresses three NRC concerns with tendons: 1) breakage of prestressing tendon wires; 2) accelerated relaxation as an effect of high temperature on the prestressing forces in tendons; and 3) trend analysis of prestressing forces. Each of these issues is addressed here.

Breakage: The STP design assumes 1-percent wire breakage. With 186 wires per tendon, and 229 tendons total, this implies an assumption of 426 broken wires per unit. To date, STP has documented fewer than 30 broken or damaged wires in each unit (0.06%), with about half of these being the result of destructive surveillance testing and all but one of the others occurring during initial installation. -

Accelerated Relaxation: Laboratory test data used to estimate tendon tension relaxation was obtained at approximately 70 degrees Fahrenheit. However, because actual tendon temperature may be higher than that, there is potential for steel relaxation to be underestimated. The proposed alternative surveillance addresses this issue by examining a tendon that is next to the containment main steam penetration. This tendon is exposed to higher temperatures than the remaining tendons, and is a conservative indicator of relaxation of tendon tension that may have occurred. There is no need to examine vertical tendons as part of the alternate surveillance, since any accelerated relaxation due to higher temperatures (if present) would be seen at the highest-temperature horizontal tendon. This tendon conservatively bounds all tendons (horizontal and

vertical) with regard to thermal-accelerated relaxation.

Trending: Trended results of previous STP surveillances are given in Table 2 and Figure 1. The trends were calculated using regression analysis consistent with IEN 99-10. (See "Trend Analysis" section above for results.)

Probabilistic Safety Assessment

The frequency of radionuclide release due to reactor containment failures at the time of an accident has been determined by a Level 2 Probabilistic Safety Assessment for the South Texas Project. Due to all analyzed accident sequences and containment failure modes, the Large Early Release Frequency (LERF) is 6.1E-07 events/year. The major contributors to this release frequency are from containment bypass sequences involving an induced steam generator tube rupture or interfacing LOCA. The containment building failure mode is a very small contributor to LERF.

Summary

Over the ten-year history of test and examination, the post-tensioning system has behaved as designed, and no damage or degradation of the concrete surfaces was identified during the examinations. All tendon groups at the South Texas Project are following a trend that is projected to remain acceptable for 40 years of plant life. Furthermore, the design has a substantial margin of safety, such that pre-stress loss would have to be far greater than predicted to reduce the ability of the containment structure to withstand the calculated accident pressure loads. Degradation this significant is detectable with the proposed alternative surveillance. Therefore, modifying the surveillance protocol as described is appropriate.

G. Duration of Proposed Alternative

This relief request is applicable to the current South Texas Project IWE/IWL inspection interval, which expires September 8, 2008.

H. Implementation Schedule

The South Texas Project requests Nuclear Regulatory Commission approval by

_____, 2002, to support procurement and scheduling of the 15th year surveillance to be performed in 2003.

Table 1

Tendon Force Measurement Summary:

Deviation from Predicted Values (%)

	Unit 1-Horizontal	Unit 1-Vertical	Unit 1-All	Unit 2-Horizontal	Unit 2-Vertical	Unit 2-All	All-Horizontal	All-Vertical	All
Low	-5.9	-1.7	-5.9	-5.9	-1.0	-5.9	-5.9	-1.7	-5.9
Median	1.1	0.7	1.0	0.3	2.3	1.1	0.7	1.3	1.1
Mean	0.7	0.9	0.7	1.3	2.5	1.7	1.0	1.6	1.2

Table 2

Tendon Force Projected Trends:

Projected Deviation from Predicted Values (%)

Trend	Unit 1-Horizontal	Unit 1-Vertical	Unit 1-All	Unit 2-Horizontal	Unit 2-Vertical	Unit 2-All	All-Horizontal	All-Vertical	All
Yr. 15	-1.91	1.71	-0.68	-0.75	5.32	0.68	-1.45	2.63	-0.21
Yr. 20	-2.38	1.87	-0.94	-1.08	5.75	0.52	-1.87	2.81	-0.44
Yr. 30	-3.03	2.09	-1.31	-1.55	6.35	0.30	-2.45	3.07	-0.77
Yr. 40	-3.50	2.25	-1.57	-1.88	6.78	0.14	-2.86	3.25	-1.01

Figure 1

Trendlines of Lift-Off Tests (years 1, 5, and 10)