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Reactor Building Post-Tensioning System Surveillance Program....

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DUKE POWER COMPANY
POWER BUILDING
422 SOUTH CHURCH STREET, CHARLOTTE, N. C. 28201

A. C. THIES
SENIOR VICE PRESIDENT
PRODUCTION AND TRANSMISSION

P. O. BOX 2178

March 12, 1975

Mr. Angelo Giambusso, Director
Division of Reactor Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Re: Oconee Nuclear Station
Unit 1
Docket No. 50-269

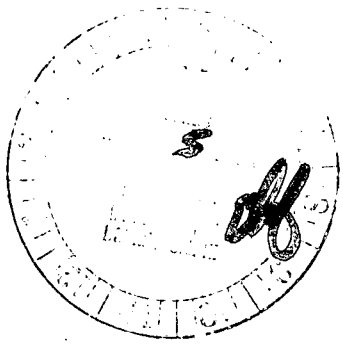
Dear Mr. Giambusso:

Please find attached three copies of the Reactor Building Post-Tensioning System Surveillance Program. This report is submitted in accordance with Oconee Technical Specifications 4.4.2.2 and 6.6.3.5.

Very truly yours,

A. C. Thies

ACT:ge



2845

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

UNIT 1

REACTOR BUILDING

POST-TENSIONING SYSTEM

SURVEILLANCE PROGRAM

March 12, 1975

TABLE OF CONTENTS

1.0 INTRODUCTION

The surveillance program for the Oconee Nuclear Station, Unit 1, reactor building post-tensioning system was defined, and is executed, in order to assure the continued quality of the system. The program consists of periodic inspections of nine pre-selected tendons - three horizontal tendons, three vertical tendons and three dome tendons - for symptoms of material deterioration or force reduction. The program assesses the condition and functional capability of the system and, therefore, verifies the adequacy of the system and provides an opportunity to take proper corrective action should adverse conditions be detected.

The requirements for the program are detailed in the Oconee Technical Specifications, Sections 4.4.2.1 and 4.4.2.2. Surveillance was conducted November 15 to December 12, 1974 in accordance with approved test procedure PT/0/A/150/14, Reactor Building Tendon Surveillance Program, and the results of this initial inspection are reported herein.

2.0 SUMMARY AND CONCLUSIONS

2.1 SUMMARY

No significant discoloration of the sheathing filler was observed. Laboratory analysis of sheathing filler samples showed impurities to be within acceptable limits.

The end anchorage components were found to be in excellent condition with no sign of the development of adverse conditions such as cracking or excessive corrosion, or missing or deformed buttonheads.

The lift-off forces for all surveillance tendons were within the range of predicted values, considering the effects of concrete creep and shrinkage, steel relaxation and initial structural deformation.

The tendon wires were in excellent condition and no corrosion along the length of the wires was observed. It was determined that no wire breaks had occurred during the interval since the initial Reactor Building Tendon Surveillance Test.

Mechanical tests of specimens showed no significant changes in the ultimate strength of the wire as compared to results obtained during acceptance tests.

2.2 CONCLUSIONS

Based on the tests and inspections described herein, it is concluded that the post-tensioning system for Oconee Nuclear Station, Unit 1, is in excellent condition, that the functional capability of the system has not diminished, and that the system shows no detectable evidence of the occurrence of any adverse deterioration.

3.0 RESULTS

3.1 SHEATHING FILLER

The sheathing filler at the ends of the nine surveillance tendons was visually examined. The filler coating on the end anchorage components, and the color and consistency of the filler, were found to be acceptable, with no evidence of water being present - see Table 1.

Samples of sheathing filler were obtained from each of three tendons from which a wire was removed. This filler was visually examined and no signs of water nor any discoloration of the sheathing filler was evident. Laboratory analysis of the filler samples showed impurities to be within acceptable limits - see Table 2.

3.2 END ANCHORAGE COMPONENTS

The results of the end anchorage component inspections are given in Table 3. Buttonheads were inspected for acceptable shape, general appearance, cracks and corrosion. No buttonhead defects or missing buttonheads were observed. Stress washers, shims and bearing plates were visually inspected for cracking and corrosion. (Some millscale and minor surface corrosion were present on the edges and faces of shims and bearing plates. However, this condition existed at the time of installation and no deterioration has occurred in the interval since installation.)

3.3 LIFT-OFF FORCES

Lift-off forces were obtained for each surveillance tendon - see Table 4. From these readings, an average force per wire was determined. The long-term trend of these wire forces is shown graphically in Figure 1. Lift-off forces were within the range of predicted values, considering the effects of concrete creep and shrinkage, steel relaxation and initial structural deformation.

3.4 WIRE SURVEILLANCE AND TESTING

One surveillance tendon of each directional group was relaxed - 2D28 51H9 and 45V16. One wire was removed from tendons 2D28, 45V16, and 51H9. The wires removed were visually checked for corrosion and pitting and to determine their general condition. The tendon wires were found to contain minor surface scratches, resulting from insertion of the tendons into their sheaths at the time of installation, and heat treating discoloration. The general condition of the wires was determined to be equivalent to their condition at time of initial installation.

Three specimens were cut from each of the extracted wires for tensile testing. The samples were taken from the ends and the middle of each of the wires. The ultimate strength of each of the specimens was determined by tensile testing by the Prescon Corporation, Simpsonville, South Carolina. These tests are summarized in Table 5 and revealed no significant changes in the ultimate strength of the wire as compared to results obtained during initial acceptance tests.

3.5 RETENSIONING AND FILLER REPLACEMENT

Following wire removal the tendons were retensioned to approximately the same stress level indicated by the lift-off force data obtained during this surveillance. The sheathing filler which was removed during the surveillance process was replaced with new filler.

SHEATHING FILLER INSPECTION

Tendon	End	Filler Coating Acceptable					Filler Color and Consistency Acceptable
		Button Heads	Stress Washer	Shims	Bearing Plate	Cap	
1D28	Shop Field	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
2D28	Shop Field	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
3D28	Shop Field	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
13H9	Shop Field	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
51H9	Shop Field	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
53H10	Shop Field	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
23V14	Shop Field	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
45V16	Shop Field	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *
61V16	Shop Field	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes

Table 1

* The field end of tendon 45V16 is a dead-end plate and inaccessible for this inspection.

LABORATORY ANALYSIS OF SHEATHING FILLER

Tendon	Water Soluble CHLORIDES (Limit 5.0 ppm)	Water Soluble NITRATES (Limit 5.0 ppm)	Water Soluble SULFIDES (Limit 5.0 ppm)
2D28	1.29	0.0	0.0
15H9	1.85	0.0	0.0
45V16	1.20	0.0	0.0

Table 2

END ANCHORAGE COMPONENT INSPECTION

Tendon	End	Buttonheads			Stress Washer		Shims		Bearing Plate	
		Corrosion	Cracks	Shape	Corrosion	Cracks	Corrosion	Cracks	Corrosion	Cracks
1D28	Shop	None	None	Good	None	None	None	None	None	None
	Field	None	None	Good	None	None	None	None	None	None
2D28	Shop	None	None	Good	None	None	None	None	None	None
	Field	None	None	Good	None	None	None	None	None	None
3D28	Shop	None	None	Good	None	None	None	None	None	None
	Field	None	None	Good	None	None	None	None	None	None
13H9	Shop	None	None	Good	None	None	None	None	None	None
	Field	None	None	Good	None	None	None	None	None	None
51H9	Shop	None	None	Good	None	None	None	None	None	None
	Field	None	None	Good	None	None	None	None	None	None
53H10	Shop	None	None	Good	None	None	None	None	None	None
	Field	None	None	Good	None	None	None	None	None	None
23V14	Shop	None	None	Good	None	None	None	None	None	None
	Field	None	None	Good	None	None	None	None	None	None
45V16	Shop	None	None	Good	None	None	None	None	None	None
	Field	*	*	*	*	*	*	*	*	*
61V16	Shop	None	None	Good	None	None	None	None	None	None
	Field	None	None	Good	None	None	None	None	None	None

Table 3

* The field end of tendon 45V16 is a dead-end plate and inaccessible for this inspection.

TENDON LIFT-OFF FORCES

Tendon	End	Lift-Off Force (PSI)	
		Previous	Current
1D28	Shop Field	5933 6133	5917 6033
2D28	Shop Field	6225 6117	6225 6050
3D28	Shop Field	6383 5766	5825 6350
13H9	Shop Field	5600 5700	6008 5900
51H9	Shop Field	5950 5567	5725 5750
53H10	Shop Field	5983 5600	5950 5900
23V14	Shop Field	5716 6000	5750 5867
45V16	Shop Field	5667 *	5700 *
61V16	Shop Field	5800 5966	5675 5667

* The field end of tendon 45V16 is a dead-end plate and was inaccessible for taking lift-off readings.

Table 4

ULTIMATE STRENGTH OF TENDON SPECIMENS

Tendon	Specimen Location	Break Force (Lbs.)	Diameter (In.)	Area (In^2)	Tensile Strength (Psi)
2D28	Shop	12500	0.25	0.0491	25458
	Center	14450	0.25	0.0491	253564
	Field	12600	0.266	0.0554	227436
51H9	Shop	13100	0.25	0.0491	266802
	Center	13100	0.25	0.0491	266802
	Field	13100	0.25	0.0491	266802
45V16	Shop	11950	0.25	0.0491	243380
	Center	11900	0.25	0.0491	242362
	Field	11850	0.25	0.0491	241344

Table 5

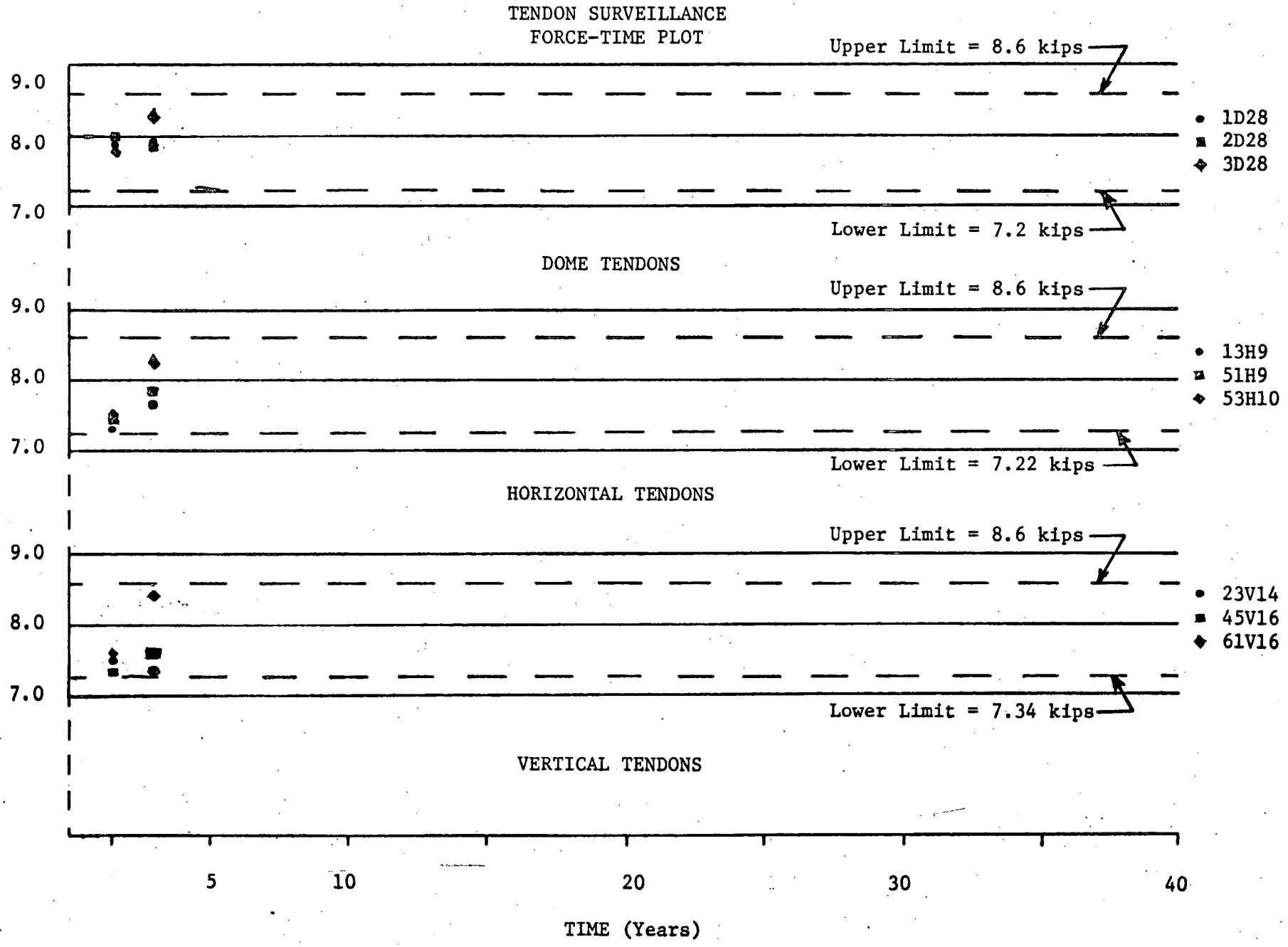

TENDON SURVEILLANCE
FORCE-TIME PLOT
Upper Limit = 8.6 kips
9.0
8.0
7.0
1D28
2D28
3D28
Lower Limit = 7.2 kips
DOME TENDONS
Upper Limit = 8.6 kips
9.0
8.0
7.0
13H9
51H9
53H10
Lower Limit = 7.22 kips
HORIZONTAL TENDONS
Upper Limit = 8.6 kips
9.0
8.0
7.0
23V14
45V16
61V16
Lower Limit = 7.34 kips
VERTICAL TENDONS
FORCE PER WIRE (Kips)
5
10
20
30
40
TIME (Years)

Figure 1