20TH YEAR
6TH

20TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Precision Surveillance Corporation

Florida Power CORPORATION

I. SURVEILLANCE PROCEDURES

Volume 2, Section 9, Appendix F of the 20th Year Physical Surveillance Report contains the detailed procedures for conducting the tendon surveillance. The surveillance consists of the following steps:

1. Visual examination of casing filler grease.
2. Analytical testing of casing filler grease samples.
3. Inspection of the anchor assembly of each of the surveillance tendon ends for deleterious conditions such as corrosion, cracks, broken or missing buttonheads.
4. Inspection of concrete surrounding the bearing plate.
5. Measurement of the liftoff force for each of the surveillance tendons.
6. Removal of one wire from the surveillance tendons which are detensioned for examination and testing.
7. Retensioning of the detensioned tendons and measuring the corresponding tendon elongation.
8. Visual inspection for corrosion, pitting, or any significant physical change of wires removed from the tendons.
9. Testing of wires removed from tendons for yield strength, ultimate strength, and percentage elongation at failure.
10. Resealing tendon cans and replacement of lost sheathing filler into the tendon duct and grease can.
11. Evaluation of test and inspection results to assess the general condition of the post tensioning system.

0/65

II. SHEATHING FILLER ANALYSIS

A sample of sheathing filler (grease) was removed from each end of the surveillance tendons. Chemical tests were performed on each sample by Suburban Laboratories, Inc., the results are presented in Appendix B and are summarized in Table I.

The maximum acceptable limits are 10 percent by weight for water content and 10 parts per million for water-soluble chlorides, nitrates and sulfides. All samples met the acceptance criteria as stated above in all respects except 51H25 field end which had a water content result of 14.9%. As there is a limited amount of grease available for testing in this grease cans, due to the large shim volume, and a leaking gasket. The small quantity of grease did not allow for additional samples and the water penetration was in the area of gasket failure. This result is not necessarily indicative of the tendon grease condition throughout the tendon. Inspection of the tendon end anchorage, shims, and buttonheads showed no abnormal corrosion which would indicate a moisture problem. The gasket was replaced and the anchorage refilled with new grease.

Tendon 53H2 samples were unavailable for testing.

Also included was the report of the neutralization number of each grease sample. This test is generally performed by grease manufacturers on new batches of the product. It is a method of determining the overbase additives in the grease. Degradation of the sheathing filler will yield a change in the acidity of the filler material as well as an increase in the ion content. The required neutralization number is >3mg KOH/g and has been achieved by all samples in this test.

The large range in the neutralization numbers found between various tendons is indicative of different types of grease, such as P2 and P4, where P2 was originally installed and P4 added during latter work. This is not a sign of grease or system degradation.

TABLE I: LABORATORY ANALYSIS OF SHEATHING FILLER

TENDON	END	ION CONCENTRATION (PPM)			% WATER	NEUTRAL No.
		CHLORIDE	NITRATE	SULFIDE	CONTENT	mg KOH/g
12V1	SHOP/ TOP	<0.50	1.24	<0.50	0.1	42.1
	FIELD/ BOTT.	<0.50	1.02	<0.50	0.4	42.1
23V2	SHOP/ TOP	<0.50	1.46	<0.50	0.2	46.6
	FIELD/ BOTT.	<0.50	2.02	<0.50	0.1	47.1
61V21	SHOP/ TOP	<0.50	1.02	<0.50	0.2	50.5
	FIELD/ BOTT.	<0.50	1.46	<0.50	<0.1	24.1
D113	SHOP/ NEAR 2	<0.50	0.79	<0.50	<0.1	36.5
	FIELD/ NEAR 6	<0.50	1.13	<0.50	0.1	39.3
[illegible]15	SHOP/ NEAR 2	<0.50	1.68	<0.50	0.2	40.9
	FIELD/ NEAR 6	<0.50	1.13	<0.50	0.2	43.2
D212	SHOP/ NEAR 1	<0.50	1.13	<0.50	0.1	26.4
	FIELD/ NEAR 3	<0.50	0.68	<0.50	0.1	40.9
D304	SHOP/ NEAR 4	<0.50	0.79	<0.50	0.3	40.9
	FIELD/ NEAR 2	<0.50	0.68	<0.50	0.1	33.7
D311	SHOP/ NEAR 4	<0.50	1.02	<0.50	0.3	47.7
	FIELD/ NEAR 2	<0.50	0.68	<0.50	0.1	33.7

<u>Acceptance Limits</u>

Test	Limits
Water Soluble Chloride	Less than 10.0 ppm
Water Soluble Nitrates	Less than 10.0 ppm
Water Soluble Sulfides	Less than 10.0 ppm
Water Content	Less than 10% Dry Weight
Neutralization No.	Greater than 3 mg KOH/g

TABLE I: LABORATORY ANALYSIS OF SHEATHING FILLER

TENDON	END	ION CONCENTRATION (PPM)			% WATER CONTENT	NEUTRAL No. mg KOH/g
		CHLORIDE	NITRATE	SULFIDE		
42H18	SHOP/ BUTT 4	<0.50	1.02	<0.50	0.1	11.8
	FIELD/ BUTT 2	<0.50	1.02	<0.50	0.1	41.5
42H32	SHOP/ BUTT 4	<0.50	0.68	<0.50	0.1	33.7
	FIELD/ BUTT 2	<0.50	0.79	<0.50	<0.1	42.1
42H44	SHOP/ BUTT 4	<0.50	0.68	<0.50	<0.1	42.1
	FIELD/ BUTT 2	<0.50	2.13	<0.50	<0.1	21.3
51H25	FIELD/ BUTT 5	<0.50	3.25	<0.50	14.9	30.8
51H26	SHOP/ BUTT 1	<0.50	3.58	<0.50	0.1	11.2
	FIELD/ BUTT 5	<0.50	1.02	<0.50	<0.1	42.1
53H46	SHOP/ BUTT 5	<0.50	0.68	<0.50	<0.1	36.5
	FIELD/ BUTT 3	<0.50	1.13	<0.50	<0.1	4.49
62H41	SHOP/ BUTT 2	<0.50	1.24	<0.50	<0.1	40.9
	FIELD/ BUTT 6	<0.50	2.69	<0.50	<0.1	28.0
62H46	SHOP/ BUTT 2	<0.50	1.35	<0.50	0.2	38.7
	FIELD/ BUTT 6	<0.50	0.90	<0.50	<0.1	6.17

Acceptance Limits

Test	Limits
Water Soluble Chloride	Less than 10.0 ppm
Water Soluble Nitrates	Less than 10.0 ppm
Water Soluble Sulfides	Less than 10.0 ppm
Water Content	Less than 10% Dry Weight
Neutralization No.	Greater than 3 mg KOH/g

III. ANCHORAGE COMPONENTS

In the following discussion, all procedures referred to are included in Volume 2, Section 9, Appendix F of the 20th Year Physical Report while all data sheets are included in Section 4, Appendix A.

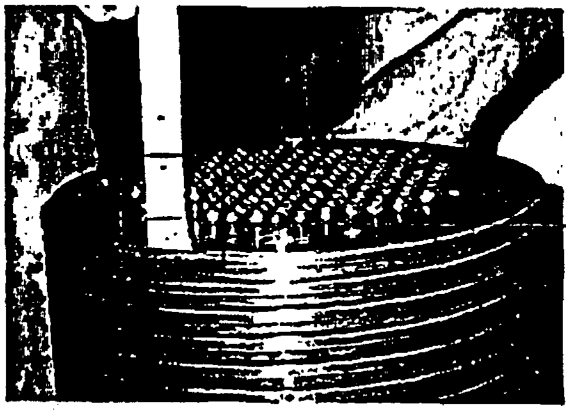
Inspection of the anchorage components began with the removal of the grease can (PSC Procedure SQ 6.0). Complete grease coating (100%) was found on all surveillance tendons except 42H18 field end with 70% of grease can coated, 42H32 field end with 60% of the grease can coated, 62H41 shop end with 60% of the grease can coated and 62H41 field end with 70% of the grease can coated. The percentage of grease coverage was recorded on Data Sheet SQ 6.0 with the results tabulated in Table II.

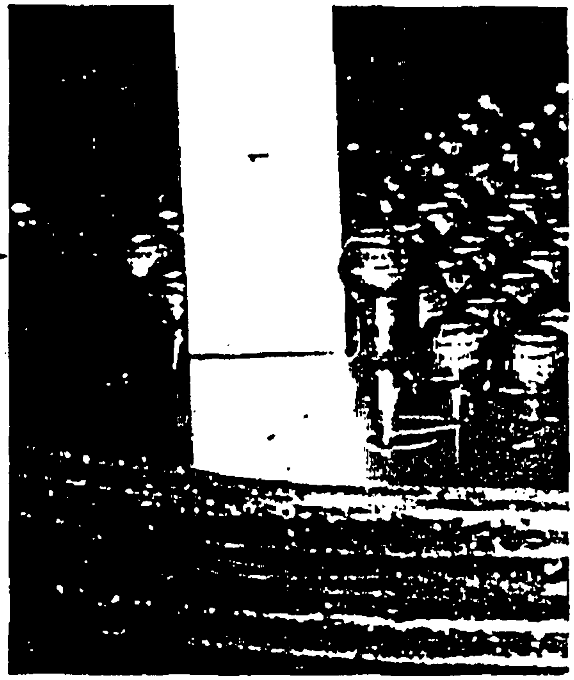
During removal of the grease can and physical inspections of the anchorage assemblies water was detected during removal of a can, or inside it, on only one tendon end. Tendon 51H25 field end exhibited drops of water in the grease can. No water was detected in any other surveillance or grease repair tendon. Water Inspections were recorded on Data Sheet SQ 6.1 and are summarized in Table III.

The anchorage components (anchorhead, bushing, shims, buttonhead and bearing plate) were inspected for corrosion level and cracks per PSC Procedure SQ 8.0. The results were recorded on Data Sheet SQ 8.0 and are summarized in Table IV. Corrosion levels on all items was either level 1 - "bright metal, no visible oxidation", or level 2 - "reddish brown color, no pitting". No evidence of cracking was observed in any of the anchorage components.

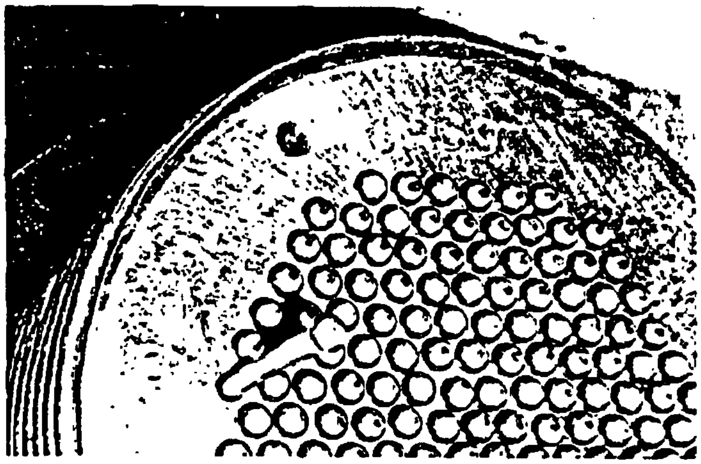
III. ANCHORAGE COMPONENTS

The buttonheads were inspected for their physical condition and a count was made of protruding or missing buttonheads per PSC Procedure SQ 8.0. The results of these inspections are also recorded on Data Sheet SQ 8.0, and summarized in Table V.





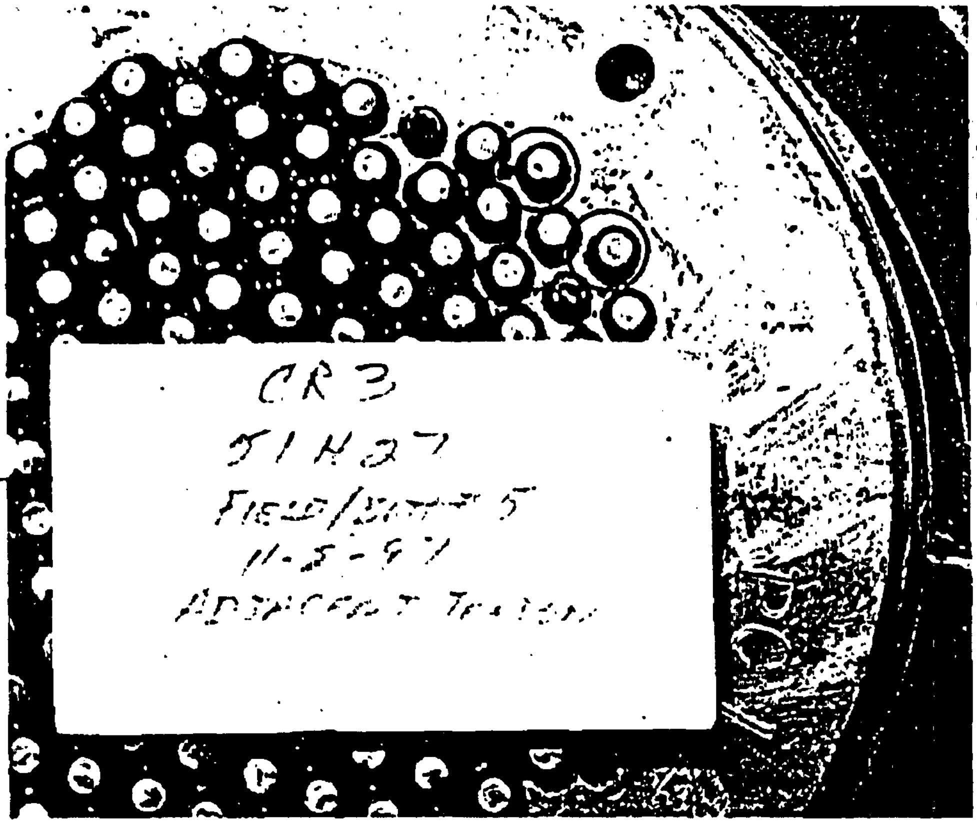
Tendon 12V1 shop end was found to have one wire protruding 0.6" and NCR No. FN604-001 was written to address this.



Tendon 51H26 (field end shown) was found to have one broken wire 6.05" long after initial liftoff was performed. NCR No. FN604-003 was generated to document this finding and the broken section was later removed during detensioning.

A continuity test was conducted and all remaining wire were found to be continuous

III. ANCHORAGE COMPONENTS



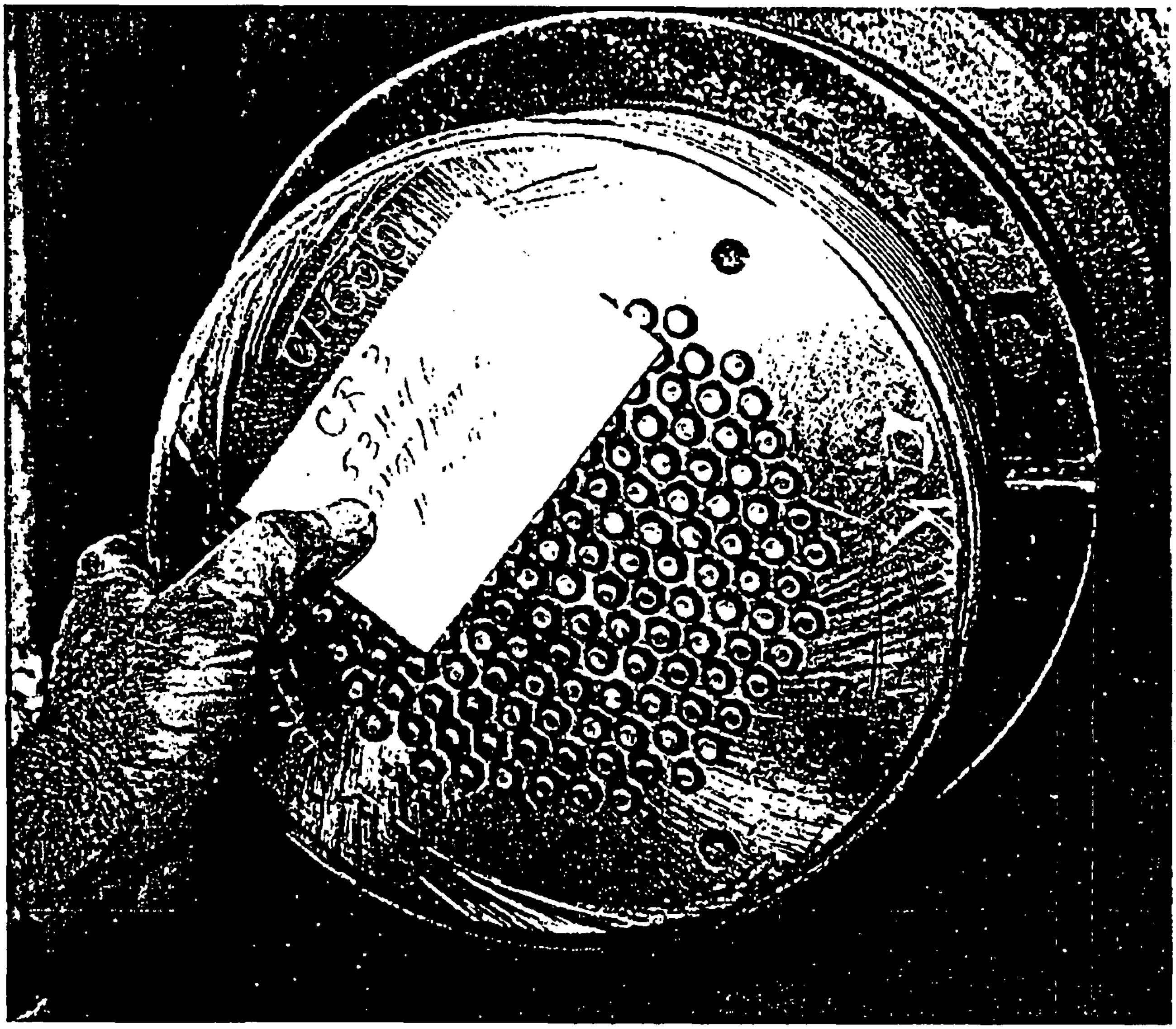
This picture of 51H27 field end shows the two small buttonheads reported on Data Sheet SQ 8.0 in red. The wires circled in green were found to be protruding after liftoff and removed. The pieces were found to be 6.15" long and NCR No. FN604-007 was raised to document this occurrence.

Tendon 62H41 was also found to have two broken wires after detensioning, NCR No. FN604-015 recorded this finding.

No other missing or protruding wires not previously reported were found.

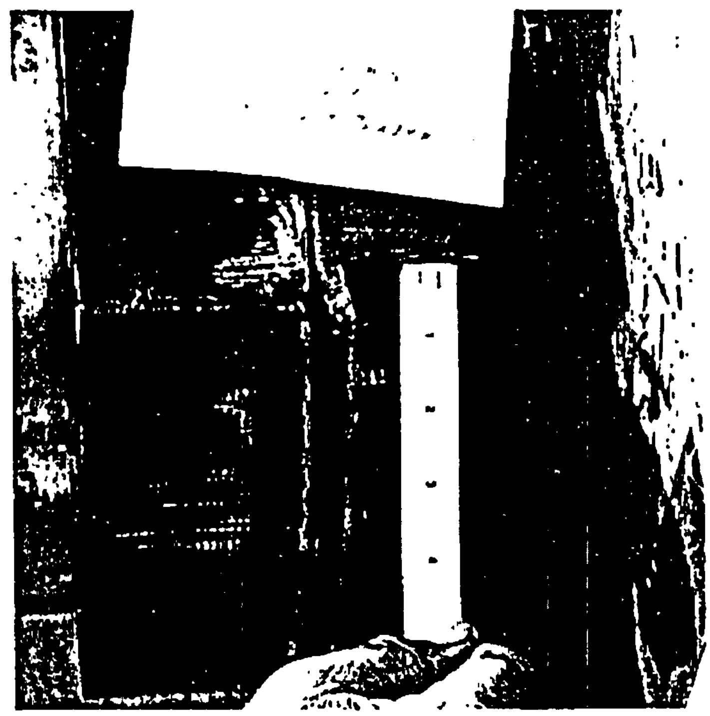
Cans were also removed to the shop end of 43V4 and the field end of 51H41 where "domed" or bulging can ends were found. Inspection revealed no apparent abnormalities and the anchorage, shims and buttonheads were found to be acceptable in all respect.

III. ANCHORAGE COMPONENTS

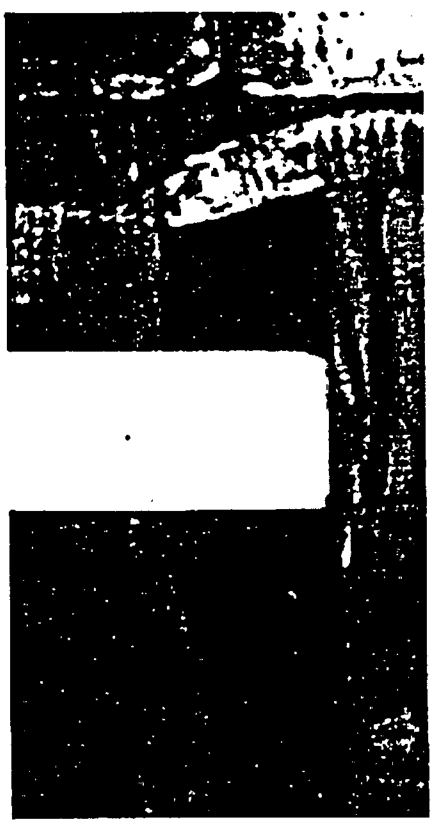


Scratches found on the face of the anchorhead on 52H46 shop end were reported on Data Sheet SQ 8.0

III. ANCHORAGE COMPONENTS

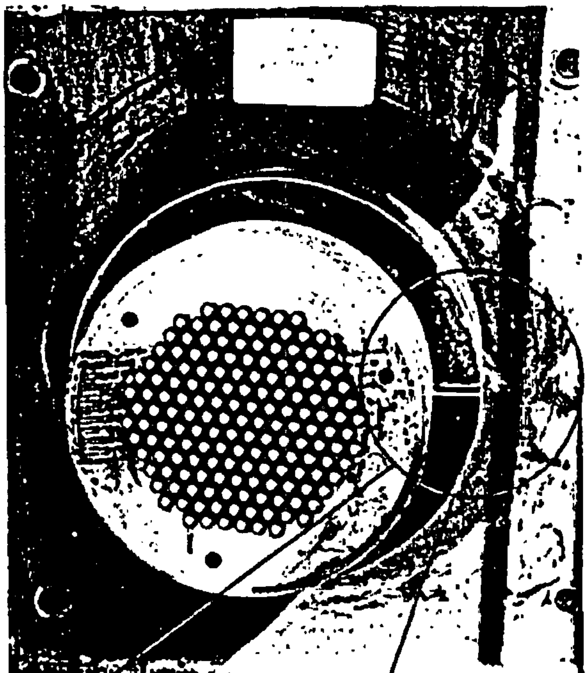


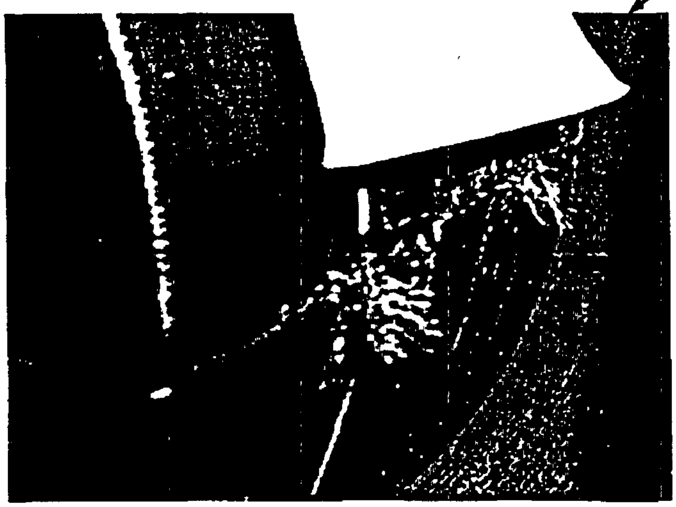
The above 3/8" shim on tendon 51H27 field end was found to be deformed at the shim gap which was 0.8" wide. This shim was replaced and the shim gap closed up during liftoff.

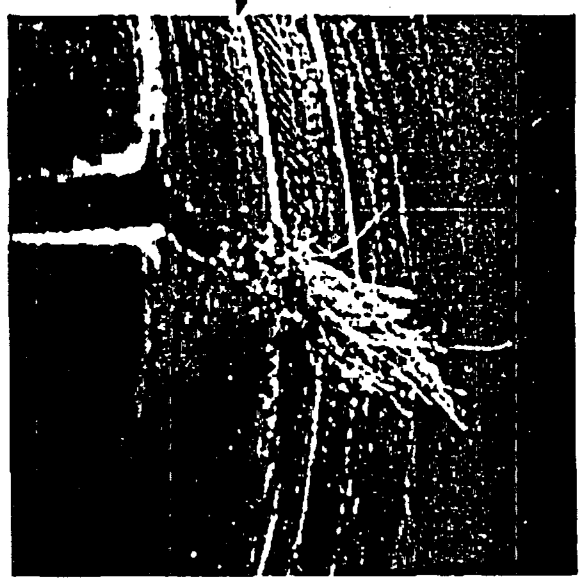


III. ANCHORAGE COMPONENTS

Pieces of rope found protruding from shim gap on tendon 51H28 field end.







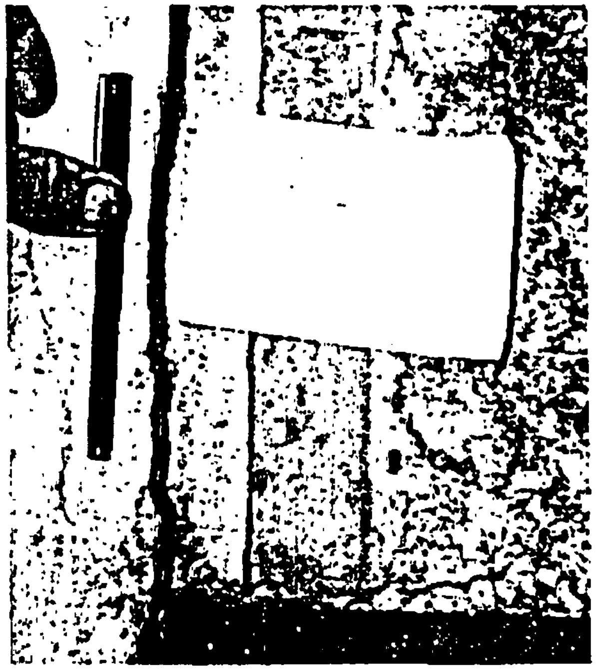
III. ANCHORAGE COMPONENTS

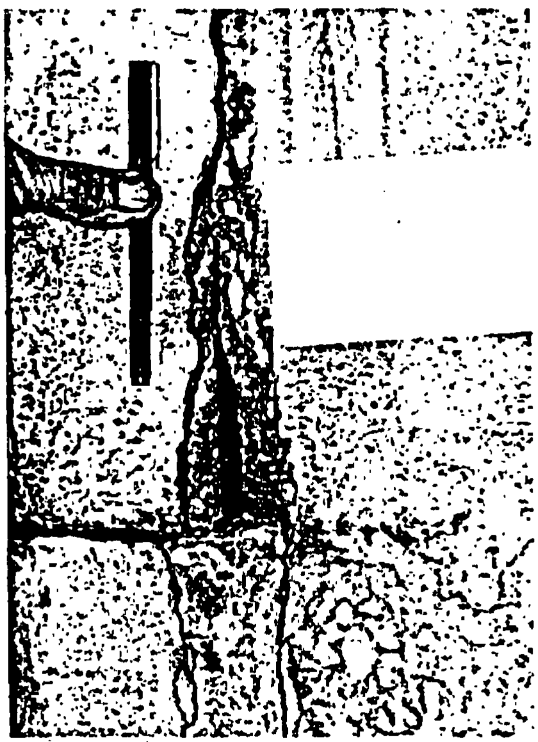
The concrete was inspected around the bearing plates for cracks per PSC Procedure SQ 8.3 with the results being recorded on Data Sheet SQ 8.3 and summarized in Table VI. Two tendons exhibited cracks exceeding 0.010", D311 and 51H26 (shown on the next two pages). No cracks that had a width in excess of 0.010" were found to any other inspection tendon. Data Sheets SQ 8.4 detail the general containment exterior concrete inspection and at the time of the surveillance a contractor was on site making concrete repairs to the containment buttresses.

Bearing plate ID's were either illegible or not found on several tendon ends.

III. ANCHORAGE COMPONENTS

Crack found around the bearing plate at 51H26 shop end.
See NCR No. FN604-004





III. ANCHORAGE COMPONENTS

Cracks found on tendon 52H26 field end.

See NCR No. FN604-002

TABLE II: SUMMARY OF DATA SHEETS SQ 6.0
GREASE CAN REMOVAL.

TENDON	END	GREASE COATING (%)				
		GREASE CAN	BUTTON-HEADS	ANCHOR-HEADS	SHIMS	BEARING PLATE
12V1	SHOP/TOP	100	100	100	100	100
	FIELD/BOT.	100	100	100	100	100
23V2	SHOP/TOP	100	100	100	100	100
	FIELD/BOT.	100	100	100	100	100
61V21	SHOP/TOP	100	100	100	100	100
	FIELD/BOT.	100	100	100	100	100
[illegible]V4	SHOP/TOP	100	100	100	100	100
D113	SHOP/ NEAR 2	100	100	100	100	100
	FIELD/ NEAR 6	100	100	100	100	100
D115	SHOP/ NEAR 2	100	100	100	100	100
	FIELD/ NEAR 6	100	100	100	100	100
D212	SHOP/ NEAR 1	100	100	100	100	100
	FIELD/ NEAR 3	100	100	100	100	100
D304	SHOP/ NEAR 4	100	100	100	100	100
	FIELD/ NEAR 2	100	100	100	100	100
D311	SHOP/ NEAR 4	100	100	100	100	100
	FIELD/ NEAR 2	100	100	100	100	100

TABLE II: SUMMARY OF DATA SHEETS SQ 6.0
GREASE CAN REMOVAL

TENDON	END	GREASE COATING (%)				
		GREASE CAN	BUTTON-HEADS	ANCHOR-HEADS	SHIMS	BEARING PLATE
42H18	SHOP/ BUTT 4	100	100	100	100	100
	FIELD/ BUTT 2	70	100	100	100	100
42H29	SHOP/ BUTT 4	100	100	100	100	100
	FIELD/ BUTT 2	100	100	100	100	100
42H30	SHOP/ BUTT 4	100	100	100	100	100
	FIELD/ BUTT 2	100	100	100	100	100
42H31	SHOP/ BUTT 4	100	100	100	100	100
	FIELD/ BUTT 2	100	100	100	100	100
42H32	SHOP/ BUTT 4	100	100	100	100	100
	FIELD/ BUTT 2	60	100	100	100	100
42H33	SHOP/ BUTT 4	100	100	100	100	100
	FIELD/ BUTT 2	100	100	100	100	100
42H34	SHOP/ BUTT 4	100	100	100	100	100
	FIELD/ BUTT 2	100	100	100	100	100
42H35	SHOP/ BUTT 4	100	100	100	100	100
	FIELD/ BUTT 2	100	100	100	100	100
42H36	SHOP/ BUTT 4	100	100	100	100	100
	FIELD/ BUTT 2	100	100	100	100	100
42H37	SHOP/ BUTT 4	100	100	100	100	100
	FIELD/ BUTT 2	100	100	100	100	100

TABLE II: SUMMARY OF DATA SHEETS SQ 6.0
GREASE CAN REMOVAL

TENDON	END	GREASE COATING (%)				
		GREASE CAN	BUTTON-HEADS	ANCHOR-HEADS	SHIMS	BEARING PLATE
42H44	SHOP/ BUTT 4	100	100	100	100	100
	FIELD/ BUTT 2	100	100	100	100	100
51H25	SHOP/ BUTT 1	100	100	100	100	100
	FIELD/ BUTT 5	100	100	100	100	100
51H26	SHOP/ BUTT 1	100	100	100	100	100
	FIELD/ BUTT 5	100	100	100	100	100
51H27	SHOP/ BUTT 1	100	100	100	100	100
	FIELD/ BUTT 5	100	100	100	100	100
51H28	SHOP/ BUTT 1	100	100	100	100	100
	FIELD/ BUTT 5	100	100	100	100	100
53H2	SHOP/ BUTT 5	100	100	100	100	100
	FIELD/ BUTT 3	100	100	100	100	100
53H46	SHOP/ BUTT 5	100	100	100	100	100
	FIELD/ BUTT 3	100	100	100	100	100
62H41	SHOP/ BUTT 2	60	100	100	100	100
	FIELD/ BUTT 6	70	100	100	100	100
62H46	SHOP/ BUTT 2	100	100	100	100	100
	FIELD/ BUTT 6	100	100	100	100	100
51H41	FIELD/ BUTT 5	100	100	100	100	100

TABLE III: SUMMARY OF DATA SHEETS SQ 6.1
INSPECT FOR WATER

TENDON	END	WATER QUANTITY
12V1	SHOP/TOP	NONE
	FIELD/BOT.	NONE
23V2	SHOP/TOP	NONE
	FIELD/BOT.	NONE
61V21	SHOP/TOP	NONE
	FIELD/BOT.	NONE
43V4	SHOP/TOP	NONE

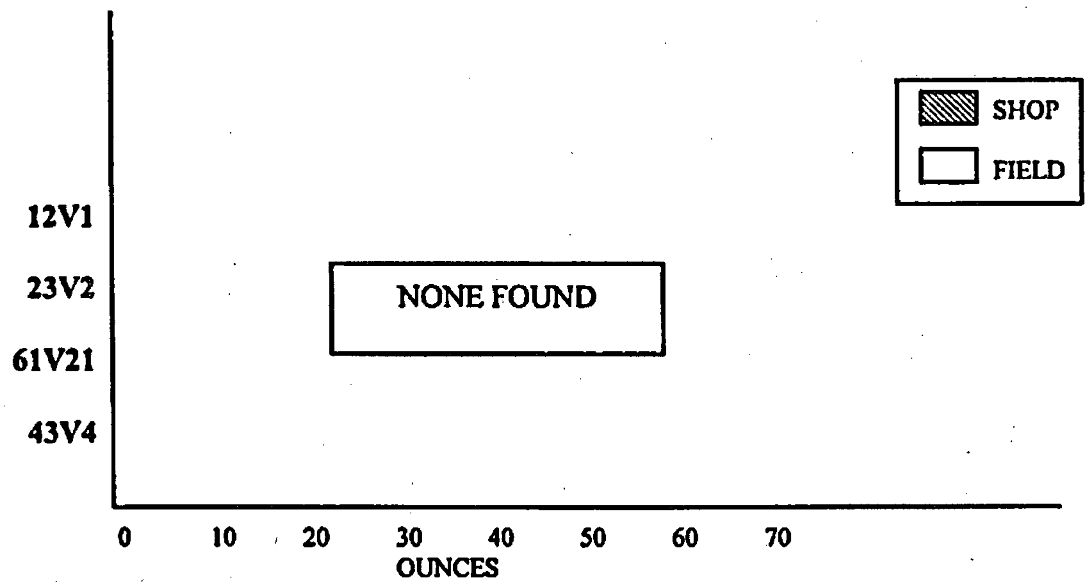


TABLE III: SUMMARY OF DATA SHEETS SQ 6.1 INSPECT FOR WATER.

TENDON	END	WATER QUANTITY
D113	SHOP/ NEAR 2	NONE
	FIELD/ NEAR 6	NONE
D115	SHOP/ NEAR 2	NONE
	FIELD/ NEAR 6	NONE
D212	SHOP/ NEAR 1	NONE
	FIELD/ NEAR 3	NONE
D304	SHOP/ NEAR 4	NONE
	FIELD/ NEAR 2	NONE
D311	SHOP/ NEAR 4	NONE
	FIELD/ NEAR 2	NONE

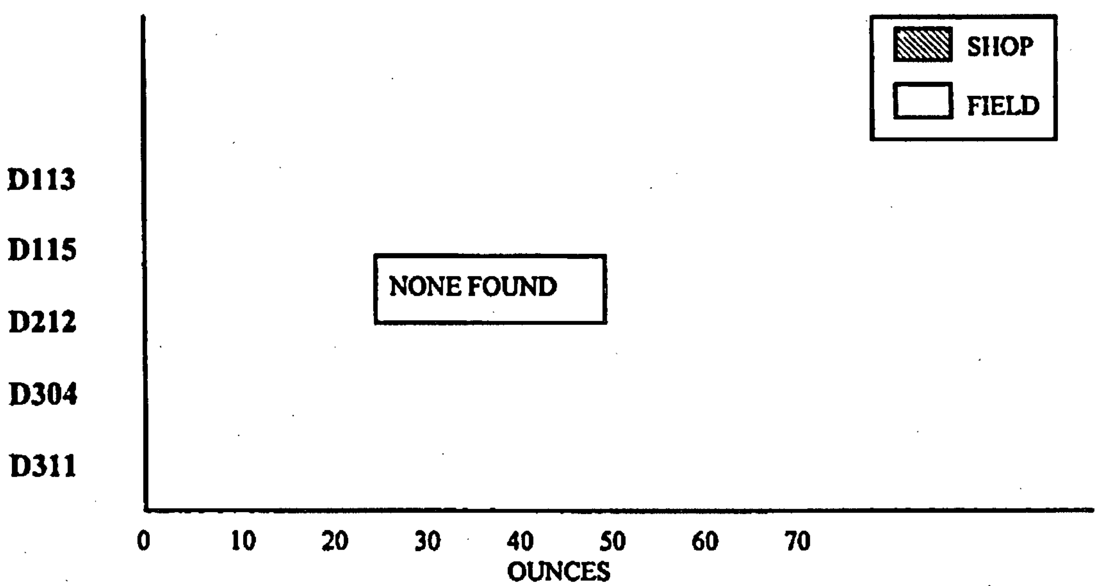


**TABLE III: SUMMARY OF DATA SHEETS SQ 6.1
INSPECT FOR WATER.**

TENDON	END	WATER QUANTITY
42H18	SHOP/ BUTT 4	NONE
	FIELD/ BUTT 2	NONE
42H29	SHOP/ BUTT 4	NONE
	FIELD/ BUTT 2	NONE
42H30	SHOP/ BUTT 4	NONE
	FIELD/ BUTT 2	NONE
42H31	SHOP/ BUTT 4	NONE
	FIELD/ BUTT 2	NONE
42H32	SHOP/ BUTT 4	NONE
	FIELD/ BUTT 2	NONE

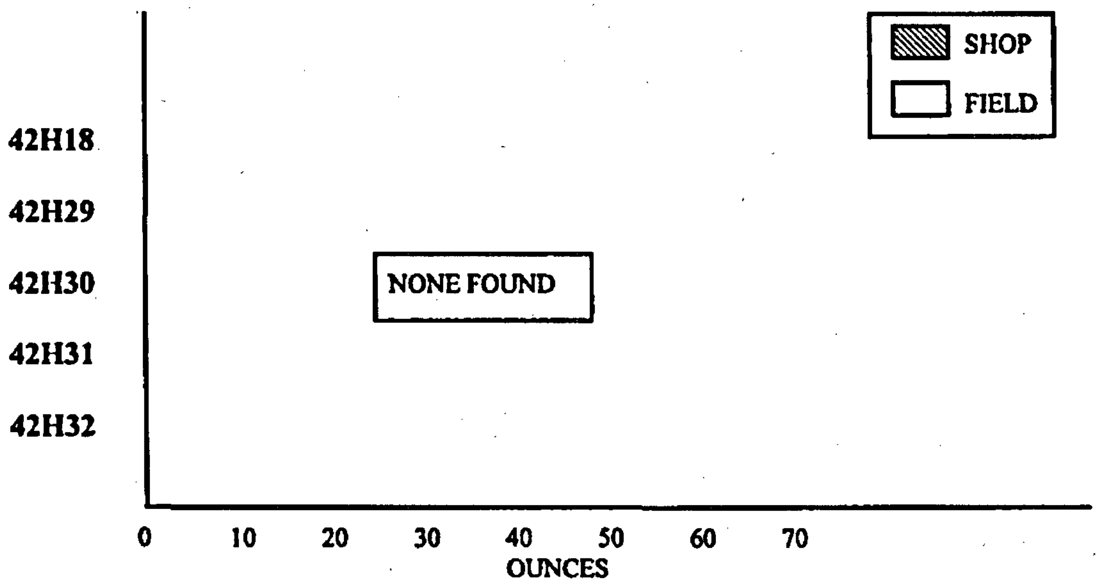


TABLE III: SUMMARY OF DATA SHEETS SQ 6.1
INSPECT FOR WATER.

TENDON	END	WATER QUANTITY
42H33	SHOP/ BUTT 4	NONE
	FIELD/ BUTT 2	NONE
42H34	SHOP/ BUTT 4	NONE
	FIELD/ BUTT 2	NONE
42H35	SHOP/ BUTT 4	NONE
	FIELD/ BUTT 2	NONE
42H36	SHOP/ BUTT 4	NONE
	FIELD/ BUTT 2	NONE
42H37	SHOP/ BUTT 4	NONE
	FIELD/ BUTT 2	NONE

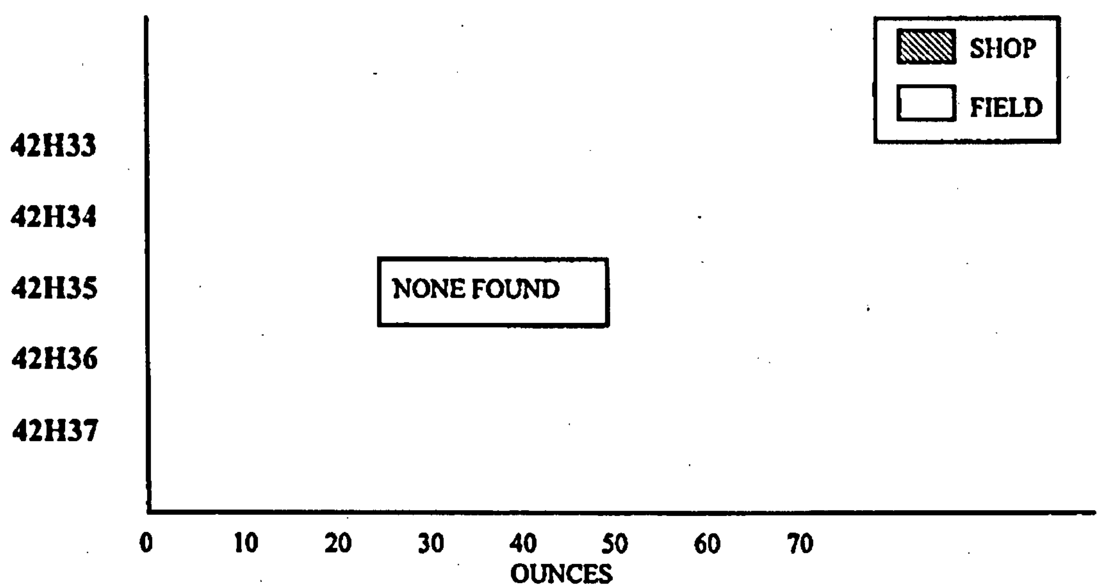
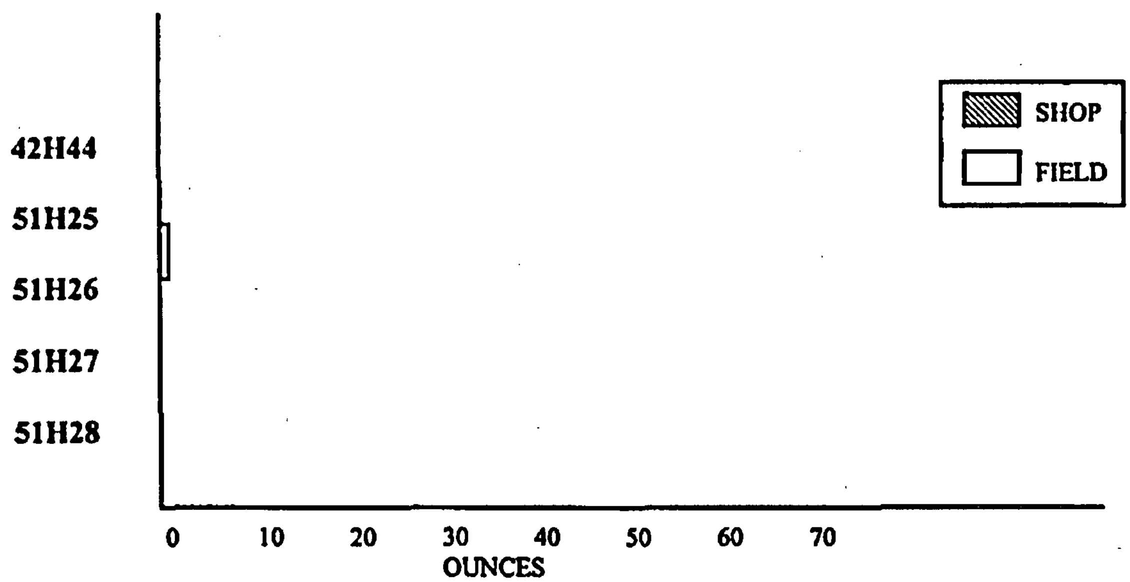


TABLE III: SUMMARY OF DATA SHEETS SQ 6.1 INSPECT FOR WATER

TENDON	END	WATER QUANTITY
42H44	SHOP/ BUTT 4	NONE
	FIELD/ BUTT 2	NONE
51H25	SHOP/ BUTT 1	NONE
	FIELD/ BUTT 5	DROPS
51H26	SHOP/ BUTT 1	NONE
	FIELD/ BUTT 5	NONE
51H27	SHOP/ BUTT 1	NONE
	FIELD/ BUTT 5	NONE
H28	SHOP/ BUTT 1	NONE
	FIELD/ BUTT 5	NONE



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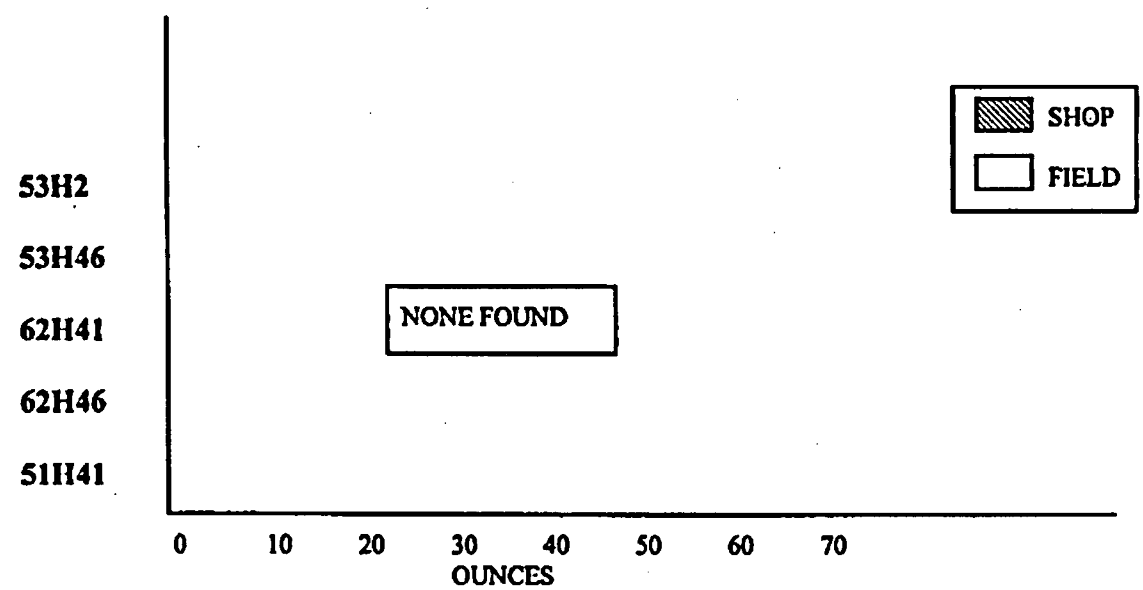
Florida Power CORPORATION

TABLE III: SUMMARY OF DATA SHEETS SQ 6.1 INSPECT FOR WATER

TENDON	END	WATER QUANTITY
53H2	SHOP/ BUTT 5	NONE
	FIELD/ BUTT 3	NONE
53H46	SHOP/ BUTT 5	NONE
	FIELD/ BUTT 3	NONE
62H41	SHOP/ BUTT 2	NONE
	FIELD/ BUTT 6	NONE
62H46	SHOP/ BUTT 2	NONE
	FIELD/ BUTT 6	NONE
[illegible]H41	FIELD/ BUTT 5	NONE



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20TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

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TABLE IV: SUMMARY OF DATA SHEETS SQ 8.0 ANCHORAGE CORROSION CONDITION

TENDON	END	ANCHOR I.D.	BUTTONHEAD CORROSION CONDITION	CORROSION LEVEL, CRACKS		
				ANCHOR-HEAD	SHIMS	BEARING PLATE
12V1	SHOP/TOP	CR650/PC121	1	1, NONE	2, NONE	2, NONE
	FIELD/BOT.	NOT FOUND	1	2, NONE	2, NONE	2, NONE
23V2	SHOP/TOP	CR736/PC121	1	2, NONE	2, NONE	2, NONE
	FIELD/BOT.	CR239/PC120	1	2, NONE	2, NONE	2, NONE
61V21	SHOP/TOP	CR957/PC121	1	2, NONE	1, NONE	2, NONE
	FIELD/BOT.	CR189/PC120	1	1, NONE	1, NONE	1, NONE
43V4	SHOP/TOP	CR788/PC121	N/A	NONE	NONE	NONE
D113	SHOP/ NEAR 2	CR411/PC121	1	2, NONE	1, NONE	1, NONE
	FIELD/ NEAR 6	CR1075/PC121	1	2, NONE	2, NONE	2, NONE
D115	SHOP/ NEAR 2	CR675/PC121	1	2, NONE	1, NONE	2, NONE
	FIELD/ NEAR 6	CR1231/PC122	1	2, NONE	1, NONE	1, NONE
D212	SHOP/ NEAR 1	CR1032/PC121	1	1, NONE	1, NONE	2, NONE
	FIELD/ NEAR 3	CR1214/PC122	1	1, NONE	1, NONE	1, NONE
D304	SHOP/ NEAR 4	CR479/PC121	1	2, NONE	1, NONE	1, NONE
	FIELD/ NEAR 2	CR696/PC121	1	1, NONE	1, NONE	2, NONE
D311	SHOP/ NEAR 4	CR1040/PC121	1	1, NONE	1, NONE	2, NONE
	FIELD/ NEAR 2	CR636/PC121	1	1, NONE	1, NONE	2, NONE

1 Bright metal; no visible oxidation.
2 Metal redish brown color; no pitting
3 Patches of red oxide, no visible pits.

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TABLE IV: SUMMARY OF DATA SHEETS SQ 8.0
ANCHORAGE CORROSION CONDITION

TENDON	END	ANCHOR I.D.	BUTTONHEAD CORROSION CONDITION	CORROSION LEVEL, CRACKS		
				ANCHOR-HEAD	SHIMS	BEARING PLATE
42H18	SHOP/ BUTT 4	CR615/PC121	2	2, NONE	2, NONE	2, NONE
	FIELD/ BUTT 2	CR906/PC121	1	2, NONE	1, NONE	2, NONE
42H29	SHOP/ BUTT 4	CR606/PC121	N/A	NONE	NONE	NONE
	FIELD/ BUTT 2	CR1208/PC122	N/A	NONE	NONE	NONE
42H30	SHOP/ BUTT 4	CR569/PC121	N/A	NONE	NONE	NONE
	FIELD/ BUTT 2	CR1143/PC122	N/A	NONE	NONE	NONE
42H31	SHOP/ BUTT 4	CR368/PC121	N/A	NONE	NONE	NONE
	FIELD/ BUTT 2	CR1233/PC122	N/A	NONE	NONE	NONE
42H32	SHOP/ BUTT 4	CR564/PC121	1	2, NONE	2, NONE	2, NONE
	FIELD/ BUTT 2	CR123/PC120	1	2, NONE	1, NONE	1, NONE
42H33	SHOP/ BUTT 4	CR546/PC121	N/A	NONE	NONE	NONE
	FIELD/ BUTT 2	CR934/PC121	N/A	NONE	NONE	NONE
42H34	SHOP/ BUTT 4	CR525/PC121	N/A	NONE	NONE	NONE
	FIELD/ BUTT 2	CR1207/PC122	N/A	NONE	NONE	NONE
42H35	SHOP/ BUTT 4	CR547/PC121	N/A	NONE	NONE	NONE
	FIELD/ BUTT 2	CR1229/PC122	N/A	NONE	NONE	NONE
42H36	SHOP/ BUTT 4	CR522/PC121	N/A	NONE	NONE	NONE
	FIELD/ BUTT 2	CR1174/PC122	N/A	NONE	NONE	NONE
42H37	SHOP/ BUTT 4	CR559/PC121	N/A	NONE	NONE	NONE
	FIELD/ BUTT 2	CR1175/PC122	N/A	NONE	NONE	NONE

1 Bright metal; no visible oxidation.
2 Metal redish brown color; no pitting
3 Patches of red oxide, no visible pits.

TABLE IV: SUMMARY OF DATA SHEETS SQ 8.0
ANCHORAGE CORROSION CONDITION

TENDON	END	ANCHOR I.D.	BUTTONHEAD CORROSION CONDITION	CORROSION LEVEL, CRACKS		
				ANCHOR-HEAD	SHIMS	BEARING PLATE
42H44	SHOP/ BUTT 4	CR572/PC121	1	1, NONE	2, NONE	2, NONE
	FIELD/ BUTT 2	CR1230/PC122	1	1, NONE	2, NONE	1, NONE
51H25	SHOP/ BUTT 1	CR26/PC120	N/A	NONE	NONE	NONE
	FIELD/ BUTT 5	CR1126/PC122	1	1, NONE	2, NONE	2, NONE
51H26	SHOP/ BUTT 1	CR384/PC121	1	2, NONE	1, NONE	1, NONE
	FIELD/ BUTT 5	CR897/PC121	1	1, NONE	1, NONE	1, NONE
51H27	SHOP/ BUTT 1	CR366/PC121	N/A	NONE	NONE	NONE
	FIELD/ BUTT 5	CR1088/PC121	N/A	NONE	NONE	NONE
51H28	SHOP/ BUTT 1	CR49/PC120	N/A	NONE	NONE	NONE
	FIELD/ BUTT 5	CR1173/PC122	N/A	NONE	NONE	NONE
53H2	SHOP/ BUTT 5	CR135/PC120	1	2, NONE	1, NONE	1, NONE
	FIELD/ BUTT 3	CR646/PC121	1	2, NONE	2, NONE	1, NONE
53H46	SHOP/ BUTT 5	CR660/PC121	1	2, NONE	1, NONE	2, NONE
	FIELD/ BUTT 3	CR1197/PC122	1	1, NONE	1, NONE	2, NONE
62H41	SHOP/ BUTT 2	CR355/PC120	1	1, NONE	1, NONE	2, NONE
	FIELD/ BUTT 6	CR454/PC121	1	1, NONE	1, NONE	1, NONE
62H46	SHOP/ BUTT 2	CR156/PC120	2	2, NONE	2, NONE	1, NONE
	FIELD/ BUTT 6	CR979/PC121	1	1, NONE	1, NONE	1, NONE
51H41	FIELD/ BUTT 5	CR1222/PC122	N/A	NONE	NONE	NONE

1 Bright metal; no visible oxidation.
2 Metal redish brown color; no pitting
3 Patches of red oxide, no visible pits.

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TABLE V: SUMMARY OF DATA SHEETS SQ 8.0 - BUTTONHEAD COUNT

TENDON	END	ORIGINAL		AS FOUND		AS +LEFT		REMOVED FOR TESTING	TOTAL	EFFECTIVE WIRES AS FOUND	EFFECTIVE WIRES AS LEFT
		PROTRUDE	BROKEN/ MISSING	PROTRUDE	BROKEN/ MISSING	PROTRUDE	BROKEN/ MISSING				
12V1	SHOP/TOP	1	0	1	0	1	0	0	1	162	162
	FIELD/BOT.	0	1	0	1	0	1	0	1	162	162
23V2	SHOP/TOP	0	0	0	0	0	0	0	0	163	163
	FIELD/BOT.	0	0	0	0	0	0	0	0	163	163
61V21	SHOP/TOP	0	0	0	0	0	0	1	1	163	162
	FIELD/BOT.	0	0	0	0	0	0	1	1	163	162
43V4	SHOP/TOP	0	0	0	0	0	0	0	0	163	163
D113	SHOP/ NEAR 2	0	0	0	0	0	0	0	0	163	163
	FIELD/ NEAR 6	0	0	0	0	0	0	0	0	163	163
D115	SHOP/ NEAR 2	0	0	0	0	0	0	0	0	163	163
	FIELD/ NEAR 6	0	0	0	0	0	0	0	0	163	163
D212	SHOP/ NEAR 1	0	1	0	1	0	1	0	1	162	162
	FIELD/ NEAR 3	0	1	0	1	0	1	0	1	162	162
D304	SHOP/ NEAR 4	0	0	0	0	0	0	0	1	163	162
	FIELD/ NEAR 2	0	0	0	0	0	0	0	1	163	162
D311	SHOP/ NEAR 4	0	0	0	0	0	0	0	0	163	163
	FIELD/ NEAR 2	0	0	0	0	0	0	0	0	163	163

TABLE V: SUMMARY OF DATA SHEETS SQ 8.0 - BUTTONHEAD COUNT

TENDON	END	ORIGINAL		AS FOUND		AS LEFT		REMOVED FOR TESTING	TOTAL	EFFECTIVE WIRES AS FOUND	EFFECTIVE WIRES AS LEFT
		PROTRUDE	BROKEN/ MISSING	PROTRUDE	BROKEN/ MISSING	PROTRUDE	BROKEN/ MISSING				
42H18	SHOP/ BUTT 4	0	0	0	0	0	0	0	0	163	163
	FIELD/ BUTT 2	0	0	0	0	0	0	0	0	163	163
42H29	SHOP/ BUTT 4	0	0	0	0	0	0	0	0	163	163
	FIELD/ BUTT 2	0	0	0	0	0	0	0	0	163	163
42H30	SHOP/ BUTT 4	0	0	0	0	0	0	0	0	163	163
	FIELD/ BUTT 2	0	0	0	0	0	0	0	0	163	163
42H31	SHOP/ BUTT 4	0	0	0	0	0	0	0	0	163	163
	FIELD/ BUTT 2	0	0	0	0	0	0	0	0	163	163
42H32	SHOP/ BUTT 4	0	0	0	0	0	0	0	0	163	163
	FIELD/ BUTT 2	0	0	0	0	0	0	0	0	163	163
42H33	SHOP/ BUTT 4	0	0	0	0	0	0	0	0	163	163
	FIELD/ BUTT 2	0	0	0	0	0	0	0	0	163	163

TABLE V: SUMMARY OF DATA SHEETS SQ 8.0 - BUTTONHEAD COUNT

TENDON	END	ORIGINAL		AS FOUND		AS LEFT		REMOVED FOR TESTING	TOTAL	EFFECTIVE WIRES AS FOUND	EFFECTIVE WIRES AS LEFT
		PROTRUDE	BROKEN/ MISSING	PROTRUDE	BROKEN/ MISSING	PROTRUDE	BROKEN/ MISSING				
42H34	SHOP/ BUTT 4	0	0	0	0	0	0	0	0	163	163
	FIELD/ BUTT 2	0	0	0	0	0	0	0	0	163	163
42H35	SHOP/ BUTT 4	0	0	0	0	0	0	1	1	163	162
	FIELD/ BUTT 2	0	0	0	0	0	0	1	1	163	162
42H36	SHOP/ BUTT 4	0	0	0	0	0	0	0	0	163	163
	FIELD/ BUTT 2	0	0	0	0	0	0	0	0	163	163
42H37	SHOP/ BUTT 4	0	0	0	0	0	0	0	0	163	163
	FIELD/ BUTT 2	0	0	0	0	0	0	0	0	163	163
42H44	SHOP/ BUTT 4	0	0	0	0	0	0	0	0	163	163
	FIELD/ BUTT 2	0	0	0	0	0	0	0	0	163	163
51H25	SHOP/ BUTT 1	0	0	0	0	0	0	0	0	163	163
	FIELD/ BUTT 5	0	0	0	0	0	0	0	0	163	163
51H26	SHOP/ BUTT 1	0	0	0	0	0	1 *	2	2	163	161
	FIELD/ BUTT 5	0	0	0	0	0	1 *	2	2	163	161

* FOUND BROKEN AFTER LIFTOFF

TABLE V: SUMMARY OF DATA SHEETS SQ 8.0 - BUTTONHEAD COUNT

TENDON	END	ORIGINAL		AS FOUND		AS LEFT		REMOVED FOR TESTING	TOTAL	EFFECTIVE WIRES AS FOUND	EFFECTIVE WIRES AS LEFT
		PROTRUDE	BROKEN/ MISSING	PROTRUDE	BROKEN/ MISSING	PROTRUDE	BROKEN/ MISSING				
51H27	SHOP/ BUTT 1	0	0	0	0	0	2 **	2	2	163	161
	FIELD/ BUTT 5	0	0	0	0	0	2 **	2	2	163	161
51H28	SHOP/ BUTT 1	0	0	0	0	0	0	0	0	163	163
	FIELD/ BUTT 5	0	0	0	0	0	0	0	0	163	163
53H2	SHOP/ BUTT 5	0	0	0	0	0	0	0	0	163	163
	FIELD/ BUTT 3	0	0	0	0	0	0	0	0	163	163
53H46	SHOP/ BUTT 5	0	0	0	0	0	0	0	0	163	163
	FIELD/ BUTT 3	0	0	0	0	0	0	0	0	163	163
62H41	SHOP/ BUTT 2	0	0	0	2 *	0	3	3	3	163	160
	FIELD/ BUTT 6	0	0	0	2 *	0	3	3	3	163	160
62H46	SHOP/ BUTT 2	0	0	0	0	0	0	0	0	163	163
	FIELD/ BUTT 6	0	0	0	0	0	0	0	0	163	163
51H41	FIELD/ BUTT 5	0	0	0	0	0	0	0	0	163	163

* FOUND BROKEN AFTER LIFTOFF
** FOUND BROKEN AFTER DETENSIONING

TABLE VI: SUMMARY OF DATA SHEETS SQ 8.3
CONCRETE INSPECTION.

TENDON	END	BEARING PLATE ID	CRACKS WITH WIDTHS >0.010"		
			QUANTITY	MAX. LENGTH (IN)	MAX. WIDTH (IN)
12V1	SHOP/TOP	CR973	NONE	N/A	N/A
	FIELD/BOT.	CR118/PC58	NONE	N/A	N/A
23V2	SHOP/TOP	NOT FOUND	NONE	N/A	N/A
	FIELD/BOT.	CR114/PC58	NONE	N/A	N/A
61V21	SHOP/TOP	NOT FOUND	NONE	N/A	N/A
	FIELD/BOT.	NOT FOUND	NONE	N/A	N/A
D113	SHOP/ NEAR 2	NOT FOUND	NONE	N/A	N/A
	FIELD/ NEAR 6	NOT FOUND	NONE	N/A	N/A
D115	SHOP/ NEAR 2	NOT FOUND	NONE	N/A	N/A
	FIELD/ NEAR 6	CR919/PC91	NONE	N/A	N/A
D212	SHOP/ NEAR 1	CR910/PC88	NONE	N/A	N/A
	FIELD/ NEAR 3	CR764/PC91	NONE	N/A	N/A
D304	SHOP/ NEAR 4	NOT FOUND	NONE	N/A	N/A
	FIELD/ NEAR 2	NOT FOUND	NONE	N/A	N/A
D311	SHOP/ NEAR 4	CR846/PC91	NONE	N/A	N/A
**	FIELD/ NEAR 2	NOT FOUND	TWO	24"	<0.050

** SEE NCR# FN604-016

TABLE VI: SUMMARY OF DATA SHEETS SQ 8.3
CONCRETE INSPECTION.

TENDON	END	BEARING PLATE ID	CRACKS WITH WIDTHS >0.010"		
			QUANTITY	MAX. LENGTH (IN)	MAX. WIDTH (IN)
42H18	SHOP/ BUTT 4	CR300/PC87	NONE	N/A	N/A
	FIELD/ BUTT 2	CR373/PC87	NONE	N/A	N/A
42H32	SHOP/ BUTT 4	CR254/PC88	NONE	N/A	N/A
	FIELD/ BUTT 2	CP654/PC76	NONE	N/A	N/A
42H44	SHOP/ BUTT 4	CR689/PC77	NONE	N/A	N/A
	FIELD/ BUTT 2	CR163/PC77	NONE	N/A	N/A
51H26 *	SHOP/ BUTT 1	CR217/PC77	TWO	15"	0.30"
**	FIELD/ BUTT 5	CR616/PC77	ONE	15"	0.10"
53H2	SHOP/ BUTT 5	CR511/PC76	NONE	N/A	N/A
	FIELD/ BUTT 3	CR539/PC76	NONE	N/A	N/A
53H46	SHOP/ BUTT 5	CR705/PC77	NONE	N/A	N/A
	FIELD/ BUTT 3	CR439/PC76	NONE	N/A	N/A
62H41	SHOP/ BUTT 2	CR202/PC76	NONE	N/A	N/A
	FIELD/ BUTT 6	CR187/ 76	NONE	N/A	N/A
62H46	SHOP/ BUTT 2	NOT FOUND	NONE	N/A	N/A
	FIELD/ BUTT 6	CR549/PC76	NONE	N/A	N/A

* SEE NCR# FN604-004
** SEE NCR# FN604-002

IV. HYDRAULIC JACK CALIBRATIONS

Precision Surveillance has developed a program for calibrating hydraulic jacks utilizing regression analysis (PSC Procedure QA 12.8.G-W). This is a process where a straight line is mathematically best fitted to a set of data points (in this case, force verses gauge pressure). This results in calculating ram area (slope) and constant (y-intercept) for each jack calibration. Completed calibrations for all of the hydraulic jacks used are contained in Appendix C and are summarized in Table VII.

A before and after comparison of the stressing jacks' ram areas revealed that none of the jacks' calibrations varied by more than 0.77% indicating that they were in a properly calibrated status.

Note that the force exerted by a jack can be calculated as follows:

Force	=	Area	x	Pressure	+	Constant
(F)		(in^2)		(KSI)		(K)

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TABLE VII: HYDRAULIC JACK CALIBRATIONS

JACK ID	BEFORE SURVEILLANCE			FORCE (Fi)	AFTER SURVEILLANCE			FORCE (Ff)	MAX PRESSURE	VARI %
	DATE	AREA (in^2)	CONSTANT (kips)		DATE	AREA (in^2)	CONSTANT (kips)			
8778	10/9/97	333.423	1.640	1835466.5	1/20/98	333.564	-7.497	1827105	5500	0.46
8833	10/9/97	335.178	-0.321	1843158	1/20/98.	335.008	-3.148	1839396	5500	0.20
9501	12/11/97	368.689	1.554	1918736.8	1/20/98	372.715	-4.549	1933569	5200	0.77
7702	2/17/98	1.542	0.120	13227	3/23/98	1.552	0.068	13260	8500	0.25

RAM 7702 USED FOR WIRE TESTING

V. TENDON LIFTOFFS AND DETENSIONING

A liftoff is performed on each surveillance tendon to monitor the force exerted by the tendon onto the structure. PSC Procedure SQ 9.0 (Volume 2, Section 9, Appendix F) details the steps to be taken to perform a liftoff. The results are documented on Data Sheet SQ 9.0 and are summarized in Table VIII.

It should be noted that performing a liftoff has only a localized effect on a tendon; therefore, it is acceptable to use the same jacks for both ends of a tendon by executing the liftoff on separate occasions.

Vertical tendon liftoffs were found to be above the base value except for 12V1 which was above 95% of base, and all dome liftoff averages were above the base value.

Horizontal liftoffs revealed two isolated areas 42H30 to 42H36 inclusive and 51H26, 51H27 where average tendon liftoffs were between 90% and 95% of base value. Two tendons, 42H35 and 51H26, were found to be below 90% of base value and detensioned for continuity test per FPC requirement. This continuity test revealed that all of the wires were continuous, one wire was removed from each tendon for testing and one broken wire removed from 51H26 was also tested. After testing the tendons were restored to base value -0% +6%. All other tendons found between 90 and 95% of base value were subsequently restored per procedure to base value -0% +6%.

These low liftoff results were documented on NCR's -010, 011, 012,.013, and 014 for 42H30 - 36 and NCR 005 for 51H26.

All other tendon liftoffs were either above base value or 95% of base value and therefore acceptable.

The average normalized liftoff for each group, vertical, dome and horizontal, exceeded the minimum required and is acceptable.

After completion of liftoffs, protruding wires were found to tendons 51H26(1), 51H27(2) and 62H46(2). These wires, once removed, were found to have broken behind the anchorhead. No corrosion was found to indicate wire failure due to deterioration and it is suspected that slight tendon head rotation while setting back down sheared the wires against the shims. In all cases the broken wires were on the outer corner edge of the tendon bundle and no gauge movement was noted to indicate failures during liftoff. These wires were probable "pinched" during original installation and additional work on these tendons has broken the wires. NCR's FN604-003,007 and 015 recorded these occurrences.

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TABLE VIII: SUMMARY OF DATA SHEETS SQ 9.0
TENDON LIFTOFFS

TENDON	END	EFFECT. WIRES	JACK No.	PRESS.	LIFTOFF	AVE. LIFTOFF	BASE VALUE	95% BASE	90% BASE	NORMALIZING FACTOR	ACCEPT
12V1	SHOP/TOP	162	8833	4390	1471	1471	1530	1453	1377	-9	YES
23V2	SHOP/TOP	163	8778	4820	1609	1609	1482	1408	1333	37	YES
61V21	SHOP/TOP	163	8833	4550	1525	.1525	1482	1408	1334	38	YES
D113	SHOP/2	163	8778	4267.5	1424.7	1427	1369	1301	1232	-35	YES
	FIELD/6	163	8833	4265	1429						YES
D115	SHOP/2	163	8778	4062.5	1356	1380	1347	1280	1213	-12	YES
	FIELD/6	163	8833	4190	1404						YES
D212	SHOP/1	162	8833	3820	1280	1335	1317	1252	1186	15	YES
	FIELD/3	162	8778	4160	1389						YES
D304	SHOP/4	163	8778	4810	1605	1598	1397	1327	1258	-64	YES
	FIELD/2	162	8833	4748	1591						YES
D311	SHOP/4	163	8778	4220	1409.5	1408	1335	1269	1202	0	YES
	FIELD/2	163	8833	4200	1407						YES

20TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

TABLE VIII: SUMMARY OF DATA SHEETS SQ 9.0 - TENDON LIFTOFFS

TENDON	END	EFFECT. WIRES	JACK No.	PRESS.	LIFTOFF	AVE. LIFTOFF	BASE VALUE	95% BASE	90% BASE	NORMALIZING FACTOR	ACCEPT
42H18	SHOP/4	163	8778	4690	1565	1476	1495	1420	1346	-56	YES
	FIELD/2	163	8833	4137	1386.5						YES
42H29	SHOP/4	163	8778	4500	1502	1448	1445	1373	1300	-7	YES
	FIELD/2	163	8833	4160	1394						YES
42H30	SHOP/4	163	8778	4355	1454	1389	1469	1396	1322	-32	NO
	FIELD/2	163	8833	3950	1324						NO
42H31	SHOP/4	163	8778	4100	1369	1338	1460	1387	1314	-21	NO
	FIELD/2	163	8833	3900	1307						NO
42H32	SHOP/4	163	8778	4320	1442	1355.5	1452	1380	1307	-15	NO
	FIELD/2	163	8833	3785	1269						NO
42H33	SHOP/4	163	8778	4490	1499	1361	1474	1400	1326	-35	NO
	FIELD/2	163	8833	3650	1223						NO
42H34	SHOP/4	163	8778	4240	1415	1377.5	1452	1380	1307		NO
	FIELD/2	163	8833	4000	1340						NO

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TABLE VIII: SUMMARY OF DATA SHEETS SQ 9.0 - TENDON LIFTOFFS

TENDON	END	EFFECT. WIRES	JACK No.	PRESS.	LIFTOFF	AVE. LIFTOFF	BASE VALUE	95% BASE	90% BASE	NORMALIZING FACTOR	ACCEPT
42H35	SHOP/4	163	8778	4110	1372	1296.5	1455	1382	1309	-17	NO
	FIELD/2	163	8833	3693	1221						NO
42H36	SHOP/4	163	8778	4490	1499	1408	1503	1428	1353	-65	NO
	FIELD/2	163	8833	3930	1317						NO
42H37	SHOP/4	163	8778	4310	1439	1401.5	1452	1379	1306	-14	YES
	FIELD/2	163	8833	4070	1364						YES
42H44	SHOP/4	163	8778	4510	1505	1471.5	1427	1356	1285	10	YES
	FIELD/2	163	8833	4291	1438						YES
51H25	SHOP/1	163	8833	4090	1370.5	1363	1401	1331	1261	38	YES
	FIELD/5	163	8778	4060	1355.5						YES
51H26	SHOP/1	163	8833	4190	1403.5	1320	1514	1438	1363	-75	NO
	FIELD/5	163	8778	3705	1237						NO
51H27	SHOP/1	163	8833	3787	1269	1265.5	1368	1300	1231	71	NO
	FIELD/5	163	8778	3780	1262						NO

TABLE VIII: SUMMARY OF DATA SHEETS SQ 9.0 - TENDON LIFTOFFS

TENDON	END	EFFECT. WIRES	JACK No.	PRESS.	LIFTOFF	AVE. LIFTOFF	BASE VALUE	95% BASE	90% BASE	NORMALIZING FACTOR	ACCEPT
51H28	SHOP/ 1	163	8833	4445	1489.5	1450.5	1518	1442	1367	80	YES
	FIELD/ 5	163	8778	4230	1412						YES
53H2	SHOP/ 5	163	9501	4400	1624	1611	1424	1353	1281	12	YES
	FIELD/ 3	163	9501	4330	1598						YES
53H46	SHOP/ 5	163	8833	4340	1454	1459.5	1472	1399	1325	-35	YES
	FIELD/ 3	163	8778	4390	1465						YES
62H41	SHOP/ 2	163	8778	4230	1412	1426	1422	1351	1280	16	YES
	FIELD/ 6	163	8833	4297.5	1440						YES
62H46	SHOP/ 2	163	8778	4280	1429	1485	1465	1392	1318	-27	YES
	FIELD/ 6	163	8833	4600	1541						YES

VI. WIRE INSPECTION AND TESTING

One wire was scheduled for removal from each detensioned tendon for visual inspection and tensile testing. PSC Procedure SQ 10.3 outlines the details involved with the wire testing and the data was recorded on Data Sheets SQ 10.2 and SQ 10.3 with the results summarized in Table X.

All wire diameters were within the acceptance criteria of 0.27559 $\pm$ 0.002". The corrosion condition of all samples was level 1 - "bright metal; no visible oxidation" and the Ultimate Strength exceeded the minimum strength criteria of 240,000 psi (240 ksi) for all wire samples tested.

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TABLE X: SUMMARY OF DATA SHEETS SQ 10.2 & 10.3 - VISUAL INSPECTION AND TENSILE TESTING OF WIRE

TENDON	SAMPLE No.	CORROSION LEVEL	SAMPLE LOCATION (FT)	DIAMETER (IN)	YIELD STRENGTH (PSI)	ULTIMATE STRENGTH (PSI)	ACCEPTABLE
61V21	1	1	20 - 29	0.275	210,770	249,197	YES
	2	1	90 - 99	0.275	210,251	251,793	YES
	3	1	170 - 179	0.275	209,212	242,966	YES
D304	1	1	20 - 29	0.2755	213,614	244,138	YES
	2	1	60 - 69	0.2755	213,614	241,552	YES
	3	1	100 - 109	0.2755	217,236	250,864	YES
42H35	1	1	20 - 29	0.276	210,286	241,219	YES
	2	1	70 - 79	0.276	210,802	246,375	YES
	3	1	140 - 149	0.276	212,864	253,077	YES
51H26	1	1	10 - 19	0.2745	210,512	254,293	YES
	2	1	70 - 79	0.2745	209,990	248,560	YES
	3	1	140 - 149	0.2745	216,766	243,869	YES
51H26	1A	1	10 - 19	0.2745	215,202	250,645	YES
	2A	1	70 - 79	0.2745	214,160	253,251	YES
	3A	1	146 - 155	0.2745	220,415	257,942	YES
62H41	1	1	20 - 29	0.2755	211,545	247,760	YES
	2	1	70 - 79	0.2755	213,614	245,173	YES
	3	1	140 - 149	0.2755	214,390	241,552	YES

VII. TENDON RETENSIONING AND RESEALING

Those scheduled tendons that had previously been detensioned for wire removal, (61V21, D304 and 62H41) along with additional detensioned tendons 42H35 and 51H26 were retensioned per PSC Procedure SQ 11.0 (Volume 2, Section 9, Appendix F). The results of the retensioning process were recorded on Data Sheets SQ 11.0 and the results are summarized in Table XI.

All new elongations were compared to original elongations and found to be acceptable (within ± 10%) except tendon 51H26 whose elongation was -11.6%, NCR No. FN604-009 was raised to record this. All tendons were locked off at forces greater than those initially found or above base value whichever was higher, and all liftoffs were within -0% +6%.

After completion of all inspections, the anchorage components were hand coated with cold grease to ensure complete coverage, the cans were reinstalled with new gaskets, torqued to the required value, and the necessary amount of sheathing filler (grease) was added. In all cases, the same amount or more grease was added than removed. Results of the grease replacement were recorded on Data Sheets SQ 12.1 and are summarized in Table XII.

A greater amount than 5% of the duct volume was added to dome tendons D212 (12.12%), D304(18.3%), D311(19.1%) and horizontal tendons42H30(6.58%) and 42H34(5.53%). NCR's FN604-018, 019, 020, and 021 were written to record this. All other tendons took an amount less than 5% of the tendon duct volume.

20TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Precision Surveillance Corporation

Florida Power CORPORATION

TABLE XI: SUMMARY OF DATA SHEETS SQ 11.0
TENDON RETENSIONING

TENDON	END	ORIGINAL ELONGATION		OBSERVED ELONGATION		% VARI.	ACCEPT	LIFTOFF BEFORE RETEN.	RETENSIONING			% VARI.	ACCEPT
		EACH	TOTAL	EACH	TOTAL				JACK	PRESS.	L/OFF		
61V21	SHOP	—	12.125		11.3	-6.80	YES	1525	8833	4740	1588	+4.13	YES
D304	SHOP	—	8.125	3.55	7.95	-2.15	YES	1605	8778	4860	1622	+1.06	YES
	FIELD	—	—	4.40	—	—	—	1591	8833	4837.5	1621	+1.89	YES
62H41	SHOP	—	10.25	4.75	9.40	-8.29	YES	1412	8778	4460	1489	+5.45	YES
	FIELD	—	—	4.65	—	—	—	1440	8833	4380	1468	+1.94	YES

TENDONS RETENSIONED AFTER WIRE REMOVAL

TENDON	END	ORIGINAL ELONGATION		OBSERVED ELONGATION		% VARI.	ACCEPT	BASE VALUE	RETENSIONING				% VARI.	ACCEPT
		EACH	TOTAL	EACH	TOTAL				JACK	PRESS.	L/OFF	AVE.		
42H35	SHOP	—	10.25	4.80	9.80	-4.40	YES	1455	8778	4597	1534	1539	+5.77	YES
	FIELD	—	—	5.00	—	—	—	—	8833	4610	1545	—	—	
51H26	SHOP	—	10.75	4.70	9.50	-11.6	NO *	1514	8833	4703	1576	1589	+4.59	YES
	FIELD	—	—	4.80	—	—	—	—	8778	4800	1602	—	—	

* SEE NCR No. FN604-009

20TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Precision Surveillance Corporation

Florida Power CORPORATION

TABLE XI: SUMMARY OF DATA SHEETS SQ 11.0 - TENDON RETENSIONING

TENDON	END	LIFTOFF BEFORE RETENSIONING			AVERAGE	BASE	RETENSIONING			AVERAGE	% ABOVE	ACCEPT
		JACK	PRESSURE	LIFTOFF	LIFTOFF	VALUE	JACK	PRESSURE	LIFTOFF	LIFTOFF	BASE	
42H29	SHOP	8778	4500	1502	1448	1445	8778	4500	1502	1493	+3.32	YES
	FIELD	8833	4160	1394	——	——	8833	4430	1484.5	——	——	
42H30	SHOP	8778	4355	1454	1389	1469	8778	4560	1522	1520	+3.47	YES
	FIELD	8833	3950	1324	——	——	8833	4530	1518	——	——	
42H31	SHOP	8778	4100	1369	1338	1460	8778	4605	1537	1547.5	+5.99	YES
	FIELD	8833	3900	1307	——	——	8833	4650	1558	——	——	
42H32	SHOP	8778	4320	1442	1355.5	1452	8778	4540	1515	1506.5	+3.75	YES
	FIELD	8833	3785	1269	——	——	8833	4470	1498	——	——	
42H33	SHOP	8778	4490	1499	1361	1474	8778	4490	1499	1513.5	+2.68	YES
	FIELD	8833	3650	1223	——	——	8833	4560	1528	——	——	
42H34	SHOP	8778	4240	1415	1377.5	1452	8778	4520	1509	1512.5	+4.17	YES
	FIELD	8833	4000	1340	——	——	8833	4525	1516	——	——	
42H36	SHOP	8778	4490	1499	1408	1503	8778	4700	1569	1572	+4.59	YES
	FIELD	8833	3930	1317	——	——	8833	4700	1575	——	——	
42H37	SHOP	8778	4310	1439	1401.5	1452	8778	4570	1525	1521.5	+4.79	YES
	FIELD	8833	4070	1364	——	——	8833	4530	1518	——	——	

20TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power CORPORATION

TABLE XI: SUMMARY OF DATA SHEETS SQ 11.0 - TENDON RETENSIONING

TENDON	END	LIFTOFF BEFORE RETENSIONING			AVERAGE	BASE	RETENSIONING			AVERAGE	% ABOVE	ACCEPT
		JACK	PRESSURE	LIFTOFF	LIFTOFF	VALUE	JACK	PRESSURE	LIFTOFF	LIFTOFF	BASE	
51H25	SHOP	8833	4090	1370.5	1363	1401	8833	4250	1425	1442	+2.93	YES
	FIELD	8778	4060	1355.5	——	——	8778	4370	1459	——	——	
51H27	SHOP	8833	3787	1269	1265.5	1368	8833	4145	1389	1399	+2.27	YES
	FIELD	8778	3780	1262	——	——	8778	4220	1409	——	——	
51H28	SHOP	8833	4445	1489.5	1450.5	1518	8833	4645	1557	1563	+2.96	YES
	FIELD	8778	4230	1412	——	——	8778	4700	1569	——	——	

TABLE XII: SUMMARY OF DATA SHEETS SQ 12.1 GREASE LOSS Vs GREASE REPLACEMENT

TENDON	GREASE REMOVED			GREASE REPLACED			DIFF. (GAL.)	NET VOLUME	%
	SHOP	FIELD	TOTAL (GAL.)	SHOP	FIELD	TOTAL (GAL.)			
12V1	2.00	36.75	38.75	40.75	0.75	41.50	+2.75	143.46	1.91
23V2	0.75	9.75	10.50	11.50	0.00	11.50	+1.00	142.52	0.70
61V21	0.75	88.50	89.25	20.25	72.50	92.75	+3.50	144.03	2.43
43V04	0.50	0.00	0.50	7.50	0.00	7.50	+7.00	N/A	N/A
D113	4.50	4.00	8.50	6.20	3.50	9.70	+1.20	115.11	1.04
D115	4.50	4.50	9.00	7.00	4.00	11.00	+2.00	117.17	1.71
D212	6.50	4.00	10.50	20.00	4.50	24.50	+14.00	115.55	12.12♦
D304	12.00	7.25	19.25	38.20	0.00	38.20	+18.95	103.68	18.30♦
D311	24.00	4.00	28.00	46.50	3.50	50.00	+22.00	115.12	19.10♦

♦ SEE NCR No. FN604-018, 019, 020

TABLE XII: SUMMARY OF DATA SHEETS SQ 12.1
GREASE LOSS Vs GREASE REPLACEMENT

TENDON	GREASE REMOVED			GREASE REPLACED			DIFF.	NET	%
	SHOP	FIELD	TOTAL (GAL.)	SHOP	FIELD	TOTAL (GAL.)	(GAL.)	VOLUME	
42H18	3.75	2.00	5.75	5.25	5.25	10.50	+4.75	121.40	3.91
42H29	3.50	3.25	6.75	5.25	6.25	11.50	+4.75	121.48	3.91
42H30	3.00	3.00	6.00	7.00	7.00	14.00	+8.00	121.59	6.58 ♦
42H31	2.50	3.00	5.50	5.25	5.75	11.00	+5.50	121.84	4.51
42H32	3.75	2.50	6.25	6.25	4.75	11.00	+4.75	121.36	3.90
42H33	3.00	3.00	6.00	6.25	4.75	11.00	+5.00	120.38	4.15
42H34	3.00	3.00	6.00	6.50	6.25	12.75	+6.75	121.99	5.53 ♦
42H35	3.25	4.50	7.75	4.90	5.30	10.20	+2.45	121.27	2.02
42H36	4.00	4.00	8.00	4.00	5.75	9.75	+1.75	121.62	1.44
42H37	4.50	4.50	9.00	6.20	5.00	11.20	+2.20	120.44	1.83
42H44	4.75	3.50	8.25	5.30	4.90	10.20	+1.95	121.08	1.61
51H25 *	3.50	3.50	7.00	8.00	4.50	12.50	+5.50	120.73	4.56
51H25 **	3.00	4.00	7.00	4.50	4.00	8.50	+1.50	120.73	1.24
51H26	4.50	3.75	8.25	5.25	4.50	9.75	+1.50	121.43	1.24
51H27	3.50	3.25	6.75	5.30	5.70	11.00	+4.25	121.60	3.50
51H28 *	3.50	4.00	7.50	4.50	4.75	9.25	+1.75	120.46	1.45
51H28 **	4.00	4.00	8.00	4.50	4.00	8.50	+0.50	120.46	0.42
53H2	4.50	4.00	8.50	5.75	6.25	12.00	+3.50	121.32	2.88
53H46	3.25	3.50	6.75	6.00	5.25	11.25	+5.25	121.60	4.32
62H41	4.00	4.00	8.00	7.10	5.30	12.40	+4.40	121.37	3.63
62H46	3.50	4.50	8.00	6.25	6.50	12.75	+4.75	121.11	3.92
51H41	N/A	3.50	3.50	N/A	4.00	4.00	+0.50	N/A	N/A

* GREASED 11/18/97
** GREASED 12/18/97

♦ SEE NCR No. FN604-021

VIII. COMPARISON WITH ORIGINAL INSTALLATION DATA

A comparison of the liftoff forces from this surveillance to the original installation lock-off forces is made in an effort to detect any evidence of system degradation. The lock-off forces are compared in order to detect any abnormal force loss which would possibly indicate an underestimation of the creep, shrinkage and/or elastic shortening effects in the Containment Building.

Three tendons were excluded from the results due to inconsistencies. Tendons 23V2 and 53H2 both reported higher liftoffs now than at installation. Both of the original reported liftoffs appear to be lower than the group average at installation, the horizontal by almost 5%, which could indicate an error in recording the original result. Tendon D304 lost only 12 kips from the original recorded liftoff. In no case were any conditions found that would indicate problems with the wire condition or forces found. These results are not considered detrimental to the structure.

Due to these results being inconsistent with the rest of the results they have been omitted from the group averages. The losses for the tendon groups were found to be 9.08% for the vertical tendons, 11.72% for the horizontal tendons and 16.63% for the dome tendons. Despite two of the horizontal tendons being below the expected base value at liftoff (subsequently retensioned to base -0% +6%) these losses are as expected for a containment of this age and do not indicate any degradation of the system.

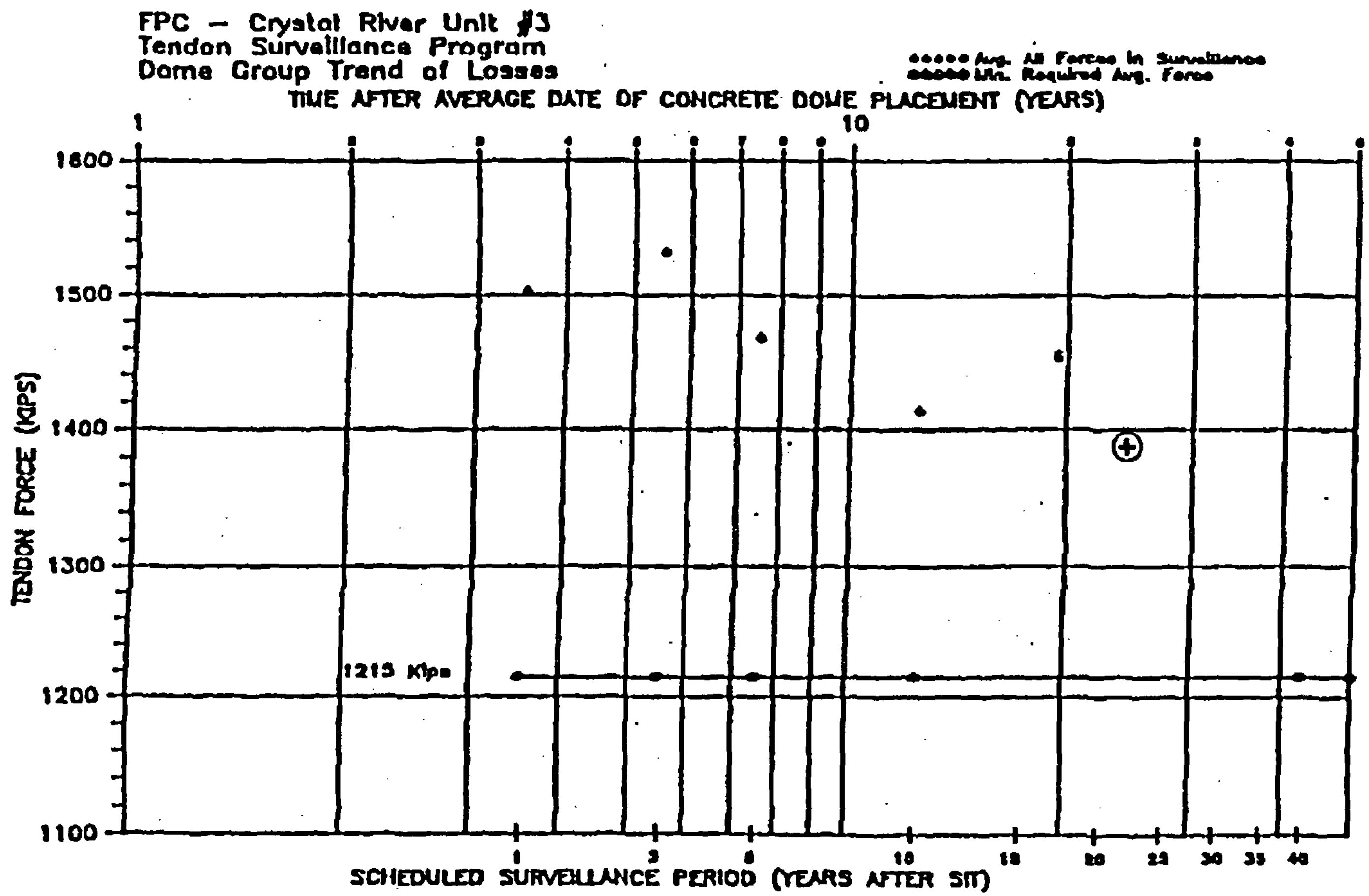
The following three pages show the graphs of the normalized average liftoffs taken from page 39 for each of the tendon groups. These trend graphs allow a high degree of confidence that the liftoff values will remain above the minimum requirement throughout the next surveillance.

TABLE XIII: COMPARISON OF ORIGINAL LOCKOFF FORCES TO AS FOUND FORCES

TENDON	LIFTOFF FORCE		LOSS	PERCENTAGE	AVERAGE
	ORIGINAL	@ 20 YEARS	(kips)	%	PERCENTAGE
12V1	1675	1471	204	12.18	9.08
23V2	1598	1609	+11 *	——	
61V21	1622	1525	97	5.98	
D113	1676	1427	249	14.86	16.63
D115	1700	1380	320	18.82	
D212	1600	1335	265	16.56	
D304	1610	1598	12 *	——	
D311	1682	1408	274	1629	
42H18	1664	1476	188	11.30	11.72
42H32	1626	1356 **	270	16.61	
42H44	1605	1472	133	8.29	
51H26	1661	1320 **	341	20.53	
53H2	1555	1611	+56 *	——	
53H46	1628	1560	68	4.18	
62H41	1609	1426	183	11.37	
62H46	1645	1485	160	9.73	

* REMOVED FROM THE AVERAGES DUE TO INCONSISTENCIES.

TENDON HISTORICAL TRENDS
DOME TENDONS



20TH YEAR SURVEILLANCE OF THE
POST-TENSIONING SYSTEM AT THE
CRYSTAL RIVER NUCLEAR PLANT
UNIT 3

Florida Power
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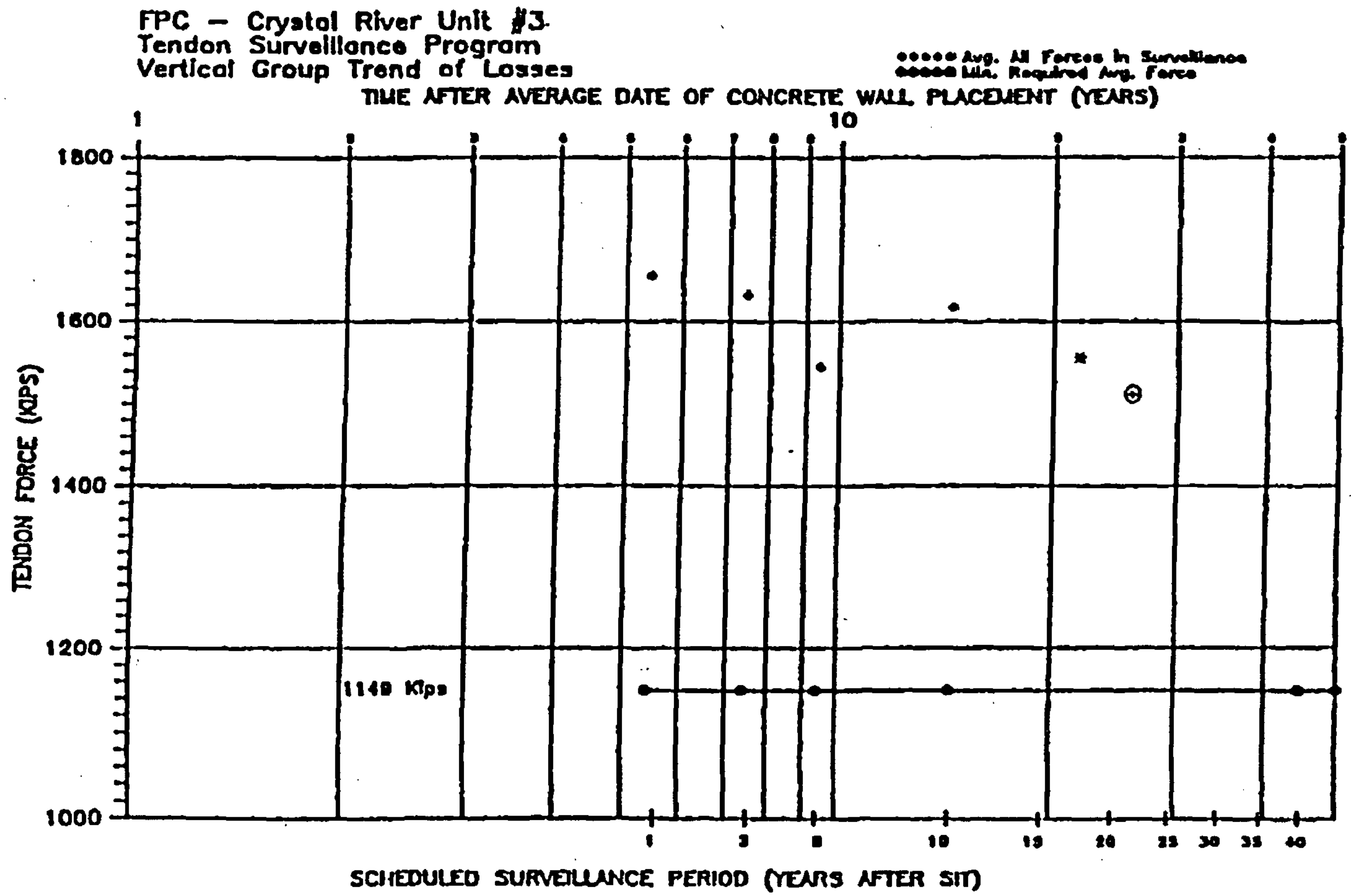
TENDON HISTORICAL TRENDS
VERTICAL TENDONS



20TH YEAR SURVEILLANCE OF THE
POST-TENSIONING SYSTEM AT THE
CRYSTAL RIVER NUCLEAR PLANT
UNIT 3

Florida Power
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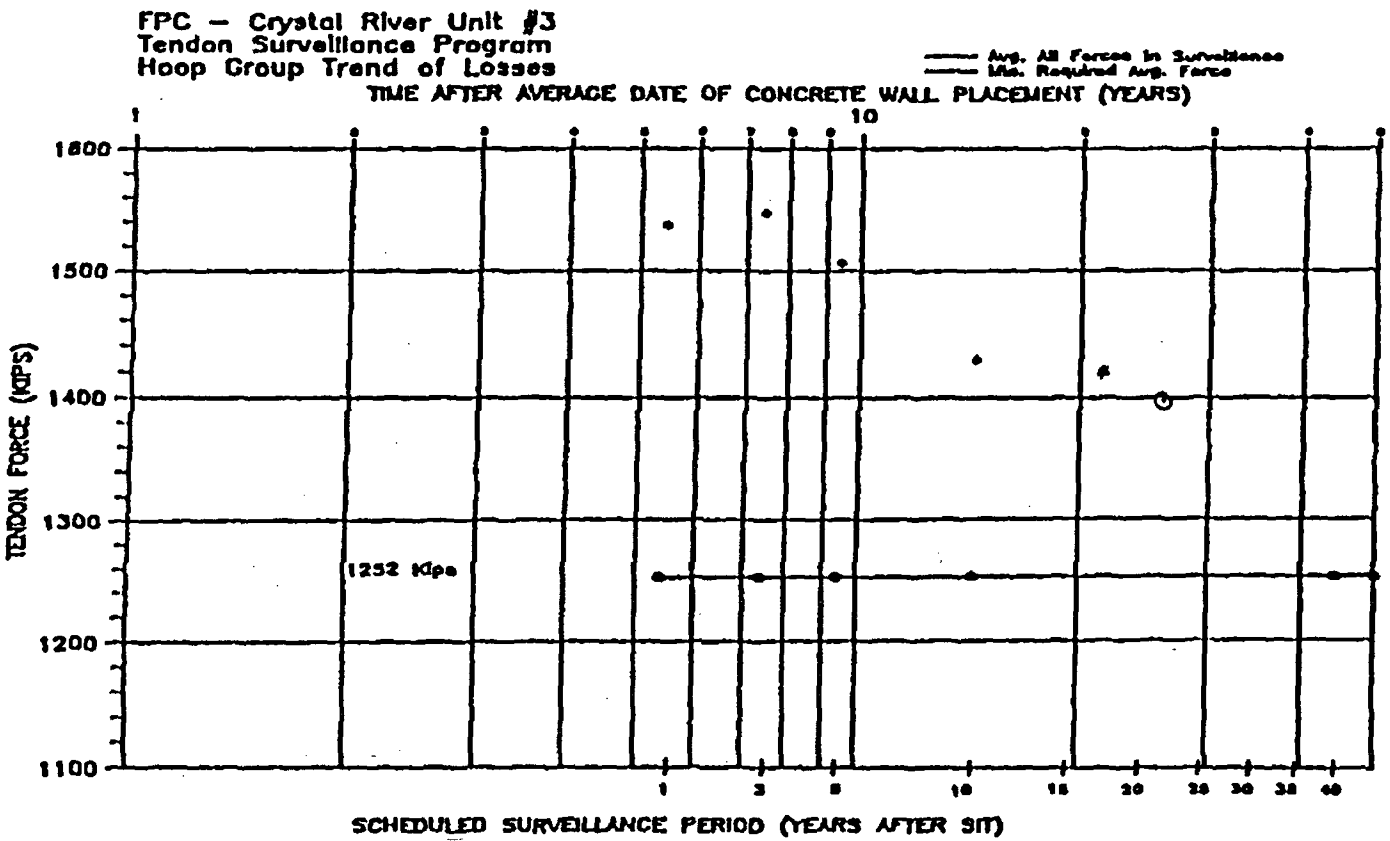
ENCLOSURE 16
(Page 3 of 3)

TENDON HISTORICAL TRENDS
HOOP TENDONS



20TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power CORPORATION

Florida Power CORPORATION

INTEROFFICE CORRESPONDENCE

A-C-XMTL.FRM

Nuclear Engineering	NT6D	240-1511
Office	MAC	Telephone

SUBJECT: Crystal River Unit 3
Quality Records Transmittal - Analysis/Calculation

TO: Records Management - NR2A

The following analysis/calculation package is submitted as the QA Record copy:

DOCNO (FPC DOCUMENT IDENTIFICATION NUMBER)	REV.	SYSTEM(S)	TOTAL PAGES TRANSMITTED
S 95-0082	3	MX	68

TITLE
6th Tendon Surveillance - Generation of Tendon Force Curves

KWDS (IDENTIFY KEYWORDS FOR LATER RETRIEVAL)
Tendon, Surveillance

DXREF (REFERENCES OR FILES - LIST PRIMARY FILE FIRST)
REA 97-1975
REA 97-2110
REA 97-2129

VEND (VENDOR NAME)	VENDOR DOCUMENT NUMBER (DXREF)	SUPERSEDED DOCUMENTS (DXREF)
FPC (from Parsons Power)	N/A	N/A

TAG

PART NO.

COMMENTS (USAGE RESTRICTIONS, PROPRIETARY, ETC.)
Revision by FPC to Parsons Power calculation (using FPC format).

NOTE:
Use Tag number only for valid tag numbers (i.e., RCV-8, SWV-34, DCH-99), otherwise; use Part number field (i.e., CSC14599, AC1459). If more space is required, write "See Attachment" and list on separate sheet.

FOR RECORDS MANAGEMENT USE ONLY
Quality Record Transmittal received and information entered into SEEK.
Entered by: ____________ Date ________
(Return copy of Quality Docment Transmittal to NOE Supprt Specialist.)

DESIGN ENGINEER	DATE	VERIFICATION ENGINEER	DATE	SUPERVISOR, NUCLEAR ENG.	DATE
John D. Shuler Jr.	2-2-98	[signature]	2-15-98	[signature]	2-18-98

cc: Nuclear Projects (If MAR/CGWR/PEERE Return to Service Related) ☐ Yes ☒ No
Supervisor, Config. Mgt. Info.
Mgr., Nucl. Operations Eng. (Original) w/attach

Calculation Review form Part III actions required ☒ Yes ☒ No
(If Yes, send copy of the form to Nuclear Regulatory Assurance and a copy of the Calculation to the Responsible Organization(s) identified in Part III on the Calculation Review form.)

1/23/98 bah

Rev. 12/97

Florida Power Corporation

ANALYSIS/CALCULATION SUMMARY

A-C-SUM.FRM

DOCUMENT IDENTIFICATION NUMBER	DISCIPLINE S	CONTROL NO. 95-0082	REVISION LEVEL 3

TITLE

6th Tendon Surveillance - Generation of Tendon Force Curves

CLASSIFICATION (CHECK ONE)
☒ Safety Related
☐ Non Safety Related

MAR/SP/CGWR/PEERE NUMBER
N/A

VENDOR DOCUMENT NUMBER
N/A

	APPROVAL SIGNATURES	PRINTED NAME
Design Engineer	[signature]	John D. Shubert, Jr.
Date	2-2-98	
Verification Engineer	[signature]	Joe A. Leze
Date	2.16.98	
Supervisor	[signature]	Dan Jopling
Date	2-16-98	

ITEMS REVISED

(see "Revision Description Sheet" for revision 3)

PURPOSE SUMMARY

Determine Tendon Force losses and prepare Tendon Force Curves for additional Tendons required for the 6th Surveillance Inspection. The data for the following Tendon's is added by Revision 3:

D111, D302, D306, 42H29, 42H30, 42H34,

42H35, 42H36, 42H37, 51H28, 51H29,

62H39, 62H43 and 62H44.

RESULTS SUMMARY

Additional Force Curves are plotted and attached.

Florida Power CORPORATION

CALCULATION REVIEW

CALC-REV.FRM

CALCULATION NO./REV.

S 95-0082 Revision 3

PART I - **DESIGN ASSUMPTION/INPUT REVIEW: APPLICABLE** ☐ Yes ☒ No

The following organizations have reviewed and concur with the design assumptions and inputs identified for this calculation:

Nuclear Plant Technical Support System Engr	N/A Signature/Date
Nuclear Plant Operations OTHER(S)	N/A Signature/Date
	N/A Signature/Date
	N/A Signature/Date

PART II - **RESULTS REVIEW: APPLICABLE** ☐ Yes ☒ No

The following organizations have reviewed and concur with the results of this calculation and understand the actions which the organizations must take to implement the results.

Nuclear Plant Technical Support System Engr	N/A Signature/Date
Nuclear Plant Operations	N/A Signature/Date
Nuclear Plant Maintenance ☐ Yes ☒ N/A	N/A Signature/Date
Nuclear Licensed Operator Training ☐ Yes ☒ N/A	N/A Signature/Date
Manager, Site Nuclear Services ☐ Yes ☒ N/A	N/A Signature/Date
Sr. Radiation Protection Engineer ☐ Yes ☒ N/A	N/A Signature/Date
Nuclear Plant EOP Group ☐ Yes ☒ N/A	N/A Signature/Date

OTHERS:

	N/A Signature/Date

Florida Power CORPORATION

CALCULATION REVIEW

CALCULATION NO./REV.
S 95-0082 Revision 3

PART III - CONFIGURATION CONTROL: APPLICABLE ☐ Yes ☒ No

The following is a list of Plant procedures/lesson plans/other documents and Nuclear Engineering calculations which require updating based on calculation results review:

Document	Date Required	Responsible Organization

Upon completion, forward a copy to the Manager, Nuclear Regulatory Assurance Group for tracking of actions if any items are identified in Part III. If calculations are listed, a copy shall be sent to the original file and the calculation log updated to reflect this impact.

PART IV - NUCLEAR ENGINEERING DOCUMENTATION REVIEW

The responsible Design Engineer must thoroughly review the below listed documents to assess if the calculation requires revision to these documents. If "Yes," the change authorizations must be listed below and issued concurrently with the calculation.

Document	Yes	No	Reference	Document	Yes	No	Reference
Enhanced Design Basis Document	☐	☒	(TC#)	Vendor Qualification Package	☐	☒	(VQP#)
FSAR	☐	☒	(Letter#)	Topical Design Basis Doc.	☐	☒	(TC#)
Improved Tech. Specification	☐	☒	(Letter#)	E/SQPM	☐	☒	(TC#)
Improved Tech. Spec. Bases	☐	☒	(Letter#)	Other Documents reviewed:			
Config. Mgmt. Info. System	☐	☒	(CIOP#)		☐	☐	(CHANGE DOC. REFERENCE)
Analysis Basis Document	☐	☒	(TC#)		☐	☐	(CHANGE DOC. REFERENCE)
Design Basis Document	☐	☒	(TC#)		☐	☐	(CHANGE DOC. REFERENCE)
Appendix R Fire Study	☐	☒	(TC#)		☐	☐	(CHANGE DOC. REFERENCE)
Fire Hazardous Analysis	☐	☒	(TC#)		☐	☐	(CHANGE DOC. REFERENCE)
NFPA Code Conformance Document	☐	☒	(TC#)		☐	☐	(CHANGE DOC. REFERENCE)

PART V - PLANT REVIEWS/APPROVALS FOR INSTRUMENT SETPOINT CHANGE

PRC/DNPO approval is required if a setpoint is to be physically changed in the plant through the NEP 213 process.

PRC Review Required ☐ Yes ☒ No — N/A
PRC Chairman /Date

DNPO Review Required ☐ Yes ☒ No — N/A
DNPO /Date

DESIGN ENGINEER/DATE	DESIGN ENGINEER - PRINTED NAME
[signature] 2-2-98	John D. Shubert, Jr.

Florida Power CORPORATION

CALCULATION VERIFICATION REPORT

Crystal River Unit 3

CALVERRP.FRM

CALCULATION NUMBER
S 95-0082 Revision 3
PROJECT/TITLE
6th Tendon Surveillance - Generation of Tendon Force Curves

	YES	NO	N/A	
1.	☒	☐	☐	Are inputs, including codes, standards, regulatory requirements, procedures, data, and Engineering methodology correctly selected and applied?
2.	☐	☐	☒	Have assumptions been identified? Are they reasonable and justified? (See NEP 101, V.c, for discussion on references).
3.	☒	☐	☐	Are references properly identified, correct, and complete? (See NEP 101, V.c., for discussion on assumptions and justification.)
4.	☒	☐	☐	Have applicable construction and operating experiences been considered?
5.	☒	☐	☐	Was an appropriate Design Analysis/Calculation method used?
6.	☐	☐	☒	In cases where computer software was used, has the program been verified or reverified in accordance with NEP 135 for safety related design applications and/or are inputs, formulas, and outputs associated with spreadsheets accurate?
7.	☐	☐	☒	Is the output reasonable compared to inputs?
8.	☐	☐	☒	Has technical design information provided via letter, REA, IOC or telecon by other disciplines or programs been verified by that discipline or program?
9.	☐	☐	☒	Has technical design information provided via letter or telecon from an external Engineering Organization or vendor been confirmed and accepted by FPC?
10.	☐	☒	☐	Do the calculation results indicate a non-conforming condition exists? If "Yes," immediately notify the responsible Supervisor.
11.	☐	☒	☐	Do the results require a change to other Engineering documents? If "Yes," have these documents been identified for revision on the Calculation Review Form?

I have performed a verification on the subject calculation package and find the results acceptable.

VERIFICATION ENGINEER	DATE	SUPERVISOR, NUCLEAR ENGINEERING	DATE
J.A. [signature] Joe L. Lee	2-15-98	[signature]	2-18-98

Florida Power CORPORATION

INTEROFFICE CORRESPONDENCE

A-C-XMTL.FRM

Nuclear Engineering	NT6D	240-1511
Office	MAC	Telephone

SUBJECT: Crystal River Unit 3
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S 95-0082	2	MX	153

TITLE
6th Tendon Surveillance - Generation of Tendon Force Curves

KWDS (IDENTIFY KEYWORDS FOR LATER RETRIEVAL)
Tendon, Surveillance

DXREF (REFERENCES OR FILES - LIST PRIMARY FILE FIRST)

VEND (VENDOR NAME)	VENDOR DOCUMENT NUMBER (DXREF)	SUPERSEDED DOCUMENTS (DXREF)
FPC (from Parsons Power)	N/A	N/A

TAG

PART NO.

COMMENTS (USAGE RESTRICTIONS, PROPRIETARY, ETC.)
Revision by FPC to Parsons Power calculation (using FPC format)

NOTE:
Use Tag number only for valid tag numbers (i.e., RCV-8, SWV-34, DCH-99), otherwise; use Part number field (i.e., CSC14599, AC1459). If more space is required, write "See Attachment" and list on separate sheet.

DESIGN ENGINEER	DATE	VERIFICATION ENGINEER	DATE	SUPERVISOR, NUCLEAR ENG.	DATE
John D. Shubert, Jr.	9-15-97	Patrick A. McCarraher	9-22-97	Dan Jopling	9-22-97

cc: Nuclear Projects (If MAR/CGWR/PEERE Return to Service Related) ☐ Yes ☒ No
Supervisor, Config. Mgt. Info.
Mgr., Nucl. Operations Eng. (Original) w/attach

Calculation Review form Part III actions required ☒ Yes ☐ No
(If Yes, send copy of the form to Nuclear Regulatory Assurance and a copy of the Calculation to the Responsible Organization(s) identified in Part III on the Calculation Review form.)

Rev. 3/97

Florida Power Corporation

ANALYSIS/CALCULATION SUMMARY

A-C-SUM.FRM

DOCUMENT IDENTIFICATION NUMBER	DISCIPLINE S	CONTROL NO. 95-0082	REVISION LEVEL 2

TITLE
6th Tendon Surveillance - Generation of Tendon Force Curves

CLASSIFICATION (CHECK ONE)
☒ Safety Related
☐ Non Safety Related

MAR/SP/CGWR/PEERE NUMBER
n/a

VENDOR DOCUMENT NUMBER
n/a

	APPROVAL SIGNATURES	PRINTED NAME
Design Engineer	[signature]	John D. Shubert, Jr.
Date	9-15-97	
Verification Engineer	Patrick A. McCarraher	PATRICK A. McCARRAHER
Date	9-22-97	
Supervisor	[signature]	D. Joplin
Date	9-22-97	

ITEMS REVISED
(see "Revision Description Sheet" for revision 2)

PURPOSE SUMMARY
Determine Tendon Force losses and prepare Tendon Force Curves for Tendons for 6th Surveillance Inspection.

RESULTS SUMMARY
Force Curves are plotted and attached.

Rev. 3/97

Florida Power CORPORATION

CALCULATION REVIEW

CALC.REV.FRM

CALCULATION NO./REV.
S 95-0082 Revision 2

PART I - DESIGN ASSUMPTION/INPUT REVIEW: APPLICABLE ☐ Yes ☒ No

The following organizations have reviewed and concur with the design assumptions and inputs identified for this calculation:

Nuclear Plant Technical Support System Engr ______ Signature/Date

Nuclear Plant Operations ______ Signature/Date

OTHER(S)

______ ______ Signature/Date

______ ______ Signature/Date

PART II - RESULTS REVIEW: APPLICABLE ☐ Yes ☒ No

The following organizations have reviewed and concur with the results of this calculation and understand the actions which the organizations must take to implement the results.

Nuclear Plant Technical Support System Engr ______ Signature/Date

Nuclear Plant Operations ______ Signature/Date

Nuclear Plant Maintenance ______ Signature/Date
☐ Yes ☐ N/A

Nuclear Licensed Operator Training ______ Signature/Date
☐ Yes ☐ N/A

Manager, Site Nuclear Services ______ Signature/Date
☐ Yes ☐ N/A

Sr. Radiation Protection Engineer ______ Signature/Date
☐ Yes ☐ N/A

OTHERS:

______ ______ Signature/Date

______ ______ Signature/Date

Florida Power Corporation

CALCULATION REVIEW

CALCULATION NO./REV.
S 95-0082 Revision 2

PART III - CONFIGURATION CONTROL: APPLICABLE ☒ Yes ☐ No

The following is a list of Plant procedures/lesson plans/other documents and Nuclear Engineering calculations which require updating based on calculation results review:

Document	Date Required	Responsible Organization
SP-182	11-1-97	Nuclear Engineering Programs

Upon completion, forward a copy to the Manager, Nuclear Regulatory Assurance Group for tracking of actions if any items are identified in Part III. If calculations are listed, a copy shall be sent to the original file and the calculation log updated to reflect this impact.

PART IV - NUCLEAR ENGINEERING DOCUMENTATION REVIEW

The responsible Design Engineer must thoroughly review the below listed documents to assess if the calculation requires revision to these documents. If "Yes," the change authorizations must be listed below and issued concurrently with the calculation.

Document	Yes	No	Reference
Enhanced Design Basis Document	☐	☒	(TC#)
FSAR	☐	☒	(Letter#)
Improved Tech. Specification	☐	☒	(Letter#)
Improved Tech. Spec. Bases	☐	☒	(Letter#)
Config. Mgmt. Info. System	☐	☒	(CIDP#)
Analysis Basis Document	☐	☒	(TC#)
Design Basis Document	☐	☒	(TC#)
Appendix R Fire Study	☐	☒	(TC#)
Fire Hazardous Analysis	☐	☒	(TC#)
NFPA Code Conformance Document	☐	☒	(TC#)
Vendor Qualification Package			(VQP#)
Topical Design Basis Doc.	☐	☒	(TC#)
E/SQPM	☐	☒	(TC#)

Other Documents reviewed:

Document	Yes	No	(CHANGE DOC. REFERENCE)
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	

PART V - PLANT REVIEWS/APPROVALS FOR INSTRUMENT SETPOINT CHANGE

PRC/DNPO approval is required if a setpoint is to be physically changed in the plant through the NEP 213 process.

PRC Review Required ☐ Yes ☒ No

PRC Chairman /Date

DNPO Review Required ☐ Yes ☒ No

DNPO /Date

DESIGN ENGINEER/DATE	DESIGN ENGINEER - PRINTED NAME
[signature] 9-15-97	John D. Shubert, Jr.

CALCULATION VERIFICATION REPORT

Crystal River Unit 3

CALVERRP.FRM

CALCULATION NUMBER
S 95-0082 Revision 2
PROJECT/TITLE
6th Tendon Surveillance - Generation of Tendon Force Curves

	YES	NO	N/A	
1.	☒	☐	☐	Are inputs, including codes, standards, regulatory requirements, procedures, data, and Engineering methodology correctly selected and applied?
2.	☒	☐	☐	Have assumptions been identified? Are they reasonable and justified? (See NEP 101, V.c, for discussion on references).
3.	☒	☐	☐	Are references properly identified, correct, and complete? (See NEP 101, V.c., for discussion on assumptions and justification.)
4.	☒	☐	☐	Have applicable construction and operating experiences been considered?
5.	☒	☐	☐	Was an appropriate Design Analysis/Calculation method used?
6.	☐	☐	☒	In cases where computer software was used, has the program been verified or reverified in accordance with NEP 135 for safety related design applications and/or are inputs, formulas, and outputs associated with spreadsheets accurate?
7.	☒	☐	☐	Is the output reasonable compared to inputs?
8.	☒	☐	☐	Has technical design information provided via letter, REA, IOC or telecon by other disciplines or programs been verified by that discipline or program?
9.	☒	☐	☐	Has technical design information provided via letter or telecon from an external Engineering Organization or vendor been confirmed and accepted by FPC?
10.	☐	☒	☐	Do the calculation results indicate a non-conforming condition exists? If "Yes," immediately notify the responsible Supervisor.
11.	☐	☒	☐	Do the results require a change to other Engineering documents? If "Yes," have these documents been identified for revision on the Calculation Review Form?

I have performed a verification on the subject calculation package and find the results acceptable.

VERIFICATION ENGINEER	DATE	SUPERVISOR, NUCLEAR ENGINEERING	DATE
Patrick A. McCanahy	9-22-97	[signature]	9-22-97

MAR 19 1997

Florida Power CORPORATION

INTEROFFICE CORRESPONDENCE

Nuclear Engineering Design	NA1E	240-3568
Office	MAC	Telephone

SUBJECT: Crystal River Unit 3
Quality Document Transmittal - Analysis/Calculation

TO: Records Management - NR2A

The following analysis/calculation package is submitted as the QA Record copy:

DOCNO (FPC DOCUMENT IDENTIFICATION NUMBER)	REV.	SYSTEM(S)	TOTAL PAGES TRANSMITTED
S-95-0082	1	MX	~~139~~ 158 3-17-97

TITLE
6th Tendon Surveillance - Generation of Tendon Force Curves

KWDS (IDENTIFY KEYWORDS FOR LATER RETRIEVAL)
Tendon Surveillance

DXREF (REFERENCES OR FILES - LIST PRIMARY FILE FIRST)
SP-182

VEND (VENDOR NAME)	VENDOR DOCUMENT NUMBER (DXREF)	SUPERSEDED DOCUMENTS (DXREF)
FPC (from Parsons Power)	N/A	N/A

TAG

PART NO.

COMMENTS (USAGE RESTRICTIONS, PROPRIETARY, ETC.)
Parsons Power calc revision using FPC format.

NOTE:
Use Tag number only for valid tag numbers (i.e., RCV-8, SWV-34, DCH-99), otherwise; use Part number field (i.e., CSC14599, AC1459). If more space is required, write "See Attachment" and list on separate sheet.

DESIGN ENGINEER	DATE	VERIFICATION ENGINEER	DATE	SUPERVISOR, NUCLEAR ENG.	DATE
[signature]	3-12-97	N/A		[signature]	3-17-97

cc: MAR Office (If MAR Related) ☐ Yes ☒ No
Mgr. Nucl. Config. Mgt.
Mgr., Nucl. Eng. Design
(Original) w/attach

Plant Document Updates Required ☐ Yes ☒ No (If Yes, send copy of the Calculation Review form to Nuclear Licensing and a copy of the Calculation to the Responsible Organization(s) identified in Part II on the Calculation Review form.)

A/E ________ ☐ Yes ☒ No
(If yes, Transmit w/attach)

Florida Power Corporation

ANALYSIS/CALCULATION SUMMARY

DOCUMENT IDENTIFICATION NUMBER	DISCIPLINE	CONTROL NO.	REVISION LEVEL
	STRUCTURAL	S-95-0082	1

TITLE

PREPARATION OF TENDON FORCE CURVES FOR 6TH TENDON SURVEILLANCE INSPECTION

CLASSIFICATION (CHECK ONE)

☒ Safety Related
☐ Non Safety Related

MAR/SP/CGWR/PEERE NUMBER

VENDOR DOCUMENT NUMBER

	REVISION APPROVALS	ITEMS REVISED
Design Engineer	Rusha Chang	SEE PAGE 1 of THIS REVISION FOR DETAILED LIST
Date	1/20/97	of CHANGES.
Verification Engineer	Patrick A. McCumber	
Date/Method*	2/5/97 | R	
Supervisor	Samir J. Serhan	
Date	10 Feb. 97	

*VERIFICATION METHODS: R - Design Review; A - Alternate Calculation; T - Qualification Testing

DESCRIBE BELOW IF METHOD OF VERIFICATION WAS OTHER THAN DESIGN REVIEW

PURPOSE SUMMARY

DETERMINE TENDON FORCE LOSSES AND PREPARE TENDON FORCE CURVES FOR TENDONS FOR 6TH SURVEILLANCE INSPECTION

RESULTS SUMMARY

FORCE CURVES ARE PLOTTED AND ATTACHED

PARSONS POWER GROUP INC. a combination of Gilbert Commonwealth and Parsons Main

2675 Morgantown Road • Reading, PA 19607 • (610) 855-2000 • Fax. (610) 855-2001

February 11, 1997

FCS-14771
Contract N00821AD, WA048

Mr. W. W. Nisula
Contract Manager
Florida Power Corporation (NA1B)
15760 West Power Line Street
Crystal River, FL 34428-6708

Attention: Mr. J. Lese

Re: Crystal River Unit 3
6th Tendon Surveillance Force Curve
Calculation

Dear Mr. Nisula:

Please find attached calculation S-95-0082 Revision 1, which documents the generation of the tendon force curves to accommodate the proposed inspection date of early March 1997.

Included are disks with related electronic files used in the preparation of the data and force curves.

Should there be any questions please feel free to contact Dr. Samir Serhan at (610) 855-3209.

Very truly yours,

Samir J. Serhan, Ph.D., P.E.
Supervising Engineer

Roy W. Adler
Project Manager

RWA/SJS/bmb

Attachment

cc: W. W. Nisula (NA1B)
D. L. Jopling (NA1E)
J. A. Lese (NA1E)
R. E. Vaughn
FPC Records Management (CL Only)
R. W. Adler(2)
P. J. Hamilton
S. J. Serhan

S-95-0082
Revision #1
Cover Letter for Info

PARSONS

Florida Power
CORPORATION

INTEROFFICE CORRESPONDENCE

Nuclear Engineering	NA1E	240-3568
Office	MAC	Telephone

SUBJECT: Crystal River Unit 3
Quality Document Transmittal - Analysis/Calculation

TO: Records Management - NR2A

The following analysis/calculation package is submitted as the QA Record copy:

DOCNO (FPC DOCUMENT IDENTIFICATION NUMBER)	REV.	SYSTEM(S)	TOTAL PAGES TRANSMITTED
S-95-0082	0	MX	383

TITLE
6th Tendon Surveillance - Generation of Tendon Force Curves

KWDS (IDENTIFY KEYWORDS FOR LATER RETRIEVAL)
Tendon Surveillance

DXREF (REFERENCES OR FILES - LIST PRIMARY FILE FIRST)

VEND (VENDOR NAME)	VENDOR DOCUMENT NUMBER (DXREF)	SUPERSEDED DOCUMENTS (DXREF)
FPC (from Parsons Power)	N/A	N/A

TAG

PART NO.

COMMENTS (USAGE RESTRICTIONS, PROPRIETARY, ETC.)
Force Curves for 6th Tendon Surveuillance

NOTE:
Use Tag number only for valid tag numbers (i.e., RCV-8, SWV-34, DCH-99), otherwise; use Part number field (i.e., CSC14599, AC1459). If more space is required, write "See Attachment" and list on separate sheet.

DESIGN ENGINEER	DATE	VERIFICATION ENGINEER	DATE	SUPERVISOR NUCLEAR ENG.	DATE
	4-26-96	N/A			4/26/96

cc: MAR Office (If MAR Related) ☐ Yes ☒ No
Mgr. Nucl. Config. Mgt.
Mgr., Nucl. Eng. Design
(Original) w/attach

Plant Document Updates Required ☒ Yes ☐ No (If Yes send copy of the Calculation Review form to Nuclear Licensing and a copy of the Calculation to the Responsible Organization(s) identified in Part III on the Calculation Review form.)

A/E ________ ☐ Yes ☒ No
(If yes, Transmit w/attach)

CALCULATION REVIEW

CALCULATION NO./REV.

S-95-0082/Revision #0

PART I - **DESIGN ASSUMPTION/INPUTREVIEW**

The following organizations have reviewed and concur with the design assumptions and inputs identified for this calculation:

Nuclear Plant Technical Support System Engr	N/A Signature/Date
Nuclear Plant Operations	N/A Signature/Date
OTHER(S)	
____________	Signature/Date
____________	Signature/Date

PART II - **RESULTS REVIEW**

The following organizations have reviewed and concur with the results of this calculation and understand the actions which the organizations must take to implement the results.

Nuclear Plant Technical Support System Engr	N/A Signature/Date
Nuclear Plant Operations	N/A Signature/Date
Nuclear Plant Maintenance ☐ Yes ☒ N/A	Signature/Date
Nuclear Licensed Operator Training ☐ Yes ☒ N/A	Signature/Date
Manager, Site Nuclear Services ☐ Yes ☒ N/A	Signature/Date
Sr. Radiation Protection Engineer ☐ Yes ☒ N/A	Signature/Date

OTHERS:

____________	Signature/Date
____________	Signature/Date

CALCULATION REVIEW

CALCULATION NO./REV.

S-95-0082/Revision #0

PART III - CONFIGURATION CONTROL

The following is a list of Nuclear Engineering and Plant procedures/lesson plans/other documents which require updating based on calculation results review:

Document	Date Required	Responsible Organization
SP-182	3/1/98	Nuclear Engineering Design
		(A. Petrowsky)

Upon completion, forward a copy to the Manager, Nuclear Licensing for tracking of actions if any items are identified in Part III.

PART IV - PLANT REVIEWS/APPROVALS FOR FIELD SETPOINT CHANGE

PRC review is required if a full 10CFR50.59 Safety Evaluation is performed. DNPO approval is required if a setpoint is to be physically changed in the plant.

PRC Review Required ☐ Yes ☒ No

PRC Chairman /Date

DNPO Review Required ☐ Yes ☒ No

DNPO /Date

DESIGN ENGINEER/DATE 4-26-96

Florida Power Corporation

ANALYSIS/CALCULATION SUMMARY

DOCUMENT IDENTIFICATION NUMBER	DISCIPLINE	CONTROL NO.	REVISION LEVEL
	STRUCTURAL	S-95-0082	0

TITLE

PREPARATION OF TENDON FORCE CURVES FOR 6TH TENDON SURVEILLANCE AND SUPPORT OF SP-182.

CLASSIFICATION (CHECK ONE)

Safety Related ✓

Non Safety Related

MAR/SP/CGWR/PEERE NUMBER

VENDOR DOCUMENT NUMBER

	REVISION APPROVALS		ITEMS REVISED
Design Engineer	Rusha Chang		INITIAL ISSUE
Date	4/15/96		
Verification Engineer	M. Marcellus		
Date/Method*	4/15/96	R	
Supervisor	[signature]		
Date	22 April 96		

*VERIFICATION METHODS: R - Design Review; A - Alternate Calculation; T - Qualification Testing

DESCRIBE BELOW IF METHOD OF VERIFICATION WAS OTHER THAN DESIGN REVIEW

PURPOSE SUMMARY

DETERMINE TENDON FORCE LOSSES & PREPARE TENDON FORCE CURVES FOR TENDONS FOR NEXT SURVEILLANCE. ALSO PREPARE SUPPORTING CALCULATIONS FOR SP-182 ENCLOSURE 30.

RESULTS SUMMARY

FORCE CURVES ARE PLOTTED & ATTACHED. CALCULATIONS SUPPORTING SP-182 ARE ATTACHED

Florida Power Corporation

DESIGN ANALYSIS/CALCULATION

Crystal River Unit 3

DESA-C.FRM

DOCUMENT IDENTIFICATION NO.	REVISION
S-95-0082	3

Revision No.: 3 This page followed by page 1A

The following items have been revised in the current revision:

Revised Pages	Affected Sections	Add	Replace	Remove	Description/Purpose of Revision
1		X			add "Revision Description Sheet" for revision 3
1A			X		change page number on revision 2 "Revision Description Sheet" from page 1 to page 1A and state that "page 1B follows"
1B			X		change page number on revision 1 "Revision Description Sheet" from page 1A to page 1B and state that "page 1C follows"
1C			X		change page number of Table of Contents from page 1B to page 1C and add item for Revision 3 Description Sheet
11			X		change data input file names to correspond to current names (i.e. DOMER3.XLW, etc) and add note
20			X		change data input file name to correspond to current name (DOMER3.XLW), add data for Tendons D111, D302, D306 and state that "page 20A follows"
20A-20B		X			add spreadsheet and curve for Tendon D111
49			X		state that "page 49A follows"
49A-49B		X			add spreadsheet and curve for Tendon D302
55			X		state that "page 55A follows"
55A-55B		X			add spreadsheet and curve for Tendon D306
63-64			X		change data input file name to correspond to current name (HOOPER3.XLW) and add data for Tendons 42H29, 42H30, 42H34 thru 42H37, 51H28, 52H29, 62H39, 62H43 and 62H44
70			X		state that "page 70A follows"
70A-70D		X			add spreadsheets and curves for Tendons 42H29 and 42H30
76			X		state that "page 76A follows"
76A-76H		X			add spreadsheets and curves for Tendons 42H34 thru 42H37
94			X		state that "page 94A follows"
94A-94D		X			add spreadsheets and curves for Tendons 51H28 and 51H29
112			X		state that "page 112A follows"
112A-112B		X			add spreadsheet and curve for Tendon 62H39
118			X		state that "page 118A follows"
118A-118D		X			add spreadsheets and curves for Tendons 62H43 and 62H44
159			X		include "Original Stresses data" for Tendons D111, D302 and D306 and change data input file name to correspond to current name (DOMER3.XLW)
160			X		include "Original Stresses data" for Tendons 42H29, 42H30, 42H34 thru 42H37, 51H28, 52H29, 62H39, 62H43 and 62H44 and change data input file name to correspond to current name (HOOPER3.XLW)
B94-B110		X			add Tendon History Sheets for Tendons D111, D302, D306, 42H29, 42H30, 42H34 thru 42H37, 51H28, 52H29, 62H39, 62H43 and 62H44
K2			X		change data input names to correspond to current names (i.e. DOMER3.XLW, etc...) and add note

REVISION TYPE: ☐ Superseded by Calculation Number ______________

(check one) ☐ Full Revision ☒ Page for Page

Florida Power Corporation

DESIGN ANALYSIS/CALCULATION

Crystal River Unit 3

DESA-C.FRM

DOCUMENT IDENTIFICATION NO.	REVISION
S-95-0082	3

Revision No.: 2   This page followed by page 1B

The following items have been revised in the current revision:

R3

Revised Pages	Affected Sections	Add	Replace	Remove	Description/Purpose of Revision
1		X			add "Revision Description Sheet" for revision 2
1A			X		change page number on revision 1 "Revision Description Sheet" from page 1 to page 1A and state that "page 1B follows"
1B			X		change page number of Table of Contents from page 1A to page 1B and add item for Revision 2 Description Sheet
3			X		change start date from Spring 1997 to Fall 1997
8			X		change start date from Spring 1997 to Fall 1997
9			X		change reference to Enclosure 30 to just state "Original Stressing Data"
10			X		change start date from March 1997 to November 1997 and change numerical values to correspond to November 1997
11			X		change data input file names to correspond to current names (i.e. DOMER2.XLW, etc...)
18			X		revise the discussion about the interpolation between data on the spreadsheets
20			X		change data input file name to correspond to current name (DOMER2.XLW)
21			X		revise spreadsheet for November 1997 start date
23-61			X		revise spreadsheets and curves for November 1997 start date
64			X		change data input file name to correspond to current name (HOOPER2.XLW)
65-124			X		revise spreadsheets and curves for November 1997 start date
126			X		change data input file name to correspond to current name (VERTR2.XLW)
127-156			X		revise spreadsheets and curves for November 1997 start date
157			X		change reference to Enclosure 30 to just state "Original Stressing Data" and Enclosure 29 to just state "data sheets"
159-161			X		change reference to Enclosure 30 to just state "Original Stressing Data" and change data input file names to correspond to current names (i.e. DOMER2.XLW, etc...)
162			X		change reference to Enclosure 29 to just state "Original Stressing Data" and Enclosure 29 to just state "data sheets"
K2			X		change data input file names to correspond to current names (i.e. DOMER2.XLW, etc...)

REVISION TYPE: (check one)

☐ Superseded by Calculation Number ______________

☐ Full Revision   ☒ Page for Page

Revision No.: 1

This page followed by page 1C R3

This form shall be used to record the purpose or reason for the revision. indicate the revision pages and/or affected sections and give a short description of the revision. Check (X) the appropriate function to add. replace or remove the affected pages.

Revised Pages	Affected Sections	Add	Replace	Remove	Description/Purpose of Revision
1		X			Add revision description sheet.
1A			X		Change page number from 1 to 1A. Add item for revision description sheet.
3			X		To change start date for the 6th surveillance inspection from March 1998 to March 1997
10			X		To change start date for the 6th surveillance inspection from March 1998 to March 1997
18			X		To change start date for the 6th surveillance inspection from March 1998 to March 1997
21			X		To change start date for the 6th surveillance inspection from March 1998 to March 1997
23-61			X		To change start date for the 6th surveillance inspection from March 1998 to March 1997
65-124			X		To change start date for the 6th surveillance inspection from March 1998 to March 1997
127-156			X		To change start date for the 6th surveillance inspection from March 1998 to March 1997
~~K1~~			~~X~~		~~[illegible]~~

REVISION TYPE: [ ] SUPERSEDED BY CALCULATION NUMBER

(check one) [ ] FULL REVISION [X] PAGE FOR PAGE

R3

TABLE OF CONTENTS

R3

1.0 PURPOSE AND OBJECTIVE

File CR3C6TSP.DOC (Word 6.0)

The purpose of this calculation is to provide tendon force curves for Florida Power Corporation for the Crystal River Unit 3 facility in support of the upcoming 6th tendon surveillance period scheduled for the Fall of 1997. Specific tasks to be performed as part of this scope include the following: R2

A.) Determine the predicted tendon losses and develop force/time curves for each of the selected tendons for the upcoming sixth surveillance period. Generate the tendon force curves for the selected tendons, the tendons adjacent to the selected tendons, and alternate tendons. Alternate tendons are tendons not specifically scheduled for this surveillance but force curves are prepared to be available in case a substitute tendon should be required during the surveillance. In addition, force curves for a group of tendons deferred/exempted from the previous surveillance will also be prepared. These are discussed in detail in Section 5.0.

B.) In addition to the force curve development, other calculations which are required to support Enclosures included within Surveillance Procedure SP-182 will also be prepared within this same calculation.

2.0 DESIGN INPUT

Design input information has been reviewed and is included as Attachment A to this calculation. Note that there are no significant changes to the basic criteria and related documentation which address the licensing of the CR3 plant with respect to the tendon surveillance program. The previous surveillance efforts completed various studies and addressed the CR3 tendon program and its' compliance with U.S. Regulatory Guide 1.35, Revision 3, since it was formally issued in July 1990. Based on FPC licensing efforts and Technical Specification revisions performed at the time of the last surveillance period, as well as recent discussions with the NRC, FPC has now committed the CR3 tendon surveillance program to be performed in accordance with U.S. NRC Regulatory Guide 1.35, Revision 3 (Reference 3).

U.S. Regulatory Guide 1.35.1, Revision 0 (Reference 4) is a daughter document referred to by the above Reg. Guide and deals specifically with the calculation of individual tendon losses and the generation of tendon force curves. While calculation efforts for the CR3 tendon force curves have followed closely with both of these Regulatory Guides as they evolved through the 1970's and 1980's, the format and current procedure for the preparation of the force curves is not in exact compliance with Regulatory Guide 1.35.1 Revision 0 as issued in 1990. The method and approach used in the generation of the CR3 force curves is superior to that of the Reg. Guide in that a specific curve is generated for each individual tendon. Based on the discussions held with the NRC and the results of their review, the method and approach used for these calculations shall be the same as used for previous surveillances. See the Attachment A information for further discussion and references to recent correspondence and documentation with the NRC on various issues related to the tendon surveillance program.

Applicable Technical Specification sections, as well as FSAR sections were also reviewed for this effort. They support the position noted above on the FPC commitment to R.G. 1.35, Rev. 3 and are discussed and referenced within the Attachment A information.

3.0 COMPUTER CODES

This calculation package is being prepared using Microsoft Word, Version 6.0 and Microsoft Excel, Version 5.0. Spreadsheets from earlier surveillance efforts were prepared using Lotus 123, Release 2.01 and 3.0 and were converted to Excel format for this calculation. All input and calculations are manually checked and verified, therefore, verification of computer programs is not applicable or necessary.

4.0 ASSUMPTIONS

Any assumptions made are noted and contained within the calculation package. None require future confirmation.

5.0 SCOPE AND TENDON SELECTION

Tendons were selected for the sixth surveillance period in accordance with the requirements of Reg. Guide 1.35, Revision 3 and using the same methodology as was used in the past surveillance. Basically, a random but representative sample was selected and checked at the site for accessibility. Specific criteria used for this selection process is summarized as follows:

Tendon Selection Process

The tendon selection process has remained the same as that completed for the last several surveillances where a random but representative sample is selected for inspection and testing. The intent is to get as many new and never tested tendons in the sample population, but still keeping one control tendon from each major tendon group to be investigated in each surveillance. Note that this current method differs from methods used during the early life of the plant where some tendons were repeated for inspection every third surveillance. Basically, the selection criteria and process used considers the following:

1.) Select tendons based on Reg. Guide 1.35 Revision 3
Based on the good results of prior surveillances, the Reg. Guide requires a minimum of 11 tendons to be inspected, including 5 hoop, 3 vertical and 3 dome. Tendons should be selected which were never previously inspected or tested. Previously detensioned and retensioned tendons should not be included (unless there is a specific need to investigate the tendon per item 3 below). In addition to being selected at random, tendon selection should be representative of various areas and conditions. For example, the hoop tendons selection was based on random selection but also considered what tendons were inspected in the past and in what hoop area. A plot of previously inspected hoop tendons was prepared to track tendons inspected by grouping (i.e. 13's, 42's, 35's, 46's, 51's, and 62's). Therefore, the selection process considered those sections not equally represented by as many tendons as completed within other sections from prior surveillances. See Attachment J for various plots and information of the hoop group. The same procedure was applied to the dome group (i.e. 100's, 200's & 300's groups) and to the vertical group (i.e. 12's, 23's, 34's, 45's, 56's & 61's & quadrants). See Attachment D for groups information.

2.) Maintain Control Tendons to be completed each surveillance.
The Reg. Guide also requires a control tendon from each group to be inspected every surveillance for comparative purposes. CR3 has not had control tendons since the first surveillance. The concept was introduced probably in the fourth surveillance. Tendons D212, 12V1 and 51H26 were probably the original control tendons since about the time of the fourth surveillance. They were intended to be inspected during the fifth surveillance but the group of tendons selected was based on the surveillance being performed during an outage. FPC decided to complete the 5th surveillance during normal plant operation and the original tendons selected were affected because many tendons were located within the area of the plant steam vent zone. This included the above three control tendons, and three new control tendons, D215, 34V6 and 46H29 were selected for completion of that surveillance. A problem with 46H29 during the 5th surveillance forced the selection of another control tendon, 46H21, for the hoop group. New control tendons may need to be selected periodically if the tendon has a problem and is ever detensioned and/or retensioned. As earlier surveillances on CR3 did repeat some tendons, the selection of these other control tendons was easily done from several good candidates. New control tendons should be selected from those previously inspected as far back as possible and cannot be one previously detensioned and/or retensioned. A tendon inspected in more than one prior surveillance is preferred.
Based on the above, it is recommended that both of the above two sets of control tendons be used by FPC as control tendons, with one set of three to be utilized in the 6th surveillance during a plant outage, and for the other three to be used in any future inspections scheduled to be performed on-line.

3.) Consider any tendons with problems or abnormal conditions as reported by plant personnel.
Any leaking tendons or tendons with any reported problems should be considered within the scope of the surveillance. Also, past inspection reports and records should be checked for open items, recommendations, or noted problem tendons.

4.) In the selection of tendons for detensioning, (one per group is required per R.G.) consider the number of effective wires as recorded in the tendon history sheets and summarized in the effective wire summary in Attachment D to this calculation. As any tendon is to be considered ineffective if it has less than 155 effective wires per the FSAR, it is therefore not desirable to select a tendon with many missing, cut or ineffective wires. Unless there was a specific need to detension that particular tendon, doing so could therefore render the entire tendon as out of service. Only a maximum of 3 tendons are allowed out of service at one time per criteria in the FSAR.

5.) The reduced force dome tendons are not normal candidates for normal liftoff testing per SP-182, Enclosure 8.

6.) Tendons adjacent to the selected tendon may require testing and should also be feasible to inspect and test. Adjacent tendons in the dome should not include any reduced force dome tendons. Jump to the next regular dome tendon for the required adjacent tendon. Also, adjacent tendons of the lowest hoop tendons (#1) shall be considered as the two directly above the selected tendon. Adjacent tendons of the highest hoop tendons (#47) shall be considered as the two directly below the selected tendon.

7.) One alternate tendon should be selected from each group, and the two adjacent tendons of these alternates at least considered for possible inclusion.

In addition to the above selection criteria, there are several other factors which have influenced the scheduling of actual field inspection and testing. These include:

A.) Steam Vent Zone -
Plant steam venting can impose a safety hazard to personnel during plant operation and early modes of shutdown. Tendon work in the range between 0 and 120 degrees is affected during plant operation by the potential steam venting of the plant. Tendon work in this area must be held off until the potential hazard is eliminated or other approval is obtained from plant operations. Note that for the fifth surveillance per FPC operations, this even includes the outside tendon caps of the affected butresses at 0 and at 120 degrees.

B.) Fuel Pool Area -
Work over the fuel pool can only be performed while missile shields are in place. (Nureg 0612 reqmt.)

C.) Plant Interior Work -
Work inside some plant areas is difficult due to access problems, high radiation areas, interferences, ram accessibility, etc.

Deferred/Exempted Tendons

After the tendons were selected for the fifth surveillance for an outage surveillance, it was decided that the 5th surveillance would be completed during normal plant operation. A group of tendons originally selected for inspection during that surveillance had to be exempted from that surveillance due to their proximity to the main steam vent zone and the associated hazards with working in that area. FPC discussed this issue with the NRC and has documented the following 8 tendons as deferred tendons:

EXEMPTED TENDON	COMMENTS
D115	Never inspected in any surveillance.
D212	Inspected in Surveillance 3 and 4. Considered as Control Tendon for outage condition.
D311	Never inspected in any surveillance.
12V1	Previously included for liftoff testing in the 3rd and 4th surveillances. Considered as Control Tendon for outage condition.
42H44	Never inspected in any surveillance.
51H26	Previously included for liftoff testing in the 3rd and 4th surveillances. Considered as Control Tendon for outage condition.
53H46	Never inspected in any surveillance.
62H46	Never inspected in any surveillance.

As FPC has committed to the NRC to address the above tendons within the upcoming 6th surveillance, these tendons were considered in the scope of this calculation. The 6th surveillance is scheduled to be completed during an outage. Since three of the above exempted tendons were also previous control tendons, it was considered that these tendons can again be used as control tendons for this surveillance instead of the 3 control tendons used in last surveillance (when the surveillance was done on-line). Therefore, the three exempted control tendons can be considered as three of the 11 tendons required per Reg. Guide. A total of 16 tendons should be inspected during the surveillance with three additional alternates selected. Note however that the scope of this calculation will include force curves to be regenerated for the other control tendons, D215, 34V6 and 46H21.

A complete historical record of all tendons included in all prior surveillances, along with the list of selected adjacent, exempted and alternate tendons which are planned for in the 6th surveillance is provided on the following Table.

Florida Power Corporation

DESIGN ANALYSIS/CALCULATION

Crystal River Unit 3

DOCUMENT IDENTIFICATION NO. Calculation S-95-0082

REVISION 2

********** CR3 TENDON SURVEILLANCE HISTORICAL RECORD **********

8-Sep-97
FILE-CR3R6TSP.XLS

TENDONS INSPECTED THROUGH THE 5TH SURVEILLANCE & PLANNED FOR IN 6TH SURVEILLANCE

SURVEILLANCE PERIOD	1ST SURVEILLANCE 11/27/77 TO 2/9/78		2ND SURVEILLANCE 3/3/80 TO 5/9/80		3RD SURVEILLANCE 9/28/81 TO 12/7/81		4TH SURVEILLANCE 9/15/87 TO 11/17/87		5TH SURVEILLANCE 11/93 TO 1/94		PLANNED 6TH SURVEILLANCE FALL 1997		PRIOR TENDON INSPECTION SUMMARY DATA
YEARS AFTER SIT SIT 11/76	1 YEAR		3.5 YEARS		5 YEARS		11 YEARS		17 YEARS		21 YEARS		
REQUIRED TO INSPECT	21 TOT-10H,6V,5D		21 TOT-10H,6V,5D		21 TOT-10H,6V,5D		11 TOT-5H,3V,3D		11 TOT-5H,3V,3D		11 TOT-5H,3V,3D		83 TOT-40H,24V,21D
ACTUALLY INSPECTED	23 TOT-10H,7V,6D		22 TOT-10H,7V,5D		21 TOT-10H,6V,5D		11 TOT-5H,3V,3D		14 TOT-8H,3V,3D		INCL 8 DEFERRED		91 TOT-43H,26V,22D
SP BASIS	SP-3583, SP-5909		SP-182		SP-182		SP-182		SP-182		TOTAL = 16		
	SP-393, SP-6456		REV -		REV 4		REV 7		REV 10 & 11				
G/C REPORT DATE	3-27-80 & 4/80		5/80		5/19/82		3/10/88		5/94				
DOME TENDONS	D139		D122		D123		D105	D	D215	R,C	D212	R,C,E	22 DOME TENDONS
123 TOTAL	D215		D140		D215	R	D212	R,C	D231	D	D304	D	INSPECTED
3 GROUPS OF 41	D221	D	D208	D	D212		D328		D224	A	D113		TO DATE
D100'S, D200'S, D300'S	D228		D323		D322	D					D115	E	
	D234		D331		D329						D311	E	
	D340										D131	A	
VERTICAL TENDONS	12V19		12V12		12V8		12V1	R,C	34V6	R,C	12V1	R,C,E	26 VERT. TENDONS
144 TOTAL	12V20		12V20	R	34V6	R	34V4		56V15	D	61V21	D	INSPECTED
6 GROUPS OF 24	12V21		23V3		34V19	D	56V2	D	61V14		23V2		TO DATE
12, 34, 56, 23, 45, 61	23V15		34V1		45V16						61V10	A	
	34V6		45V6		56V11								
	45V3	D	56V20		61V5								
	56V1		56V8	D,R									
HORIZONTAL TENDONS	13H10		13H22		13H19	R	13H20		35H1		51H26	R,C,E	43 HOOP TENDONS
282 TOTAL	13H19		13H32	D	13H46		13H40	D	42H1		42H18		INSPECTED
6 GROUPS @ 47 HIGH	13H37		13H43		42H20		51H26	R	46H21	C(New)	42H32		TO DATE
13, 24, 35, 46, 51, 62	13H47		51H10		42H40		51H41		46H28	ADJ.,T	42H44	E	
3 TENDONS PER HOOP	51H11		51H23		51H26		46H19		46H29	R,C(Old),D	62H22		
	62H19		51H37		51H45				46H30	ADJ.	62H41	D	
	46H21		53H24		53H39				46H17	D	62H46	E	
	46H29		53H28		53H40				62H8		53H46	E	
	46H37	D	53H44		62H34						53H2	A	
TOTAL TENDONS = 549	46H46		46H42		46H10	D							
TOTAL INSPECTED	23		22		21		11		14		16 + 3 ALT.		91 TOTAL INSPECTED

LEGEND -
A, ALTERNATE — ADJ., ADJACENT — C, CONTROL — D, DETENSIONED & RETENSIONED
E, EXEMPTED/DEFERRED FROM 5TH SURV. — R, REPEATED — T, RETENSIONED

R2

RET: Life of Plant RESP: Nuclear Engineering

6/95

6.0 CALCULATIONS

6.1 General Background and Schedule Information

General Background

Tendon forces curves are to be prepared for the upcoming 6th tendon surveillance period at CR3. From the basic criteria as presented in the Design Input Section, as well as from several discussions with Mr. Joe Lese of Florida Power & Light, it was determined that the criteria for this surveillance period has not changed since the last surveillance efforts. A review of Tech Spec and FSAR criteria confirms the FPC positions with respect to the tendon program. Supporting work for this surveillance period will be based on the same criteria that was used and accepted in the previous surveillance periods.

Tendon losses have been calculated in the past per the Reference 8, 9, 10 and 11documentation. Individual tendon losses include the following:

- Force loss due to elastic shortening of the containment as a result of the prestressing process and the particular sequence of tendon stressing.
- Force loss due to the stress relaxation of the tendon wires.
- Loss of prestress force due to the creep characteristics of the concrete structure.
- Loss of prestress force due to the shrinkage of the concrete structure.

Based on some earlier calculations made for tendon losses per the Reference 11 document, Lotus spread sheet templates were prepared for tendon losses calculations for the 4th tendon surveillance calculations. See References 9 & 10. These templates were reran and tested for their accuracy and validity for the fifth surveillance. In addition, the procedure for the gathering of all input data was automated in the fifth surveillance to the format presented herein. Numerous test cases were ran to duplicate force curves prepared in the past. There were four master templates prepared for the fourth surveillance; one for the hoop tendons, one for the vertical tendons, and two for the dome tendons. The dome tendons are divided into two groups; one for tendons with an original stressing sequence below 27, and the other for tendons with stressing sequences above 27.

Based on the work previously accomplished in the prior surveillances, new spreadsheets were prepared this surveillance using Microsoft Excel for the collection of input data and for the calculation of tendon losses needed for generation of force curves. The generation of the force curves was also automated this surveillance by using Excel to plot the graphs. The organization of most data used for this calculation was setup into Excel workbooks with subfiles built and included in each workbook. There is a separate workbook for each of the three tendon groups and each one contains the following:

- Tabulated input data
- Original tendon stressing sequences.
- Effective wire summaries.
- "Original Stressing Data" calculations for SP-182.
- Separate files including each tendon loss spreadsheet, plot data and an individual force curve. R2

Additional information on electronic file names etc. used in this calculation is provided in Attachment K.

Schedule Information

The expected timing for the sixth surveillance is Fall 1997. A date of November 1, 1997 will be used as a bases for determining the predicted values of base, 95% base and 90% base and labeling this information on the force curves. This allows for field use and decisions to be made based on the requirements of Surveillance Procedure, SP-182. R2

The scales of the force curves are based upon previous surveillance efforts. The x axis is a log scale in time representing the time after average date of dome or wall concrete placement, in years. This scale is labeled at the top of each curve. Force curves are plotted using the actual log scale points for the x axis (not the scheduled surveillance years after SIT) versus the calculated tendon forces in kips on the y axis. The scale at the bottom of the curve for scheduled surveillance periods after SIT are for ease and readability relative to regular scheduled surveillances per Reg. Guide 1.35, Revision 3.

Most of the CR3 surveillances were performed on the regularly scheduled years, however, the 5th surveillance was actually performed in the 17th year after SIT. Note that the containment Structural Integrity Test (SIT) was performed in November 1976.

For the dome tendons force curves, the point on the bottom scale at SIT corresponds to the log scale at the top of 2.5 years. Therefore, a corresponding log scale data point must be determined for curve plotting for the period of the 6th surveillance.

Based on a date of November 1, 1997 for the Fall 1997 surveillance, the length of time between November 1976 (@ SIT) and November 1, 1997 is 21 years. Since the dome group at SIT is at year 2.5 on the log scale, the 6th surveillance will correspond to (21.0 + 2.5) or 23.5 years on the log scale. R2

The same procedure must be performed for the hoop and vertical groups as they have different reference points on the log scale for time after concrete wall placement. Both hoop and vertical groups are the same with SIT corresponding to year 4.4 on the log scale. Therefore, the 6th surveillance period will correspond to (21.0 + 4.4) or 25.4 years on the log scale. R2

A vertical line will be shown on the force curves at the point of the next surveillance and the calculated values of base, 95% base and 90% base representing points on the curves at that time will be included on each of the curves.

6.2 General Procedure for Force Curve Generation

The same procedure within the calculation for the preparation of the force curves for the fourth and fifth surveillance periods will be followed.

6.2.1 Preparation of Data Input Spreadsheets

In each of the Excel workbooks is a data input file where data from source calculations and current tendon history sheets has been tabulated. See DOMER3.XLW (DOMEINP), HOOPR3.XLW (HOOPINP) & VERTR2.XLW (VERTINP). R3

The compiled books of tendon surveillance historical information, as updated to include the results of the fifth surveillance, provide key input data for the development of force curves. See References 12, 13 & 14. The selected tendon history sheets related to this surveillance have been included herein as Attachment B of this calculation. The Reference 11 calculation is essentially a source calculation for this procedure with the Reference 8 & 10 calculations also providing information.

Notes and references related to the tabulation of the data on these spreadsheets are shown on the individual sheets. The data input tabulations are presented as the first sheet within the following Sections 6.3, 6.4 & 6.5.

6.2.2 Procedure for Determination of Individual Tendon Losses

The procedure for the tendon loss calculations, as derived from the reference documentation, is as follows:

1.) Calculate original force in the tendons

The original force in the tendons is determined as follows:

$$ORIG.FORCE = 0.7 * F_{ULT} * \left[\frac{ActualLiftoff\ Pressure}{PredictedLiftoff\ Pressure}\right] \times WireFactor$$

Where:
f_{ult} = 240 Ksi, typical for all CR3 wires.

Wire area = 0.07685 in2 per Appendix F of the Reference 11 calculation.

F_{ult} (Kip Force)= Tendon Area (in2) x f_{ult} (Ksi) = 0.05985 * 240

Tendon Area (in2) = Area/Wire (in2) x No. of Wires. (Considered by wire factor.)

Actual and predicted original liftoff pressures are obtained from Tendon History Sheets References 12, 13, 14, with those within the scope of this calculation attached in Attachment B.

Refer to the Appendix F part of the Reference 11 calculation, for source data of above formula. The above expression was used as the basis for the calculations for all the shop and field end forces calculated on the Data Input Spreadsheets. This procedure does not apply to retensioned tendons.

Note that the wire factor as shown in the various spreadsheets is a value representing the tabulated number of effective wires over a total of 163. The number of wires is usually 163 unless cut, loose or considered ineffective. The number of effective wires as recorded from the original installation is documented on the tendon history sheets. The number of effective wires for each tendon has been updated, tabulated and presented in the Effective Wires Summary for each individual group within Attachment D. This tabulation was updated to include the results of all previous surveillances. It does not imply each of the tendons was specifically checked for the numbers of effective wires as presented in the table. It represents only data from the original records and as made available from surveillance records and subsequent inspections.

Note that the wire factor used is based on current information and is not based on the number of wires at the time of original installation, therefore the original Force calculated may not be the "original force" in the tendon back at that time. The effect of less effective wires lowers the curve vertically. This is insignificant at the current time as the curve of interest will be correct for use at this time. Another method would have been to plot the original value using the wire factor then and then to show a step down on the curve should a lower wire factor occur at some point later on the graph.

2.) Calculate Elastic Shortening Losses

The elastic shortening losses are a function of the stressing sequence number for the individual tendon. In addition, the tendon wire factors are also considered and used. The base expression used to calculate these forces is the same as used in previous calculations and is already built into the basic spreadsheet templates. All the equations for elastic shortening were confirmed as being the same as established in prior calculations. Based on the review of the procedure for calculating these losses, it is concluded that the existing templates are still appropriate and correct with the additional input of stressing sequence data and wire factors to be input for the current group of tendons for this surveillance.

Reference 10 & Reference 11 data and information on elastic shortening was included in Attachment E to these calculations. See Attachment C for original stressing sequences for all tendons and see the Data Input Worksheets & Attachment D information for tendon wire factors and source data.

Elastic Shortening Losses for Dome Tendons

Note there are two expressions used for elastic shortening for the dome tendons depending on the stress sequence numbers. For dome tendons in sequences 1 through 27, the Domelow template is used. For dome tendons in sequences 28 through 32, the Domehigh template is to be used. This is because of the two separate expressions used for the calculation.

Elastic Shortening Losses-
For Dome Tendons in Sequences 1 through 27-

N = 27 Total Sequences
n = Sequence of particular tendon.

Force Loss due to elastic shortening = F_{les}

$$F_{les} = \left[\frac{N-n}{N} \times 82.7 + 75\right] \times WireFactor$$

Elastic Shortening Losses-
For Dome Tendons in Sequences 28 through 32-

N = 5 (Sequences 28 through 32)
n = Sequence number less 27

i.e. for sequence 28, n = 1
for sequence 29, n = 2
for sequence 30, n = 3
for sequence 31, n = 4
for sequence 32, n = 5

$$Fles = \left[\frac{N-n}{N} \times 47.4 - 13.7\right] \times WireFactor$$

The value for elastic shortening in kips declines as the stressing sequence increases. A review of the data for the dome group shows that values for the dome group go from 154.6 kips for sequence 1 tendons down to 75 kips for sequence 27 tendons, and further going down to -13.7 kips for the last sequence, sequence 32. Note that wire factor differences between individual tendons will cause the calculated result to vary slightly for two tendons within the same stressing sequence.

Elastic Shortening Losses for Hoop Tendons -

N = 60 Total Sequences
n = Sequence of particular tendon.

Force Loss due to elastic shortening =

$$Fles = \left[\frac{(N-n)}{N} \times 134.0\right] \times WireFactor$$

A review of the data for the hoop tendon group shows that the range of values for the calculated elastic shortening go from 127.3 kips for sequence 3 tendons down to 0 kips for the last tendon sequence, sequence 60.

Elastic Shortening Losses for Vertical Tendons -

N = 31 Total Sequences
n = Sequence of particular tendon.

Force Loss due to elastic shortening =

$$Fles = \left[\frac{(N-n)}{N} \times 73.5 \right] \times WireFactor$$

A review of the data for the vertical tendon group shows that the range of values calculated for elastic shortening go from 71.1 kips for sequence 1 tendons down to 4.7 kips for sequence 29 tendons. There are a total of 31 stressing sequences for the vertical tendons.

3.) Calculate Wire Stress Relaxation Losses

Wire stress relaxation losses and the procedure for the determination of these losses for the 4th and 5th surveillances are addressed in the Reference 10 and 11 calculations. The original wire relaxation curve, as provided by test data from the wire vendor forms the bases for wire relaxation loss values (See also FSAR Figure 5-23). It was determined that the same procedures and figures as calculated in those prior calculations are still applicable for this surveillance. Applicable data from the reference sources was attached and included within this calculation as Attachment F.

Note that there were adjustments made to the original stress relaxation values from the vendor relaxation curve to allow for some conservatism and for temperature consideration of 100 degrees vs. 68 degrees F. Also, per the original design the wire factor or actual number of effective wires was considered as negligible for these losses and was not included. Note that values for stress relaxation range between 40 and 50 kips for the surveillance period for all three tendon groups.

4.) Calculate Creep Losses

Concrete creep calculations in the Reference 11 document are attached in Attachment G. The losses are based on the curve contained in the reference calculation. Creep values are different for each of the three groups of tendons. For the dome tendons in the coming surveillance period, creep values are the same and are about 152 to 158 kips, hoop values are between 79 and 83 kips, verticals are 36 to 38 kips.

5.) Calculate Shrinkage Losses

Attachment H contains source information for concrete shrinkage from Reference 10, pg. 11 and Reference 11, cover page & Pages 13 & 14. The straight line shrinkage losses in micro inches per inch as calculated in the above two references are still applicable for this surveillance period. Tabulated values from these references were input into the dome, hoop and vertical spreadsheets. There are no additional variables or considerations and the same values are to be used for this calculation. From a review of the output information, the dome values are constant at 8 to 9 kips, hoop values are above 5 kips, verticals are also slightly above 5 kips.

6.) Total Losses

Calculated force losses for elastic shortening, wire stress relaxation, creep and shrinkage are added for a total of all losses. Also, a percent of this total of all losses is calculated based on the original average force in the tendon.

7.) Determine Predicted Forces for Base, 95% Base and 90% Base values

The original force less the total of losses calculated yields the base predicted value for the subject period of surveillance inspection. The 95% and 90% values are then calculated based on the calculated predicted base value.

8.) Normalization Factors

Normalization factors are calculated based on the expressions and the source article contained in Attachment I of this calculation. This factor usually does not change much over the forty year time span of the calculation. The base expression for the dome normalization factor value is presented as follows:

$$(A-B)\times(1-C)+(D-97.7)$$

Where:

A = Average of all Domes group
B = Original average tendon force
C = Wire Stress Relaxation Percentage
D = Elastic Shortening

As an example, Dome tendon D112 calculates as follows:

$$NormalizationFactor=(1639-1676)\times(1-0.0257)+(D-97.7) \text{ or}$$

$$NF=(-37)\times(0.9743)+(-101.9) \text{ or}$$

NF = -138 which matches the spreadsheet calculation.

Similar expressions are shown for the hoop and vertical tendons in the information in Attachment I.

9.) Plotting of Data

Only the data from Column B, L, M, & N are tabulated on a separate area on the side of the spreadsheet. See Columns R, S, T & U; Rows 40 through 50. Only these values are selected for plotting on the force curves. This is for ease of plotting and has no affect on the quality or accuracy of the plots. An example copy of this data immediately follows the first dome tendon.

The plots of all dome curves with all the data points showed the force curve plot line as slightly crooked from a true linear plot. The large scale used showed some inflection points slightly off of linear. After investigation, the condition was avoided by omitting data points at year 10 and 15 after SIT for the final plotted figures. This was done only for presentation purposes and there is no affect on the accuracy of the plot or the base values calculated and presented on each curve.

A column by column explanation of the losses calculation worksheet follows:

INDIVIDUAL TENDON LOSSES
LOSSES CALCULATION WORKSHEET
NOTES AND LEGEND

Individual tendon losses are calculated based on the procedure presented in the preceding section. The following notes explain the spreadsheet process, input and calculations performed for each of the columns presented. The shaded values on the losses worksheet are extracted from the data input worksheet.

<u>Column</u> <u>Description</u>

A. Inspection Period after SIT
Scale based on years after SIT which is shown on the bottom scale of each individual plot. Note that this information is provided for easier readability with respect to SIT but is not the actual log scale used to construct the x axis of the plots.

B. Years after Concrete Placement
Scale of years after concrete placement as used for the x axis for plotting of the force curves and shown as the upper log scale at the top of each plot.. Note that one year after SIT for the dome tendons is 3.5 years on the log scale and for the hoop and vertical tendons is 5.4 years. See Section 6.1 of this calculation for further information.

C. Elastic Shortening
Calculated based on formulas presented in Section 6.2.2 and Attachment E information.

D. Stress Relaxation Percent
Calculated based on original wire loss curve percentages modified per the information presented in Attachment F of this calculation.

E. Stress Relaxation Forces
Data input from the Reference 11 calculation page 12. See Attachment F.

F. Creep Strain
Strain value (x 0.0001Data input from the Reference 11 calculation. See Attachment G of this calculation for data.

G. Creep Strain Force
Data input from the Reference 11 calculation. See Attachment G of this calculation for data.

H. Shrinkage Values
Data input from the Reference 11 calculation based on the shrinkage curve. See Attachment H of this calculation for data.

I. Shrinkage Force
Data input from the Reference 11 calculation. See Attachment H of this calculation for data.

J. Total Force Loss
Calculated value, Sum of columns C, E, G,& I.

K. Total Percent Loss
Total loss in percentage, Column J / Average of original forces for shop & field ends calculated and shown above on the spreadsheet.

L. Base
The average original force for the tendon noted above on the spreadsheet, less the total losses calculated in Column J. Note that total losses were not calculated on the row for the 17 year period, the 21 year 3 month period, as well as the 21 year period after SIT. These rows represent the fifth, the originally planned sixth and the current sixth surveillance periods and the values of Base were derived through linear interpolation of above and below data presented on the spreadsheet. The quality and accuracy is not affected by this procedure. R2

M. 95% Base
0.95 x Column L for the same row.

N. 90% Base
0.90 x Column L for the same row.

O. Normalization Factor -
Calculated based on formula presented in this calculation and in the information presented in Attachment I.

Column H & I	Calculated force values in Kips which represent ram pressure @ 1500 psi. These forces represent a zero slack starting point for both shop and field ends of each tendon and provide a basis for the start of any retensioning effort. The following expression is used to calculate these values: 0.7 * Tendon Ultimate Strength * 1500 / Predicted Lift-Off Pressure at 0.7 Tendon Ultimate Strength. See Reference 10 Calculation, page 34.
Column J & K	Calculated force values in Kips which represent forces at 80% ultimate based on the following expression: (Actual pressure @ 80% ultimate strength (Columns F or G) * 0.7 Tendon Ultimate Strength) / Predicted pressure @ 70% Ultimate Strength.
Column L & M	Actual elongation data, repeated from columns B and C.

In addition, the following calculations support the ultimate strength values provided on these spreadsheets:

Tendon wire ultimate strength = f_{ult} for wire = 240 ksi
Tendon Ultimate Strength = F_{ult} = [f_{ult} for wire * Tendon wire area] =
= 240 ksi * (0.05985 * 163 wires) = 2341.3 Kips

0.7 * F_{ult} = 0.7 *2341.3 = 1638.9 Kips
0.8 * F_{ult} = 0.8 *2341.3 = 1873 Kips

CALCULATIONS SUPPORTING SP-182 "ORIGINAL STRESSING DATA" FOR THE DOME TENDONS GROUP

0.7 Tendon Ultimate Strength = 1639 Kips
0.8 Tendon Ultimate Strength = 1873 Kips

File: DOMER3.XLW

Tendon ID	Actual Elongation (In.)		Predicted Lift-Off Pressure (psi)		80% Ultimate Pressure (psi)		For SP-182 "Original Stressing Data"					
							Row 1 (Kips)		Row 2 (Kips)		Row 3 (In.)	
	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
D111	5	5	6810	6810	7780	7780	361	361	1872	1872	5	5
D112	4-3/4	5	6800	6840	7770	7790	362	359	1873	1867	4-3/4	5
D113	4-7/8	4-3/4	6800	6840	7770	7790	362	359	1873	1867	4-7/8	4-3/4
D114	5-1/8	4-5/8	6800	6840	7770	7790	362	359	1873	1867	5-1/8	4-5/8
D115	5	5	6840	6800	7790	7770	359	362	1867	1873	5	5
D116	4-3/4	5-1/8	6760	6800	7720	7750	364	362	1872	1868	4-3/4	5-1/8
D130	5	5	6870	6810	7810	7780	358	361	1863	1872	5	5
D131	4-1/2	4-7/8	6710	6740	7660	7700	366	365	1871	1872	4-1/2	4-7/8
D132	4-1/2	4-7/8	6760	6800	7720	7750	364	362	1872	1868	4-1/2	4-7/8
D211	5-1/4	5-1/2	6810	6870	7780	7810	361	358	1872	1863	5-1/4	5-1/2
D212	4-5/8	4-7/8	6770	6770	7730	7720	363	363	1871	1869	4-5/8	4-7/8
D213	4-3/4	4-3/4	6840	6800	7790	7770	359	362	1867	1873	4-3/4	4-3/4
D214	4-3/4	4-7/8	6670	6740	7600	7680	369	365	1868	1868	4-3/4	4-7/8
D215	4-1/2	5-1/8	6800	6870	7800	7810	362	358	1880	1863	4-1/2	5-1/8
D216	5	5	6800	6810	7770	7780	362	361	1873	1872	5	5
D302	3-5/8	3-7/8	6530	6510	7450	7430	376	378	1870	1871	3-5/8	3-7/8
D303	4-1/4	3-3/4	6760	6770	7720	7730	364	363	1872	1871	4-1/4	3-3/4
D304	4-1/8	4	6840	6800	7790	7770	359	362	1867	1873	4-1/8	4
D305	4-1/8	4-3/16	6700	6680	7630	7620	367	368	1867	1870	4-1/8	4-3/16
D306	4-3/4	4-3/4	6810	6810	7780	7780	361	361	1872	1872	4-3/4	4-3/4
D310	5	4-1/2	6770	6770	7720	7730	363	363	1869	1871	5	4-1/2
D311	4-11/16	4-5/8	6800	6840	7770	7790	362	359	1873	1867	4-11/16	4-5/8
D312	4-7/8	4-7/8	6840	6800	7790	7770	359	362	1867	1873	4-7/8	4-7/8

R3
R3
R3
R3

Notes -
See the same calculations completed for the vertical group for notes and explanation of data & expressions used in Columns A through M.

28-Jan-98
3:54 PM

CALCULATIONS SUPPORTING SP-182 "ORIGINAL STRESSING DATA" FOR THE HOOP TENDONS GROUP

0.7 Tendon Ultimate Strength = 1639 Kips
0.8 Tendon Ultimate Strength = 1873 Kips

File: HOOPR3.XLW

Tendon ID	Actual Elongation (In.)		Predicted Lift-Off Pressure (psi)		80% Ultimate Pressure (psi)		For SP-182 "Original Stressing Data"					
							Row 1 (Kips)		Row 2 (Kips)		Row 3 (In.)	
	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
42H17	5-5/8	4-5/8	6870	6810	7810	7780	358	361	1863	1872	5-5/8	4-5/8
42H18	5	5-3/8	6840	6799	7810	7750	359	362	1871	1868	5	5-3/8
42H19	5-1/4	5	6870	6810	7810	7780	358	361	1863	1872	5-1/4	5
42H29	5-1/2	5-1/8	6870	6810	7810	7780	358	361	1863	1872	5-1/2	5-1/8
42H30	4-7/8	5-3/4	6870	6790	7810	7750	358	362	1863	1871	4-7/8	5-3/4
42H31	5-1/4	4-7/8	6870	6810	7810	7780	358	361	1863	1872	5-1/4	4-7/8
42H32	5-1/4	5-1/8	6870	6790	7810	7750	358	362	1863	1871	5-1/4	5-1/8
42H33	5-3/8	5-1/4	6870	6810	7810	7780	358	361	1863	1872	5-3/8	5-1/4
42H34	5-1/2	5-3/8	6750	6660	7680	7600	364	369	1865	1870	5-1/2	5-3/8
42H35	5	5-1/4	6830	6770	7760	7720	360	363	1862	1869	5	5-1/4
42H36	5-1/8	5-1/8	6870	6790	7810	7750	358	362	1863	1871	5-1/8	5-1/8
42H37	5-5/16	4-7/8	6870	6810	7810	7780	358	361	1863	1872	5-5/16	4-7/8
42H43	5-1/2	5-1/8	6870	6810	7810	7780	358	361	1863	1872	5-1/2	5-1/8
42H44	5-1/8	5	6790	6840	7750	7790	362	359	1871	1867	5-1/8	5
42H45	5-7/16	5	6870	6810	7810	7780	358	361	1863	1872	5-7/16	5
46H20	5-1/4	5-1/8	6640	6600	7700	7610	370	373	1901	1890	5-1/4	5-1/8
46H21	5-1/8	5-1/4	6720	6730	7700	7640	366	365	1878	1861	5-1/8	5-1/4
46H22	5-5/8	5-1/4	6720	6730	7700	7640	366	365	1878	1861	5-5/8	5-1/4
51H25	5	5-1/8	6770	6800	7720	7750	363	362	1869	1868	5	5-1/8
51H26	5-1/2	5-1/4	6760	6760	7750	7700	364	364	1879	1867	5-1/2	5-1/4
51H27	5-1/8	4-7/8	6740	6670	7680	7600	365	369	1868	1868	5-1/8	4-7/8
51H28	5-1/8	5	6760	6750	7750	7700	364	364	1879	1870	5-1/8	5
51H29	5-1/2	4-3/4	6810	6750	7780	7700	361	364	1872	1870	5-1/2	4-3/4
53H1	5-3/4	5-1/8	6700	6760	7650	7720	367	364	1871	1872	5-3/4	5-1/8
53H2	5-3/4	4-5/8	6800	7770	7760	7720	362	316	1870	1628	5-3/4	4-5/8
53H3	5-3/8	4-1/8	6670	6710	7600	7660	369	366	1868	1871	5-3/8	4-1/8
53H45	5-1/4	5-1/4	6840	6800	7790	7770	359	362	1867	1873	5-1/4	5-1/4
53H46	4-7/8	5-3/8	6760	6730	7750	7660	364	365	1879	1865	4-7/8	5-3/8
53H47	4-3/4	5-1/2	6840	6800	7790	7770	359	362	1867	1873	4-3/4	5-1/2
62H21	5-1/8	4-3/4	6760	6700	7720	7650	364	367	1872	1871	5-1/8	4-3/4
62H22	5-5/16	5	6800	6750	7770	7700	362	364	1873	1870	5-5/16	5
62H23	5-1/8	5-1/4	6800	6750	7770	7700	362	364	1873	1870	5-1/8	5-1/4
62H39	5-7/16	5-1/4	6800	6750	7770	7700	362	364	1873	1870	5-7/16	5-1/4
62H40	5-3/8	4-7/8	6800	6750	7770	7700	362	364	1873	1870	5-3/8	4-7/8
62H41	5-1/4	5	6800	6750	7770	7700	362	364	1873	1870	5-1/4	5
62H42	5-3/8	5-1/16	6800	6750	7770	7700	362	364	1873	1870	5-3/8	5-1/16
62H43	5-3/8	4-7/8	6710	6670	7660	7600	366	369	1871	1868	5-3/8	4-7/8
62H44	5-1/2	4-7/8	6800	6750	7770	7700	362	364	1873	1870	5-1/2	4-7/8
62H45	5-3/16	5-1/8	6760	6700	7770	7700	364	367	1884	1884	5-3/16	5-1/8
62H46	5-1/8	5-3/8	6800	6750	7770	7700	362	364	1873	1870	5-1/8	5-3/8
62H47	5-5/8	4-1/2	6680	6640	7620	7550	368	370	1870	1864	5-5/8	4-1/2

Notes -
See the same calculations completed for the vertical group for notes and explanation of data & expressions used in Columns A through M.

28-Jan-98
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CALCULATIONS SUPPORTING SP-182 "ORIGINAL STRESSING DATA" FOR THE VERTICAL TENDONS GROUP R2

0.7 Tendon Ultimate Strength 1639 Kips
0.8 Tendon Ultimate Strength 1873 Kips R2

File: VERTR2.XLW

Tendon ID	Actual Elongation (In.)		Predicted Lift-Off Pressure (psi)		80% Ultimate Pressure (psi)		For SP-182 "Original Stressing Data" Row 1 (Kips)		Row 2 (Kips)		Row 3 (In.)	
	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
23V24	12-7/8	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-7/8	N/A
12V1	12-1/2	N/A	6800	N/A	7770	N/A	362	N/A	1873	N/A	12-1/2	N/A
12V2	12-1/2	N/A	6800	N/A	7770	N/A	362	N/A	1873	N/A	12-1/2	N/A
23V1	12-1/4	N/A	6800	N/A	7770	N/A	362	N/A	1873	N/A	12-1/4	N/A
23V2	13-1/8	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	13-1/8	N/A
23V3	13	N/A	6760	N/A	7750	N/A	364	N/A	1879	N/A	13	N/A
34V5	12-5/8	N/A	6800	N/A	7770	N/A	362	N/A	1873	N/A	12-5/8	N/A
34V6	13	N/A	6810	N/A	7780	N/A	361	N/A	1872	N/A	13	N/A
34V7	12-3/4	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-3/4	N/A
61V9	12-5/16	N/A	6860	N/A	7840	N/A	358	N/A	1873	N/A	12-5/16	N/A
61V10	12-3/4	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-3/4	N/A
61V11	12-5/8	N/A	6710	N/A	7660	N/A	366	N/A	1871	N/A	12-5/8	N/A
61V20	12-1/2	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-1/2	N/A
61V21	12-1/8	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-1/8	N/A
61V22	12-7/8	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-7/8	N/A

Notes -
Columns A through G are data input extracted from the tendon history books (applicable sheets contained in Attachment B).
Columns H through M are calculated using the expressions noted below.

Column Tendons within the scope of this surveillance.
Col.B&C Actual elongation data taken from tendon history sheets for shop and field ends respectively.
For the vertical tendons, only the shop end applies.
Col.D&E Predicted Liftoff Pressures taken from tendon history sheets for shop and field ends respectively.
Col.F&G 80% Ultimate pressures taken from tendon history sheets for shop and field ends respectively.
Col.H&I Columns H & I - Calculated force values in Kips for "Original Stressing Data" Row 1 which represent ram pressure @ 1500 psi. R2
These forces represent a zero slack starting point for both shop and field ends of each tendon and provide a basis for retensioning efforts.
The following expression is used to calculate the values for Row 1 data:
0.7 * Tendon Ultimate Strength * 1500 / Predicted Lift off Pressure at 0.7 tendon Ultimate Strength.
ie. for 23V24: 1639 * 1500 / 6870 = 358
Col.J&K Calculated force values in Kips for Original Stress Data" Row 2 data which represent forces at 80% Ultimate based on the following expression: R2
Actual pressure @ 80% Ultimate Strength (Cols. F or G) * 0.7 Ultimate Strength / Predicted pressure @ 70% Ult. from Cols. D or E.
ie. for 23V24: 7810 * 1639 / 6870 = 1863
Col.L& Actual elongation values repeated from Columns B & C for Row 3 of "Original Stressing Data". R2

12-Sep-97
9:49 AM

7.0 CONCLUSIONS

Tendon Force/Time Curves have been generated from the results of this calculation. Final force curves are presented and attached in Section 6.0 of this calculation.

Force curves for the three control tendons were also generated by this calculation and were used for comparison and verification of data and spread sheets with the same curves generated previously for the same tendons. The comparison was completed and the data sheets and force curves were found to be the same as that previously generated.

Other calculations supporting the "Original Stressing Data" and "Data Sheets" in SP-182 were completed and are presented in Section 6.6 of this calculation. R2

8.0 REFERENCES

The following references are used in the preparation of this calculation:

1. G/C Letter to FPC, FCS-14594, Scope Document, November 24, 1995, for Preparation of Tendon Force Curves for the 6th Surveillance and site trip to CR3.
2. G/C Letter to FPC, FCS-12439, August 13, 1991, Tendon Selection and Recommendations for the Fifth Surveillance.
3. Reg. Guide 1.35, Revision 3
4. Reg. Guide 1.35.1, Revision 0
5. CR3 FSAR, Section 5.2
6. Technical Specification, Section 3.6.1.6 & Section 4.6.1.6.
7. Design Input for the 5th Surveillance, DI-55220-152.0 SE, Revision 2.
8. G/C Calculation of Force curves for the 5th Surveillance for SP-182, Revision 11.
9. Design Input 5500-528-1, Revision to SP-182 Procedure for Tendons and Calculations for Force-Time Curves for Surveillance 4, Revisions 0 and 1, Jan.87 and Sept.87.
10. G/C Calculation 5500-528-1, Tendon Loss Calculations for Surveillance 4, Revisions 0 and 1, Jan.87 and Sept.87.
11. G/C Calculation 04-4762-099, Tendon Loss Calculations and Appendices for CR3 Tendons, J.Fulton and G.T.DeMoss, 3/6/87 and 1980 calculations.
12. Dome Tendon History Sheets updated to the 5th surveillance.
13. Hoop Tendon History Sheets updated to the 5th surveillance.

14. Vertical Tendon History Sheets updated to the 5th surveillance.
15. Effective Wire Summary information, letter to FPC
16. Prescon Vendor Drawings
17. SP-182, Rev 11.
18. Surveillance Report for the Fifth Inspection Period, VSL.
19. Engineering Report for the Fifth Tendon Surveillance, G/C Letter to FPC, FCS 14401, 6/20/94.

ATTACHMENT A

DESIGN INPUT DATA
FOR 6TH SURVEILLANCE

Design Input Information for the 6th Surveillance

The Gilbert/Commonwealth Design Input document prepared for the 5th surveillance is still applicable since it was prepared at the time FPC addressed new licensing and Tech Spec revisions concerning the CR3 Tendon Surveillance Program. The document and some of it's attachments are attached herein. Also, correspondence from the NRC resulting from it's review of CR3 tendon program issues is attached for reference.

The following Tech Spec sections were reviewed and are applicable to the tendon surveillance program.

Section 3.6.1.2, Amendment 149
Section 5.6.2.7, Amendment 149

FSAR Sections applicable include:
Sections 5.2 & 14.2.2
Figures 5-24 and 5-25

Calculation S-95-0082
Attachment A
Page A3

AUG 09 '95 03:06PM NUC ADMIN BLDG P.2

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 28, 1995

SUBJECT: FIFTH TENDON SURVEILLANCE
FILE NO.: 3N0795-11
RECEIVED: 8/07/95
ASSIGNED TO: L.V. CECILIA
DUE DATE: T.B.D.

Mr. Percy M. Beard, Jr.
Senior Vice President,
Nuclear Operations (NA2I)
Florida Power Corporation
ATTN: Manager, Nuclear Licensing
15760 W Power Line Street
Crystal River, Florida 34428-6708

SUBJECT: REVIEW OF THE FIFTH TENDON SURVEILLANCE REPORT - CRYSTAL RIVER NUCLEAR GENERATING PLANT UNIT 3 (TAC NO. M90195)

Dear Mr. Beard:

By letter dated August 12, 1993, as supplemented December 15, 1994, and May 15, 1995, you submitted for staff review a report on the results for the fifth (seventeenth year after structural integrity test (SIT)) physical surveillance of the Crystal River 3 (CR3) Plant containment building post-tensioning system. You performed the surveillance in accordance with the requirements of the original plant technical specifications (TS) for tendon surveillance and Regulatory Guide (RG) 1.35 Revision 3. On the basis of your surveillance and inspection of the various elements of the post-tensioning system, you concluded that the surveillance results demonstrate the integrity of the containment tendon system.

We have completed our review of your submittal and we concur with your conclusion with certain exceptions. Your surveillance revealed grease leakage, corrosion of anchorheads and bearing plates and spalling and cracking of concrete, all of which could be detrimental to the containment tendon system. Please submit an action plan to rectify the undesirable conditions as identified and to implement appropriate actions to rectify them before the next scheduled inspection. Our evaluation is enclosed.

This completes our review under the TAC No. M90195 and, therefore, the TAC is closed.

This requirement affects nine or fewer respondents, and therefore, it is not subject to Office of Management and Budget review under P.L. 96-511.

Sincerely,

L. Raghavan, Project Manager
Project Directorate II-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket No. 50-302

Enclosure: As stated

cc w/enclosure:
See next page

Mr. Percy M. Beard
Florida Power Corporation

Crystal River Unit No. 3
Generating Plant

cc:

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Corporate Counsel
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15760 W Power Line Street
Crystal River, Florida 34428-6708

Enclosure

The Crystal River 3 (CR3) plant technical specifications (TS) require performing periodic tendon surveillance consisting of sheathing filler material inspection, tendon lift-off force measurement, anchorage component inspection, tendon wire inspection and tensile testing, grease leakage check, and tendon detensioning and retensioning and resealing for a number of selected tendons. For the fifth surveillance, in addition to the three control tendons (one for each group), you randomly selected two dome, two vertical and four hoop tendons and subjected them to lift-offs, with one tendon in each group being detensioned and retensioned. You performed the surveillance in accordance with the requirements of the original plant TS for tendon surveillance and Regulatory Guide (RG) 1.35 Revision 3. On the basis of your surveillance and inspection of the various elements of the post-tensioning system, you concluded that the surveillance results demonstrate the integrity of the containment tendon system.

On the basis of our review of your submittal, we concur with your conclusion with certain exceptions. Your surveillance revealed grease leakage, corrosion of anchorheads and bearing plates and spalling and cracking of concrete, all of which could be detrimental to the containment tendon system. These conditions are evaluated below.

1. Grease Voids

From the data on grease removed from and grease replaced into the tendon sheathings, there appeared to be an unusually high amount of grease voids or leakage. The amount of grease added ranged from 9.5% to as high as 30.5%. In a letter dated September 22, 1994, we indicated that the loss of grease appears to be unusually high in comparison to other plants with similar prestressed concrete containments and post-tensioning systems. Your response indicated that the losses closely match those of previous surveillances, and a thorough investigation had not determined a root cause for the abnormality. However, from the physical test of individual tendon wires, the chemical tests of the grease itself, and the lift-off tests, the tendon system is maintaining its integrity. Furthermore, there has been no grease leakage observed on the outside surface of the containment. On the basis of these observations, you reiterated that, in spite of the abnormally high amount of grease voids, the structural integrity of the tendons has not been affected.

We find your response to be reasonable. However, in view of the detrimental effects of potential grease leakage, you should monitor more closely the grease injection procedure in future surveillances and perform a thorough root cause investigation for grease loss.

2. Anchorage Assembly and Tendon Wire

Your surveillance revealed high levels of corrosion on the anchor heads on five of the tendons (three on the field end and two on both ends) under surveillance. A pitting condition existed on localized areas of these anchor heads, with no signs of active oxidation or buildup of crust or rust. No free moisture was observed within the sealed caps of any tendon. The bulk filler grease covered all tendon stressing anchor heads except for the top end of one vertical tendon. You believe that this condition has existed since original installation. You concluded that the observed conditions do not indicate abnormal degradation and will not affect the function of the anchor heads.

Your surveillance also discovered high levels of corrosion on bearing plates outside the sealed area of the tendon end caps of six tendons (on one end of three tendons and on both ends of another three). The corrosion occurred exterior to the O-ring seal and has not progressed to the point of breaching the integrity of the O-ring and affecting the tendon anchorage components. Repairs were made to the bearing plates to stop further degradation. The protection of the anchorage components is assured and the function and integrity of the bearing plates is maintained.

However, based on our review of tendon surveillance reports of a number of plants, we find that the types of corrosion of anchorage components have not been observed in other facilities and are unique to CR3. Therefore, we believe that it is necessary for you to expand the inspection to anchorage assemblies, especially the bearing plates, of other tendons not under surveillance to ensure timely repair of any adverse conditions.

You indicated that the cracking and spalling of concrete are insignificant. However, this requires repair before causing a further deterioration of concrete and reinforcement. It should also be also noted that your report provided only general statements regarding moisture content and the detrimental chemical contents and does not give details of water content for each of the grease samples taken from the specific tendons and free water discovered at end anchorages and grease cans. RG 1.35 requires such detailed information and should be provided in future surveillance reports.

One wire from each of the detensioned dome, hoop and vertical tendons was tested. In addition, ineffective wires and broken wires were removed for sample selection and testing. All of the tested samples exceeded the required minimum values for yield strength and elongation. All but one exceeded the required minimum ultimate strength. The cause for the broken wires was determined to be of a mechanical nature not due to stress corrosion. The buttonheads were inspected for their physical condition and were found to be effective and acceptable.

3. Tendon Lift-off Forces

We have reviewed the lift-off forces of three dome, three vertical and five hoop tendons and also the information on the correlation of force and elongation of the three detensioned and retensioned tendons. With the exception of one hoop tendon (46H29) which had only 88.1% of the base value (less than the 90% of the base value as required), the lift-off forces of other tendons were above the lower bound values established for these tendons. Additional hoop tendons were lifted off to meet the requirements in RG 1.35 under such a situation. The forces and the corresponding elongations for the three detensioned and retensioned tendons were reviewed, and for each tendon there is no linearity relation between the two. It appears to us that more careful elongation measurements could have provided the required correct information and assurance of the quality of the overall tendon surveillance performed.

The purpose of tendon surveillance is to determine if the time dependent prestress losses such as creep and shrinkage of concrete and relaxation of tendon wires are within the predicted range. The trend of such losses can be obtained by performing a regression analysis of the tendon lift-off forces for the tendons in a group from all the surveillances conducted to date after the SIT. Before performing the analysis it is necessary to correct the tendon seating force. This is because during tendon installation and tensioning it is not possible to anchor all the tendons in a group at the same force level and at the same time. The tendons are installed sequentially. When the containment is subjected to the tendon force, there will be elastic deformation. The tendon tensioned first will have lower force at completion of tensioning for the group than those tensioned last. Therefore, the seating force must be corrected to reflect the tendon anchor force for the elastic shortening, taking into consideration the tendon tensioning sequence. On the theory that the containment design is based on the average tendon force of the group, an average of the corrected tendon anchor forces is determined. By dividing this average force by each individual corrected tendon force, a so-called normalizing factor (NF) is obtained. This NF is used to modify the lift-off force of the tendon to obtain the average force which should be compared with the required tendon force. The NF for each tendon is a constant and will be used throughout all the surveillances. This appears to be the procedure used by a number of utilities. Theoretically, after normalization, all tendons in a group should have the same average value. Due to the method used in establishing the NF and in obtaining the lift-off forces, the normalized tendon force is at best approximate; but it should not vary appreciably from the average value for the group.

In contrast to the NF approach, the RG 1.35 approach to consider the prestress losses is through the use of upper bound and lower bound of tendon forces as discussed in RG 1.35.1 and shown in Fig.2 therein. The average of the tendon anchor forces which are the tendon seating forces corrected for elastic losses can be used as the initial prestressing force. A graph similar to that shown in Fig.2 of RG 1.35.1 should be first constructed. The lift-off force obtained for the group of tendons represented by the graph should be plotted on the graph without any correction. By plotting the lift-off forces from consecutive tendon surveillance of the group of tendons, it becomes possible to perform a trending analysis of the tendon forces.

In response our request for additional information on normalization, you provided a formula for the NF, which is actually a tendon force correction and includes not only prestress loss due to elastic deformation, but also the relaxation of the tendon wire. In view of this, the NF will be different for each surveillance since it involves the time factor. This only complicates the normalization procedure and does not improve the accuracy. If the NF involves relaxation of tendon wire, it appears the other time-dependent prestress loss due to creep and shrinkage should also be included. It is to be noted that correction is made to the seating force only for the elastic loss which is not time dependent and the normalization factor which is based on the corrected tendon anchor forces is used to modify the lift-off force to the average tendon force of the group. The NF procedure is based on the fact that after correction for elastic shortening loss each of the tendon forces and the average of these tendon forces for the group of tendons are large compared to the time-dependent prestress losses. Therefore, the ratio, i.e. the NF, between each tendon force and the average tendon force for the group after correction for elastic shortening loss will not vary significantly from that after correction for the time-dependent losses. The NF procedure is based on this premise.

In response to our concerns regarding your normalization procedure and use of the average of lift-off forces for the trend analysis, you performed analyses for each of the following cases for each group of tendons:

1) Using lift-off averages, normalized
2) Using all data points, normalized
3) Using lift-off averages, unnormalized
4) using all data points, unnormalized

The information for each case was plotted on a graph the same as that shown in Fig. 2 of RG 1.35.1 and a regression analysis was performed for each case in each group. From the results of these analyses, we observed insignificant differences between the normalized cases (1) and (2) or the unnormalized cases (3) and (4), and appreciable differences between the normalized and the unnormalized cases. However, based on the trend of all groups of tendons, no group of tendons would be expected to go below its minimum required during the 40-year plant life.

In spite of the favorable outcome of the results as summarized above, we believe that for future surveillances, the lift-off forces should be used for the trend analysis without averaging and normalization. Each tendon lift-off force should be compared with the predetermined values of base, 95% base, and 90% base as required by RG 1.35.

In conclusion, we concur with your conclusion that the results of the surveillance demonstrated the integrity of the containment tendon system. However, before the next surveillance you should resolve the problem of missing grease and should undertake a program of inspection of the anchorage system which consists of the anchor heads and the bearing plates to assure that the pitting of the anchor heads and the corrosion of the bearing plates uncovered in the surveillance are not widespread and would not jeopardize the integrity of the tendon anchorage system. You should repair the cracking and spalling of concrete so that there will be no further deterioration of concrete or reinforcement. For future surveillances, the trend study of the tendon forces should be based on the lift-off forces without averaging and normalization. In retensioning tendons, the elongations corresponding to the forces should be carefully measured so ~~that the linearity between~~ the two is preserved. This can serve as an additional check on the accuracy of the measurements performed.

MAR 27 '96 09:42PM NUC ADMIN BLDG

Calculation S-95-0082
Attachment A
Page A9

Joe:

This is a copy of the electronic file from the NRC approval letter for postponement of the Eight exempted tendons.

Luetta

Mr. Percy M. Beard, Jr.
Senior Vice President,
Nuclear Operations (SA2A)
Florida Power Corporation
ATTN: Manager, Nuclear
Licensing
15760 W Power Line Street
Crystal River, Florida 34428-6708

SUBJECT: CRYSTAL RIVER NUCLEAR GENERATING PLANT UNIT 3 - POSTPONEMENT OF SURVEILLANCE OF EIGHT TENDONS EXEMPTED FROM THE FIFTH TENDON SURVEILLANCE (TAC NO. M94056)

Dear Mr. Beard:

By letter dated October 23, 1995, you requested staff approval for postponing surveillance of eight tendons which were exempted from the fifth tendon surveillance performed in 1993 to the sixth tendon surveillance. You had committed to include the eight tendons in your sixth tendon surveillance which was originally scheduled to be performed in 1996. You now propose to perform the sixth tendon surveillance in 1998 which is less than 5 years from the fifth tendon surveillance which was performed in November 1993. Accordingly, you are requesting staff approval to postpone the surveillance of the eight tendons to the 1998 sixth tendon surveillance.

By letter dated May 15, 1995, you submitted results of your fifth tendon surveillance to demonstrate integrity of the containment tendon system. In a letter dated July 28, 1995, we forwarded our evaluation of the Fifth Tendon Surveillance Report, and concluded that the trend of all groups of tendons is such that no group of tendons will go below its minimum required lift-off forces before the 40-year plant life. Our July 28, 1995 letter also identified certain undesirable conditions such as grease leakage, anchorage bearing plate corrosion, cracking and spalling of concrete. In response to these concerns, you committed to perform, during Refuel 10 (in 1996), a complete walkdown of 649 tendons comprising the containment post-tensioning system. You also committed to perform visual inspection to monitor external corrosion, grease leakage, and monitor for spalling of concrete and take appropriate corrective actions where warranted.

On the basis of the fifth tendon surveillance results and your commitment to perform visual inspection during the Refuel 10, we find it acceptable to perform the surveillance of the eight tendons during the sixth tendon surveillance scheduled for Refuel 11 in 1998, which is within the 5 year surveillance frequency.

In this matter, we also would like to draw your attention to the following. In November 1976, you performed the structural integrity test (SIT) on the Crystal River 3 (CR3) prestressed concrete containment. Per Regulatory Guide

(RG) 1.35, the tendon surveillances are to be performed 1, 3, and 5 years after SIT and every 5 years thereafter. You have committed to follow the RG 1.35 criteria. However, a review of the history of your tendon surveillance indicates that your 3rd, 4th and 5th tendon surveillances have been performed on an approximately 6-year interval. While plant technical specifications allow schedule flexibility (a 25% inspection interval extension for conducting surveillances), such a schedule extension should not be continued on a long-term basis. Also, the general industry practice has been a plus or minus 6 months schedule variance.

This completes our effort under TAC No. M94056 and the TAC is closed. If you have any questions, please call me at (301) 415-1471.

Sincerely,

L. Raghavan, Project Manager
Project Directorate II-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket No. 50-302

cc: See next page

Engineering Instruction No. 1

DESIGN INPUT RECORD	PROJECT Crystal River Unit 3	W.O. 04-5520-152	IDENTIFIER DI-6520-152.0 SE
	SUBJECT Tendon Surveillance Program - Preparation of Misc. Calculations and Surveillance Procedure SP-182		
	DISCIPLINE Structural 2241		PAGE 1 OF ~~5~~ 6

REVISION	0	1	2	3
ITEM(S) REVISED				
ORIGINATOR	M. Marcellus	M. Marcellus	M. Marcellus	
DATE	8 Oct 93	27 OCT 93	17 NOV 93	
REVIEW	DD Krause	DD Krause	[illegible]	
DATE	8 OCT 93	27 OCT 93	21 Nov 93	
APPROVAL (DCE)	C.M. Pastorelli	C.M. Pastorelli	C.M. Pastorelli	
DATE	10-8-93	10-27-93	Nov. 21, 1993	
FUTURE CONFIRMATION REQUIRED?	No	No	No	
MICROFILMED / DATE				

INSTRUCTIONS: USE "N/A" FOR ITEMS NOT APPLICABLE. IDENTIFY ITEMS REQUIRING FUTURE CONFIRMATION BY CIRCLE OR CLOUD. IDENTIFY REVISED INFORMATION BY VERTICAL LINE IN RIGHT MARGIN AND REVISION NUMBER. USE ADDITIONAL SHEETS AS NECESSARY.

REVISION 1 – REVISED TEXT AS NOTED, REVISED ATTACHMENT 2 & ADDED ATTACHMENTS 3, 4.
REVISION 2 – REVISED TEXT AS NOTED, REVISED ATTACHMENT 2

DISTRIBUTION RECORD

REV.	DISCIPLINE ENGINEERS				OTHERS								
	MECH	C/S	ELEC	STR/PIP	LAYOUT	RE-CORDS	PM				DCE	MECH DRAFT	ELEC DRAFT
REVIEW													
0						X							
1						X							
2						X							
3						X							

	DESIGN INPUT RECORD	IDENTIFIER DI-5520-152.0 SE
	DESIGN INPUT FOR: CR3 5TH TENDON SURVEILLANCE PERIOD	PAGE: 2 of 6
		REVISION: 2
		DATE: 17NOV93

1. SCOPE OF THIS DIR; BASIC FUNCTIONS OF SYSTEM, STRUCTURE, OR COMPONENT:

This DIR presents Design Input documentation related to the 5th Tendon Surveillance Program for Crystal River Unit 3. The scope of this DIR is for the preparation of Force/Time Curves for individual tendons, misc. calculations supporting surveillance activities, as well as for the revision of Surveillance Procedure, SP-182, for the performance of site inspection activities.

Revision 1 of this DIR will address the change in inputs required as a result of the NRC not accepting the FPC proposed Tech Spec revision for the CR3 Tendon Surveillance Program to comply with the requirements of ASME Section XI, Subsection IWL. FPC's discussions with the NRC concluded that the FPC program requirements should be based on Reg Guide 1.35, Revision 3, issued July 1990.

Revision 2 of this DIR will address the change in inputs required as a result of several meetings at the CR3 site. FPC's discussions with the NRC concluded that the new FPC Tech Spec Program may not be implemented as soon as expected and that the current Tech Spec requirements are to be be addressed for this surveillance within the acceptance criteria of SP-182, Revision 11.

2. CLASSIFICATION; DESIGN CODE(S) AND STANDARDS:

Nuclear Safety Related Classification
Existing Tech Spec 3.6.1.6 and 4.6.1.6, Amendment 29 & 31.
FSAR 5.2
Reg Guide 1.35, Revision 3, July 1990.

3. PERFORMANCE REQUIREMENTS AND SOURCE:

The Tendon Surveillance Program is controlled by Tech Spec Sections 3.6.1.6 and 4.6.1.6. However, FPC is currently going through a Tech Spec Improvement Program and will possibly be implementing this Program in mid November in the middle of the surveillance. The new Tech Spec (See Attachment 1) will commit the Surveillance Program to Regulatory Guide 1.35, Revision 3 criteria. FPC has discussed this with the NRC, and it was agreed that the new acceptance criteria is acceptable for use for this entire surveillance period. Therefore, the Reg. Guide criteria will be the basis for a revision to the existing Revision 10 of Surveillance Procedure SP-182. ~~Per FPC direction, the requirements of the current existing Tech Spec will not be included in the revision to SP-182 (See Attachment 2).~~ It was determined in mid November that the existing current Tech Spec requirements will have to be addressed in SP-182, Revision 11 until the actual implementation of the new Tech Spec program takes place. This acceptance criteria is to be worked into SP-182 in addition to the Reg. Guide 1.35 acceptance criteria already built into the draft version.

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	DESIGN INPUT FOR: CR3 5TH TENDON SURVEILLANCE PERIOD	PAGE: 3 of 6
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4. DESIGN MARGINS OR SAFETY FACTORS:

Design margins and safety factors are as included in the above Codes and Standards.

5. DESIGN CONDITIONS AND SOURCE:

There are no design activities.

6. OPERATING CONDITIONS AND SOURCE:

This surveillance will be performed during normal plant operation. Tendons in the area between Buttresses 1 and 3, (0^{o} to 120^{o}) must be avoided due to the safety hazard of the main steam vents in that area. After numerous discussions with the site, it was determined that outside tendons with the following group/buttress numbers are to be considered inaccessible due to the steam venting problem: 13HXX, 42HXX, 51HXX, 53HXX, 62HXX. Inside tendons accessiblity must be individually confirmed through an FPC walkdown/concurrance. Radiological conditions, safety, and interference with safety related systems and components may affect the selection of tendons inside the plant. Adequate consideration must be given to the potential effects on safety related systems from any surveillance activity.

FPC has been informed by G/C that the tendon selection process can be sucessfully completed for this surveillance using the limitations on the tendon population as noted above, however, the next several surveillances cannot be performed during plant operation because of these effects on the random tendon selection process.

In addition, the exempted tendons from the selection process of this surveillance must be reviewed and considered for inclusion in the next surveillance. The exact position for the resolution of many exempted tendons will depend on the final accepted position taken by the NRC on the proposed Tech Spec position taken by FPC. See the Attachment 3 letter, Attachment 1. This position will not affect remaining work for this surveillance but will need to be considered in future work.

7. AMBIENT CONDITIONS AND SOURCE:

Ambient temperatures and pressures of the Reactor Building during normal operation of the plant are to be considered. Elevated temperature effects on the tendons may need to be considered.

8. MATERIAL(S):

Most tendon materials are replacement of original materials. A summary of tendon related materials can be found in FSAR Section 5.2.2.3.3 and in the CR3 Reactor Building Design Basis Document.

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	DESIGN INPUT FOR: CR3 5TH TENDON SURVEILLANCE PERIOD	PAGE: 4 of 6
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9. OTHER REQUIREMENTS:

The requirements of Reg Guide 1.35, Revision 3, are essentially the same as the requirements of ASME Section XI, Subsection IWL. In many places, the ASME Code provides a greater level of detail than the requirements of the Reg Guide. The ASME Code document will be utilized as a reference in the interpretation of some Reg. Guide requirements and criteria.

FPC administrative procedures noted in References 16, 17, and 18 are to be followed for the revision of SP-182.

The normal 40 year plant life is to be considered. As yet, no consideration for plant life extension has been requested from FPC. Future retensioning or other tendons work may need to consider any FPC plant life extension plans or considerations.

10. REFERENCES:

1. Design Input 5500-528-1, Revision to SP-182 Procedure for Tendons and Calculations for Force-Time Curves for Surveillance 4, Revisions 0 and 1, Jan. 87 and Sept. 87.
2. Calculation 5500-528-1, Tendon Loss Calculations for Surveillance 4, Revisions 0 and 1 Jan. 87 and Sept. 87.
3. J. Fulton and G. T. DeMoss Calculation 04-4762-099, Tendon Loss Calculations and Appendices for CR3 Tendons, 3/6/87 and 1980 calculations.
4. Vertical Tendon History Sheets
5. Hoop Tendon History Sheets
6. Dome Tendon History Sheets
7. SP-182, Revision 10.
8. SP-182, Revision 7. (Last surveillance proven revision)
9. ASME B & PV Code, Section XI, Subsection IWL
10. Regulatory Guide 1.35, Revision 3, Issued July 1990.
11. Regulatory Guide 1.35.1, Revision 0, Issued July 1990.
12. G/C Engineering Study on the CR3 Tendon Surveillance Program, FCS-13670, March 5, 1993.

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DESIGN INPUT FOR: CR3 5TH TENDON SURVEILLANCE PERIOD	PAGE: 5 of 6
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13. G/C Study of ASME Section XI, Subsection IWL for the CR3 tendon Surveillance Program, FCS-13892, June 2, 1993.

14. G/C Letter to FPC, FCS-12439, August 13, 1992, for Task 1 deliverables, Tendon Selection, General Report and recommendations for the 5th Surveillance.

15. Prescon Vendor Drawings - G/C Vendor Code 4680, Drawing Numbers 52-0026-0001A through 52-0026-0043P.

16. FPC Administrative Instructions, AI-402B, Procedure Writing (Except for EP/AP/VP), Revision 8, 10/25/91.

17. FPC Administrative Instructions, AI-400-C, Permanent Procedures Revisions, Revision 10, 11/19/92.

18. FPC Administrative Instructions, AI-701, Conduct of Inservice Inspection, Revision 9, 7/11/91.

19. G/C Memo, 10/27/93, D.L. Keiser to M. Marcellus, Calculation references for minimum required prestress forces.

20 Crystal River 3 Reactor Building Design Basis Document.

21. G/C Engineering Report for the 3rd Surveillance, By T.H. Noble, May 19, 1982.

22. G/C Engineering Report for the 4th Surveillance, By J. Herr, March 10, 1988.

23. G/C Scope Document Letter to FPC, FCS-13766, 4/2/93.

ATTACHMENTS

1. Proposed and submitted FPC Tech Spec showing compliance to ASME Section XI, Subsection IWL, fax received from FPC on 9/24/93.

2. G/C Letter to FPC, 10/8/93, FCS-14114, M. Marcellus to J. Mascoll/B.Crane/B. Gutherman, Summary of G/C Design Input positions.

3. FPC Letter to the NRC, October 25, 1993, Withdrawal of Tech Spec Change 197 with attached revised Tech Spec, Changing from ASME IWL compliance to Reg Guide 1.35, Rev 3 compliance.

Engineering Instruction No. 1

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4. G/C Letter to FPC, 10/12/93, FCS-14119, M. Marcellus to J. Mascoll/B.Crane/B. Gutherman, Revised summary of G/C Design Input positions.

5. G/C Letter to FPC, 10/27/93, FCS-14158, M. Marcellus to J. Mascoll/B.Crane, with G/C comments on the proposed Tech Spec.

ONLY ATTACHMENT 4 WAS INCLUDED IN CALC S95-0082

Calculation S-95-0082
Attachment A
Page A17

DI-5520-152.0 SE
ATTACHMENT 4
Page 1

Gilbert/Commonwealth engineers and consultants
Green Hills Corporate Center, Rt. 10 & Pheasant Rd., Reading, PA 19607

ROY W. ADLER
Project Manager
Nuclear Services

October 12, 1993

FCS-14119
Work Order #04-5520-152
Contract NPM00AD, WA 152

DI
(REV 1

NOTE - THIS LETTER SUPERCEDES POSITIONS 1, 2 & 3 IN FCS-14114, 10/8/93, ATTACHMENT THIS D.I.

Mr. R. T. Bowles
Nuclear Project Management Engineer
Florida Power Corporation
P. O. Box 14042/C2I
St. Petersburg, Florida 33733

Attention: J. O. Mascoll, B. Crane, B. Gutherman

Re: Crystal River 3
Tendon Surveillance Program

Ref: FCS-14114 Dated October 7, 1993

Action By: FPC - October 13, 1993
Review and Comments,
Unless N/A

Dear Mr. Bowles:

Key issues and criteria for the tendon surveillance program were reviewed with you in the above referenced letter. Since then, the direction for implementation of our work has significantly changed based upon the NRC rejection of the Tech Spec for the Tendon Surveillance Program. Based on discussions with Bruce Crane, we will now perform all related tendon surveillance tasks based on the following:

1. Revision 11 of SP-182 will now be performed to comply with Reg. Guide 1.35 Revision 3, not ASME Section XI, Subsection IWL. An earlier review of the Reg. Guide versus the CR3 program concluded there were no significant issues or disadvantages to committing to Reg. Guide, Revision 3. However, until our review and revision is complete, G/C is recommending that FPC consider that there are some exceptions likely to be taken against the full compliance to the Reg. Guide by FPC. G/C will notify FPC as any significant exception is identified.

2. The documentation of the above position, acceptance items and specific interpretations of the Reg. Guide acceptance criteria has not been decided at this time. It may be within CP-145. However, an interim place is to include these positions within SP-182. G/C will now include some of the general positions in the SP-182 document, but is uncertain whether all engineering/licensing positions and acceptance criteria can be properly placed in SP-182. SP-182 has basically addressed site inspection activities in the past and has not addressed engineering/licensing issues to any level of detail.

Gilbert/Commonwealth engineers and consultants
P.O. Box 1498 Reading PA 19603/Tel 215-775-2600/Fax 215-775-2670/Telex 173-220

3. It is assumed that the Tech Spec Improvement Program will be in place and accepted by the NRC by November 22nd. With the surveillance rapidly approaching, a Tech Spec revision prior to that date is impractical. The acceptance criteria for the interim period up to November 22 was discussed. Based on the established CR3 Tendon Surveillance Program as defined by SP-182 and other documents, it is assumed that this entire tendon surveillance can be performed against the new criteria. Therefore, the acceptance criteria within SP-182 which is related to the existing Tech Spec positions will be removed and replaced by the Reg. Guide 135, Revision 3 positions. This will involve new enclosures and calculations within SP-182.

Note that the above direction significantly changes most positions noted in the reference letter. However, items 4, 5, 6 and 7 of that letter are unchanged for G/C to implement the required scope of work.

FPC concurrence with the above positions by October 13 is required for G/C to complete our tasks in support of the surveillance. Any revision to the above will impact our completion of SP-182. Additional rework, enclosures and verification resulting from this change in criteria, as discussed above, has impacted the schedule. Assuming no further change in basic criteria, SP-182 Revision 11 will be electronically transmitted to FPC on October 26 for review and comments. In addition, a copy of the document will be Federal Expressed at the same time.

Should there be questions or discussion on any of the above items, please feel free to contact us at your convenience.

Very truly yours,

M. D. Marcellus
M. D. Marcellus
Structural Task Engineer

R W Adler
R. W. Adler
Project Manager

cc: R. T. Bowles
J. Mascoll
B. Gutherman
B. Crane
FPC Records Management (CL Only)
R. W. Adler (2)
C. N. Rentschler
D. D. Krause

ATTACHMENT B

TENDON HISTORY SHEETS FOR 6TH SURVEILLANCE

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D112 CUT LENGTH 142'-7 1/2"

SHOP WASHER ID: PC 121 CR 469 FIELD WASHER ID: PC 122 CR 1243

1. CAI/QA vendor inspection cover letter number-FPC # 10190 DATE 4/1/74

2. Date tendon received on-site 3-18-74 RMR Number 37984

3. Date installed in conduit 5-1-74 Installation NCR's ______

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 10-1-74 Buttonheading NCR's ______

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 12-9-74 Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 3/4 / 4 3/4	4 3/4 / 5	9 1/2 / 9 3/4
Lift-Off Pressure - Predicted/Actual	6800/6950	6840/7000	N/A
Shim Thickness/80% Ultimate Pressure	7 / 17770	7 3/16 / 17790	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 3-25-75 Bulk-Filling NCR's ______

   Time since installation 10 3/4 months Inlet Pressure 50 psi Outlet Temp. 140°

   Date end caps refilled: Shop ______ Field ______

7. Data compiled by D. Miller Organization Salem

   Date 3/30/77

8. Additional Comments: ______

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D 113 CUT LENGTH 144'-6"

SHOP WASHER ID: PC 411 CR 121 FIELD WASHER ID: PC 121 CR 1075

1. GAI/QA vendor inspection cover letter number-FPC # 10190 DATE 4/1/74
2. Date tendon received on-site 3-18-74 RMR Number 37984
3. Date installed in conduit 5-2-74 Installation NCR's ____

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 10-1-74 Buttonheading NCR's ____

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0
5. Date stressed 11-21-74 Stressing NCR's 1717

   Date restressed ____ Restressing NCR's ____

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 7/8"/4 7/8"	4 7/8"/4 3/4"	9 3/4"/9 5/8"
Lift-Off Pressure - Predicted/Actual	6860 psi/7100 psi	6840 psi/6850 psi	N/A
Shim Thickness/80% Ultimate Pressure	7 3/4"/7770	6 5/8"/7790 psi	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163
6. Date Bulk-filled 3-25-75 Bulk-Filling NCR's ____

   Time since installation 10 3/4 months Inlet Pressure 50 psi Outlet Temp. 140°

   Date end caps refilled: Shop ____ Field ____
7. Data compiled by D. Waller Organization Salem

   Date 3/30/77
8. Additional Comments:

Florida Power
CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D113 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. GAI/QA vendor inspection cover letter number-FPC # ______ DATE ______
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______

   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______

   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ______ Total effective wires after stressing ______
6. Date Bulk-filled ______ Bulk-Filling NCR's ______

   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D. Waller Organization Salem

   Date 4/11/77
8. Additional Comments: Dome Repair -
   Degreasing - Shop End (7/15/76)

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D114 CUT LENGTH 146'-2 3/8"

SHOP WASHER ID: PC 121 CR 814 FIELD WASHER ID: PC 122 CR 1206

1. GAI/QA vendor inspection cover letter number-FPC # 10190 DATE 4/1/74

2. Date tendon received on-site 3-18-74 RMR Number 37984

3. Date installed in conduit 5-2-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 10-1-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 11-27-74 Stressing NCR's 1726, 1727

Date restressed 12-11-74 Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 7/8 / 5 5/8	4 7/8 / 4 5/8	9 3/4 / 9 3/4
Lift-Off Pressure - Predicted/Actual	6800 / 7,000	6840 / 6,900	N/A
Shim Thickness/80% Ultimate Pressure	7 / 7770	6 9/16 / 7790	N/A

Unseated/Broken Wires 1 Total effective wires after stressing 162

6. Date Bulk-filled 3-25-75 Bulk-Filling NCR's

Time since installation 10 3/4 month Inlet Pressure 45 psi Outlet Temp. 140°

Date end caps refilled: Shop 11-24-76 Field 11-24-76

7. Data compiled by D. Walker Organization Salem

Date 3/30/77

8. Additional Comments: One wire not seated on field End.

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Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D114 CUT LENGTH ________

SHOP WASHER ID: PC ________ CR ________ FIELD WASHER ID: PC ________ CR ________

1. CAI/QA vendor inspection cover letter number-FPC # ________ DATE ________

2. Date tendon received on-site ________ RMR Number ________

3. Date installed in conduit ________ Installation NCR's ________

   Wires removed ________ Wires replaced ________ Total Ineffective wires ________

4. Date buttonheaded ________ Buttonheading NCR's ________

   Bad wires ________ Accept. Reheads ________ Total Ineffective wires ________

5. Date stressed ________ Stressing NCR's ________

   Date restressed ________ Restressing NCR's ________

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ________ Total effective wires after stressing ________

6. Date Bulk-filled ________ Bulk-Filling NCR's ________

   Time since installation ________ Inlet Pressure ________ Outlet Temp. ________

   Date end caps refilled: Shop ________ Field ________

7. Data compiled by D Walle Organization Salem

   Date 1/11/77

8. Additional Comments: Dome Repair –

Degreasing – Shop End (7/10/76) Field End (7/13/76)

~~Detensioning~~ Lift off Pressure – Shop 5890 Field 6300 (7/11/76)

Regreasing – (11/24/76) 200 PSIG NCR 2581 190° NCR 2582

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D115 CUT LENGTH 147'-7½"

SHOP WASHER ID: PC — CR 675 FIELD WASHER ID: PC 122 CR 1231

1. GAI/QA vendor inspection cover letter number-FPC # 10190 DATE 4/1/74
2. Date tendon received on-site 3-18-74 RMR Number 37984
3. Date installed in conduit 5-2-74 Installation NCR's
   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 9-30-74 Buttonheading NCR's
   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0
5. Date stressed 11-11-74 Stressing NCR's
   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5"/5"	5"/5"	10"/10"
Lift-Off Pressure - Predicted/Actual	6840/7050 psi	6800/7100 psi	N/A
Shim Thickness/80% Ultimate Pressure	6⅝"/7790	6⅝"/7770	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 3-25-75 Bulk-Filling NCR's
   Time since installation 10¾ months Inlet Pressure 52 PSI Outlet Temp. 140°
   Date end caps refilled: Shop - Field
7. Data compiled by D. Waller Organization Salem
   Date 3/30/77
8. Additional Comments:

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Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D 115 CUT LENGTH ____

SHOP WASHER ID: PC ____ CR ____ FIELD WASHER ID: PC ____ CR ____

1. GAI/QA vendor inspection cover letter number-FPC # [illegible] DATE [illegible]

2. Date tendon received on-site ____ RMR Number ____

3. Date installed in conduit ____ Installation NCR's ____

Wires removed ____ Wires replaced ____ Total Ineffective wires ____

4. Date buttonheaded ____ Buttonheading NCR's ____

Bad wires ____ Accept. Reheads ____ Total Ineffective wires ____

5. Date stressed ____ Stressing NCR's ____

Date restressed ____ Restressing NCR's ____

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

Unseated/Broken Wires ____ Total effective wires after stressing ____

6. Date Bulk-filled ____ Bulk-Filling NCR's ____

Time since installation ____ Inlet Pressure ____ Outlet Temp. ____

Date end caps refilled: Shop ____ Field ____

7. Data compiled by D Miller Organization Salem

Date 4/11/77

8. Additional Comments: Dome Repair -
Degreasing - Shop End (7/15/76) Cap reinstalled

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D 115 CUT LENGTH ______

SHOP WASHER ID: PC 121 CR ______ FIELD WASHER ID: PC ______ CR ______

1. CAI/QA vendor inspection cover letter number-FPC # ______ DATE ______
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______
   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______
   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______
   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ______ Total effective wires after stressing ______
6. Date Bulk-filled ______ Bulk-Filling NCR's ______
   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______
   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D. J. Giffin Organization FPC
   Date 9-30-77
8. Additional Comments: IN PREPARATION FOR 1ST SURVEILLANCE

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D116 CUT LENGTH 148'-10 1/8"

SHOP WASHER ID: PC 121 CR 946 FIELD WASHER ID: PC 121 CR 734

1. CAI/QA vendor inspection cover letter number-FPC # 10190 DATE 4/1/74
2. Date tendon received on-site 3-18-74 RMR Number 37984
3. Date installed in conduit 5-6-74 Installation NCR's
   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 9-30-74 Buttonheading NCR's
   Bad wires 1 Accept. Reheads 0 Total Ineffective wires 1
5. Date stressed 12-5-74 Stressing NCR's
   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5"/4 3/4"	5"/5 1/8"	10"/9 7/8"
Lift-Off Pressure – Predicted/Actual	6760 psi/6950 psi	6300 psi/6750 psi	N/A
Shim Thickness/80% Ultimate Pressure	7"/7720	7 1/4"/7750	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 162

6. Date Bulk-filled 3-25-75 Bulk-Filling NCR's
   Time since installation 10 1/2 mnth Inlet Pressure 50 psi Outlet Temp. 140°
   Date end caps refilled: Shop Field
7. Data compiled by D. Walker Organization Salem
   Date 3/30/77
8. Additional Comments:

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRE-STRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D130 CUT LENGTH 142'-7½"

SHOP WASHER ID: PC 121 CR 924 FIELD WASHER ID: PC 122 CR 1260

1. GAI/QA vendor inspection cover letter number-FPC # 10202 DATE 4/1/74

2. Date tendon received on-site 3-22-74 RMR Number 38020

3. Date installed in conduit 5-13-74 Installation NCR's ______

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 9-20-74 Buttonheading NCR's ______

   Bad wires 8 Accept. Reheads 8 Total Ineffective wires 0

5. Date stressed 10-31-74 Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4¾"/5"	4¾"/5"	9½"/10"
Lift-Off Pressure - Predicted/Actual	6870/6550	6810/6800	N/A
Shim Thickness/80% Ultimate Pressure	5⅝"/17810	5⅜"/17780	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 4-4-75 Bulk-Filling NCR's ______

   Time since installation 10¾ mnths Inlet Pressure 55 psi Outlet Temp. 140°

   Date end caps refilled: Shop ______ Field ______

7. Data compiled by D. Muller Organization Salem

   Date 3/30/77

8. Additional Comments: ______

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D131 CUT LENGTH 140'-4 3/8"

SHOP WASHER ID: PC 121 CR 1002 FIELD WASHER ID: PC 121 CR 470

1. GAI/QA vendor inspection cover letter number-FPC # 10202 DATE 4/1/74
2. Date tendon received on-site 3-22-74 RMR Number 38020
3. Date installed in conduit 5-13-74 Installation NCR's ______
   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 9-20-74 Buttonheading NCR's 1616
   Bad wires 11 Accept. Reheads 9 Total Ineffective wires 2
5. Date stressed 12-5-74 Stressing NCR's ______
   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 3/4"/4 1/2"	4 3/4"/4 7/8"	9 1/2"/9 3/8"
Lift-Off Pressure - Predicted/Actual	6710/6700	6740/6600	N/A
Shim Thickness/80% Ultimate Pressure	6 1/4"/7660	6 1/4"/7700	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 161

6. Date Bulk-filled 4-4-75 Bulk-Filling NCR's ______
   Time since installation 10 3/4 months Inlet Pressure 31 psi Outlet Temp. 160°
   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D. Waller Organization Salem
   Date 3/30/77
8. Additional Comments: ______

Florida Power Corporation

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D131 CUT LENGTH ____

SHOP WASHER ID: PC ____ CR ____ FIELD WASHER ID: PC ____ CR ____

1. GAI/QA vendor inspection cover letter number-FPC # ____ DATE ____
2. Date tendon received on-site ____ RMR Number ____
3. Date installed in conduit ____ Installation NCR's ____

   Wires removed ____ Wires replaced ____ Total Ineffective wires ____
4. Date buttonheaded ____ Buttonheading NCR's ____

   Bad wires ____ Accept. Reheads ____ Total Ineffective wires ____
5. Date stressed ____ Stressing NCR's ____

   Date restressed ____ Restressing NCR's ____

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ____ Total effective wires after stressing ____
6. Date Bulk-filled ____ Bulk-Filling NCR's ____

   Time since installation ____ Inlet Pressure ____ Outlet Temp. ____

   Date end caps refilled: Shop ____ Field ____
7. Data compiled by D Waller Organization Salem

   Date 4/11/77
8. Additional Comments: Dome Repair -

   Degreasing - Shop (7/19/76) Field (7/19/76)

   Regreasing - (12/1/76) 225 PSIG NCR # 2582, 180° NCR # 2581

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

ON IDENTIFICATION NUMBER D 132 CUT LENGTH 137'-11"

SHOP WASHER ID: PC 121 CR 938 FIELD WASHER ID: PC 121 CR 955

.. CAI/QA vendor inspection cover letter number-FPC # 10202 DATE 4/1/74

!. Date tendon received on-site 3-22-74 RMR Number 38020

). Date installed in conduit 5-13-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

. Date buttonheaded 9-20-74 Buttonheading NCR's

Bad wires 1 Accept. Reheads 0 Total Ineffective wires 1

. Date stressed 12-3-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4¾/4½	4⅝/4⅞	9⅜/9⅜
Lift-Off Pressure - Predicted/Actual	6760/6,700	6800/6,700	N/A
Shim Thickness/80% Ultimate Pressure	6"/7,720	6⅝"/7,750	N/A

Unseated/broken Wires 0 Total effective wires after stressing 162

. Date Bulk-filled 1-4-75 Bulk-Filling NCR's

Time since installation 10 months Inlet Pressure 20psi Outlet Temp. 160°

Date end caps refilled: Shop Field

. Data compiled by D. Waller Organization Salem

Date 3/30/77

. Additional Comments:

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D211 CUT LENGTH 142'-0 1/2"

SHOP WASHER ID: PC 121 CR 487 FIELD WASHER ID: PC 122 CR 1268

CAI/QA vendor inspection cover letter number-FPC # 10245 DATE 4/10/74

Date tendon received on-site 3-29-74 RMR Number 38246

Date installed in conduit 5-30-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

Date buttonheaded 10-17-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

Date stressed 10-30-74 Stressing NCR's 1681, 1683

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 3/8" / 5 1/4"	5" / 5 1/2"	9 3/8" / 10 3/4"
Lift-Off Pressure - Predicted/Actual	6810 / 7100psi	6,870 / 7,000psi	N/A
Shim Thickness/80% Ultimate Pressure	5 1/2" / 7,780	6" / 7810	N/A

Unseated/Broken Wires 1 Total effective wires after stressing 162

Date Bulk-filled 3-26-75 Bulk-Filling NCR's

Time since installation 9 3/4 month Inlet Pressure 50psi Outlet Temp. 132°

Date end caps refilled: Shop Field

Data compiled by D Waller Organization Salem

Date 3/29/77

Additional Comments: One wire not seated on washer.

Florida Power Corporation

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D211 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. GAI/QA vendor inspection cover letter number-FPC # ______ DATE ______
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______

   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______

   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ______ Total effective wires after stressing ______
6. Date Bulk-filled ______ Bulk-Filling NCR's ______

   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D. Walker Organization [illegible]

   Date 4/11/77
8. Additional Comments: Dome Repair –

   Degreasing – Shop (7/15/76)

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

NDON IDENTIFICATION NUMBER D212 CUT LENGTH 144'-3"

OP WASHER ID: PC 121 CR 1032 FIELD WASHER ID: PC 122 CR 1214

GAI/QA vendor inspection cover letter number-FPC # 10245 DATE 4/10/74

Date tendon received on-site 3-29-74 RMR Number 38246

Date installed in conduit 6-4-74 Installation NCR's 1410

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

Date buttonheaded 10-17-74 Buttonheading NCR's

Bad wires 1 Accept. Reheads 0 Total Ineffective wires 1

Date stressed 12-3-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
ngation (1500 psi to 80% ult.)-Pred./Act.	4 3/8" / 4 5/8"	5 1/8" / 4 7/8"	9 1/2" / 9 1/2"
Lift-Off Pressure - Predicted/Actual	6,770 / 6,600 psi	6,770 / 6,700 psi	N/A
Shim Thickness/80% Ultimate Pressure	6 3/8" / 7,730	6 3/8" / 7,720	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 162

Date Bulk-filled 3-26-75 Bulk-Filling NCR's

Time since installation 9 3/4 mnths Inlet Pressure 47 psi Outlet Temp. 124°

Date end caps refilled: Shop Field

Data compiled by D Waller Organization Salem

Date 3/29/77

Additional Comments:

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON SURVEILLANCE RECORD

TENDON NO. D212

Inspection Period and Date	Location	LIFT OFF CONDITION Force (kips)	Avg. Force (kips)	Shim Thickness (in)	Elongation (in)	Total Effective Wires	RETENSIONING Force (kips)	Avg. Force (kips)	Shim Thickness (in)	Elongation (in)	Total Effective Wires	Reactor Bldg. Temperature °F Int.	Ext.	Comments
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Original Stressing	S	1588		6 3/8"	4 5/8"		N/A		N/A	N/A				
12/3/74	F	1612	1600	6 3/8"	4 7/8"	162	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
3rd	S	1392		6 3/8"	N/A		N/A		N/A	N/A				1. Lift-off only
10/26/81	F	1283	1338	6 3/8"	N/A	162	N/A	N/A	N/A	N/A	162	82	83	
4TH	S-1	1292		6 5/8	N/A		N/A		N/A	N/A		85° TO	S 67°F	1. 12 GAL OF GREASE NET ADDED
10/26/87	F-3	1260	1276	6 1/2	N/A	162	N/A	N/A	N/A	N/A	N/A	90°F	E 72°F	

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D213 CUT LENGTH 146'-2¼"

SHOP WASHER ID: PC 121 CR 984 FIELD WASHER ID: PC 121 CR 878

1. GAI/QA vendor inspection cover letter number-FPC # 10245 DATE 4/10/74

2. Date tendon received on-site 3-29-74 RMR Number 38246

3. Date installed in conduit 6-10-74 Installation NCR's

. Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 10-16-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 11-18-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5⅛"/4¾"	4⅜"/4¾"	9½"/9½"
Lift-Off Pressure - Predicted/Actual	6840/6,900 psi	6800/6,800 psi	N/A
Shim Thickness/80% Ultimate Pressure	6⅝"/7,790	6⅜/7,770	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 3-26-75 Bulk-Filling NCR's

Time since installation 9½ months Inlet Pressure 51 psi Outlet Temp. 122°

Date end caps refilled: Shop Field

7. Data compiled by D. Waller Organization Salem

Date 3/29/77

8. Additional Comments: Yellow slime

Florida Power Corporation

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRE'TRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D 213 CUT LENGTH

SHOP WASHER ID: PC CR FIELD WASHER ID: PC CR

1. GAI/QA vendor inspection cover letter number-FPC # DATE
2. Date tendon received on-site RMR Number
3. Date installed in conduit Installation NCR's
   Wires removed Wires replaced Total Ineffective wires
4. Date buttonheaded Buttonheading NCR's
   Bad wires Accept. Reheads Total Ineffective wires
5. Date stressed Stressing NCR's
   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires Total effective wires after stressing
6. Date Bulk-filled Bulk-Filling NCR's
   Time since installation Inlet Pressure Outlet Temp.
   Date end caps refilled: Shop Field
7. Data compiled by D Walker Organization Sudam
   Date 4/11/77
8. Additional Comments: Dome Repair — Degreasing — Shop — (7/15/76)

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D 214 CUT LENGTH 147'-11 1/4"

SHOP WASHER ID: PC — CR 765 FIELD WASHER ID: PC *121 CR 964(YW)

GAI/QA vendor inspection cover letter number-FPC # 10245 DATE 4/10/74

Date tendon received on-site 3-29-74 RMR Number 38246

Date installed in conduit 6-10-74 Installation NCR's

Wires removed 1 Wires replaced 0 Total Ineffective wires 1

Date buttonheaded 10-16-74 Buttonheading NCR's

Bad wires 1 Accept. Reheads 0 Total Ineffective wires 1

Date stressed 12-6-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/4" / 4 3/4"	4 3/8" / 4 7/8"	9 5/8" / 9 5/8"
Lift-Off Pressure – Predicted/Actual	6670 / 6800 psi	6740 / 6800 psi	N/A
Shim Thickness/80% Ultimate Pressure	7" / 7600	7 3/8" / 7680	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 161

Date Bulk-filled 3-26-75 Bulk-Filling NCR's

Time since installation 9 1/2 months Inlet Pressure 48 psi Outlet Temp. 134°

Date end caps refilled: Shop Field

Data compiled by D. Waller Organization Salem

Date 3/29/77

Additional Comments: * Yellow shims used with yellow washer.

Florida Power
CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D 214 CUT LENGTH ________

SHOP WASHER ID: PC ________ CR ________ FIELD WASHER ID: PC ________ CR ________

1. GAI/QA vendor inspection cover letter number-FPC # ________ DATE ________
2. Date tendon received on-site ________ RMR Number ________
3. Date installed in conduit ________ Installation NCR's ________

   Wires removed ________ Wires replaced ________ Total Ineffective wires ________
4. Date buttonheaded ________ Buttonheading NCR's ________

   Bad wires ________ Accept. Reheads ________ Total Ineffective wires ________
5. Date stressed ________ Stressing NCR's ________

   Date restressed ________ Restressing NCR's ________

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ________ Total effective wires after stressing ________
6. Date Bulk-filled ________ Bulk-Filling NCR's ________

   Time since installation ________ Inlet Pressure ________ Outlet Temp. ________

   Date end caps refilled: Shop ________ Field ________
7. Data compiled by D. Malley Organization Sabey

   Date 4/11/77
8. Additional Comments: Dome Repair -

Degreasing - Shop (7/11/76) Field (7/9/76)

Lift-off Readings - Shop 5600 (7/13/76) Field 6350 (7/10/76)

Regreasing - Field 200 PHG NCR# 2581, 2582, 190°-190° (12/1/76)

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D 214 CUT LENGTH ______

SHOP WASHER ID: PC 121 CR ______ FIELD WASHER ID: PC ______ CR ______

1. GAI/QA vendor inspection cover letter number-FPC # ______ DATE ______

2. Date tendon received on-site ______ RMR Number ______

3. Date installed in conduit ______ Installation NCR's ______

   Wires removed ______ Wires replaced ______ Total Ineffective wires ______

4. Date buttonheaded ______ Buttonheading NCR's ______

   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______

5. Date stressed ______ Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ______ Total effective wires after stressing ______

6. Date Bulk-filled ______ Bulk-Filling NCR's ______

   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

   Date end caps refilled: Shop ______ Field ______

7. Data compiled by D. J. [signature] Organization FPC

   Date 9-30-77

8. Additional Comments: IN PREPARATION FOR 1ST SURVEILLANCE

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D-215 CUT LENGTH 149'-3 3/4

SHOP WASHER ID: PC 121 CR 1022 FIELD WASHER ID: PC 121 CR 445

1. CAI/QA vendor inspection cover letter number-FPC # 10245 DATE 4/10/74

2. Date tendon received on-site 3-29-74 RMR Number 38246

3. Date installed in conduit 6-10-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 10-16-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 11-4-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 7/8" / 4 1/2"	4 7/8" / 5 1/8"	9 3/4" / 9 5/8"
Lift-Off Pressure - Predicted/Actual	6800 / 6900 psi	6870 / 7000 psi	N/A
Shim Thickness/80% Ultimate Pressure	7" / 7800	6 3/4" / 7810	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 3-26-75 Bulk-Filling NCR's

Time since installation 9 1/2 months Inlet Pressure 55 psi Outlet Temp. 132°

Date end caps refilled: Shop Field

7. Data compiled by D. Walk[illegible] Organization Salem[illegible]

Date 3/29/77

8. Additional Comments:

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D 215 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. CAI/QA vendor inspection cover letter number-FPC # ______ DATE ______

2. Date tendon received on-site ______ RMR Number ______

3. Date installed in conduit ______ Installation NCR's ______

Wires removed ______ Wires replaced ______ Total Ineffective wires ______

4. Date buttonheaded ______ Buttonheading NCR's ______

Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______

5. Date stressed ______ Stressing NCR's ______

Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

Unseated/Broken Wires ______ Total effective wires after stressing ______

6. Date Bulk-filled ______ Bulk-Filling NCR's ______

Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

Date end caps refilled: Shop ______ Field ______

7. Data compiled by D. Walls Organization Salem

Date 4/11/77

8. Additional Comments: Dome Repair -
Degreasing - Shop (7/15/76)

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D-215 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. GAI/QA vendor inspection cover letter number-FPC # ______ DATE ______
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______

   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______

   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off ~~Pressure~~ FORCE - Predicted/Actual (KIPS) LOCK-OFF FORCE BELOW	1336.6/1612	1336.6/1675.5	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163
6. Date Bulk-filled ______ Bulk-Filling NCR's ______

   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

   Date end caps refilled: Shop 2-9-78 Field 2-9-78
7. Data compiled by D.F. Goff Organization FPC

   Date 5-15-78
8. Additional Comments: INSPECTED FIRST SURVEILLANCE (2-3-78)

   1) NO INDICATION OF RUST - CORROSION

   2) LOCK-OFF FORCE (SHOP - SAME AS LIFT-OFF; FIELD - 1654 K)

   3) NO CRACKING AT ANCHORAGE

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON SURVEILLANCE RECORD

TENDON NO. D215

Inspection Period and Date	Location	Lift Off Condition: Force (kips)	Lift Off Condition: Avg. Force (kips)	Lift Off Condition: Shim Thickness (in)	Lift Off Condition: Elongation (in)	Lift Off Condition: Total Effective Wires	Retensioning: Force (kips)	Retensioning: Avg. Force (kips)	Retensioning: Shim Thickness (in)	Retensioning: Elongation (in)	Retensioning: Total Effective Wires	Reactor Bldg. Temperature °F Int.	Reactor Bldg. Temperature °F Ext.	Comments
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Original Stressing	S	1663		7"	4½"		N/A		N/A	N/A				
11/4/74	F	1670	1667	6 3/4"	5 1/8"	163	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1st	S	1612		7"	N/A		1612		7"	N/A				
2/3/78	F	1676	1644	6 3/4"	N/A	163	1654	1633	6 3/4"	N/A	163	92	46	
3rd	S	1568		7"	N/A		N/A		7"	N/A				1. Lift-off only
10/27/83	F	1619	1594	6 3/4"	N/A	163	N/A	N/A	6 3/4"	N/A	163	82	85	
5TH	S	1458		7 1/8	N/A		N/A		N/A	N/A				32 GALLONS OF GREASE ADDED OVER REMOVED
11/9/93	F	1579	1518	6 7/8	N/A	163	N/A	N/A	N/A	N/A	N/A	123°	72°	

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Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D 216 CUT LENGTH 150'-6 3/4

SHOP WASHER ID: PC 121 CR 912 FIELD WASHER ID: PC 122 CR 1239

1. GAI/QA vendor inspection cover letter number-FPC # 10245 DATE 4/10/74

2. Date tendon received on-site 4-1-74 RMR Number 38273

3. Date installed in conduit 6-10-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 10-15-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 12-3-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5¼"/5"	4⅝"/5"	9⅞"/10"
Lift-Off Pressure - Predicted/Actual	6800/6700psi	6810/6700psi	N/A
Shim Thickness/80% Ultimate Pressure	7¼"/7770	6¾"/7780	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 3-26-75 Bulk-Filling NCR's

Time since installation 9½ months Inlet Pressure 55 psi Outlet Temp. 132°

Date end caps refilled: Shop Field

7. Data compiled by D. Walker Organization Salem

Date 3/29/77

8. Additional Comments:

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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'DON IDENTIFICATION NUMBER D 303 CUT LENGTH 115'-8 3/4

'P WASHER ID: PC 121 CR 447 FIELD WASHER ID: PC 121 CR 836(YW)

CAI/QA vendor inspection cover letter number-FPC # 10357 DATE 4/30/74

Date tendon received on-site 4-10-74 RMR Number 38726

Date installed in conduit 6-20-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

Date buttonheaded 10-11-74 Buttonheading NCR's

Bad wires 1 Accept. Reheads 0 Total Ineffective wires 1

Date stressed 11-14-74 Stressing NCR's 1704

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
'longation (1500 psi to 80% ult.)-Pred./Act.	3 3/4", 4 1/4"	3 3/4", 3 3/4"	7 1/2", 8"
Lift-Off Pressure - Predicted/Actual	6760/6700 psi	6770/7030 psi	N/A
Shim Thickness/80% Ultimate Pressure	6 1/4"/7720	6 3/8"/7730	N/A

Unseated/Broken Wires 1 Total effective wires after stressing 161

Date Bulk-filled 3-27-75 Bulk-Filling NCR's 1880

Time since installation 9 1/4 month Inlet Pressure: 95 psi Outlet Temp. 124°

Date end caps refilled: Shop Field

Data compiled by D. Waller Organization Salem

Date 4/1/77

Additional Comments: Broken wire.

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D 303 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. GAI/QA vendor inspection cover letter number-FPC # ______ DATE ______
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______
   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______
   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______
   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ______ Total effective wires after stressing ______
6. Date Bulk-filled ______ Bulk-Filling NCR's ______
   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______
   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D. Waller Organization Salem
   Date 4/11/77
8. Additional Comments: Dome Repair –
   Degreasing - Shop (7/8/76) Field (7/7/76) (7/17/76)
   Regreasing - 200 PSIG NCR #2582 190° NCR #2581

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D304 CUT LENGTH 120'-4 1/2"

SHOP WASHER ID: PC 121 CR 479 FIELD WASHER ID: PC 121 CR 696

GAI/QA vendor inspection cover letter number-FPC # 10357 DATE 4/30/74

Date tendon received on-site 4-10-74 RMR Number 38726

Date installed in conduit 5-23-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

Date buttonheaded 10-11-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

Date stressed 12-6-74 Stressing NCR's 1764

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	3 7/8" / 4 1/8"	3 7/8" / 4"	7 3/4" / 8 1/8"
Lift-Off Pressure - Predicted/Actual	6840 / 6800 psi	6800 / 6600 psi	N/A
Shim Thickness/80% Ultimate Pressure	5 3/4" / 7790	6 3/4" / 7770	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

Date Bulk-filled 3-27-75 Bulk-Filling NCR's

Time since installation 10 months Inlet Pressure 35 psi Outlet Temp. 120°

Date end caps refilled: Shop Field

Data compiled by D. Waller Organization Salem

Date 4/1/77

Additional Comments:

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Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D 304 CUT LENGTH

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. GAI/QA vendor inspection cover letter number-FPC # ______ DATE ______
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______
   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______
   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______
   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ______ Total effective wires after stressing ______
6. Date Bulk-filled ______ Bulk-Filling NCR's ______
   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______
   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D Waller Organization Salem
   Date 4/11/77
8. Additional Comments: Dome Repair —
   Degreasing - Field (7/7/76)

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D305 CUT LENGTH 124'-9 1/4"

SHOP WASHER ID: PC 120 CR 172 FIELD WASHER ID: PC 121 CR 541

GAI/QA vendor inspection cover letter number-FPC # 10357 DATE 4/30/74

Date tendon received on-site 4-10-74 RMR Number 38726

Date installed in conduit 5-22-74 Installation NCR's 1386

Wires removed 1 Wires replaced 0 Total Ineffective wires 1

Date buttonheaded 10-11-74 Buttonheading NCR's

Bad wires 3 Accept. Reheads 1 Total Ineffective wires 2

Date stressed 11-25-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 1/8" / 4 1/8"	4 1/8" / 4 9/16"	8 1/4" / 18 5/16
Lift-Off Pressure - Predicted/Actual	6700 / 6900 psi	6680 / 6650 psi	N/A
Shim Thickness/80% Ultimate Pressure	6" / 7630	5 5/8" / 7620	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 160

Date Bulk-filled 3-27-75 Bulk-Filling NCR's

Time since installation 10 months Inlet Pressure 25 psi Outlet Temp. 126°

Date end caps refilled: Shop Field

Data compiled by D. Waller Organization Salem

Date 4/1/77

Additional Comments:

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D 305 CUT LENGTH ____

SHOP WASHER ID: PC ____ CR ____ FIELD WASHER ID: PC ____ CR ____

1. GAI/QA vendor inspection cover letter number-FPC # ____ DATE ____

2. Date tendon received on-site ____ RMR Number ____

3. Date installed in conduit ____ Installation NCR's ____

   Wires removed ____ Wires replaced ____ Total Ineffective wires ____

4. Date buttonheaded ____ Buttonheading NCR's ____

   Bad wires ____ Accept. Reheads ____ Total Ineffective wires ____

5. Date stressed ____ Stressing NCR's ____

   Date restressed ____ Restressing NCR's ____

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ____ Total effective wires after stressing ____

6. Date Bulk-filled ____ Bulk-Filling NCR's ____

   Time since installation ____ Inlet Pressure ____ Outlet Temp. ____

   Date end caps refilled: Shop ____ Field ____

7. Data compiled by D. Walle Organization Salem

   Date 4/11/77

8. Additional Comments: Dome Repair

Degreasing - Shop (7/8/76) Field (7/8/76)(7/19/76)

Regreasing - 200 PSIG NCR# 2582, 164° NCR# 2581

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D310 CUT LENGTH 140'-11'

SHOP WASHER ID: PC 121 CR 1069 FIELD WASHER ID: PC 121. CR 363

1. GAI/QA vendor inspection cover letter number-FPC # 10357 DATE 4/30/74

2. Date tendon received on-site 4-12-74 RMR Number 38757

3. Date installed in conduit 5-22-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 10-9-74 Buttonheading NCR's

Bad wires 1 Accept. Reheads 0 Total Ineffective wires 1

5. Date stressed 11-27-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 5/8" / 5"	4 5/8" / 4 1/2"	9 1/4" / 9 1/2"
Lift-Off Pressure - Predicted/Actual	6770/6800 PSI	6770/6800 PSI	N/A
Shim Thickness/80% Ultimate Pressure	6" / 7720	6" / 7730	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 162

6. Date Bulk-filled 3-27-75 Bulk-Filling NCR's

Time since installation 10 months Inlet Pressure 30 PSI Outlet Temp. 138°

Date end caps refilled: Shop Field

7. Data compiled by D. Waller Organization Salem

Date 4/1/77

8. Additional Comments: Lift off not simultaneous

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D310 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. GAI/QA vendor inspection cover letter number-FPC # ______ DATE ______

2. Date tendon received on-site ______ RMR Number ______

3. Date installed in conduit ______ Installation NCR's ______

   Wires removed ______ Wires replaced ______ Total Ineffective wires ______

4. Date buttonheaded ______ Buttonheading NCR's ______

   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______

5. Date stressed ______ Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ______ Total effective wires after stressing ______

6. Date Bulk-filled ______ Bulk-Filling NCR's ______

   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

   Date end caps refilled: Shop ______ Field ______

7. Data compiled by D. Walley Organization Salem

   Date 4/11/77

8. Additional Comments: Dome Repair —
Degreasing — Shop (7/8/76)

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
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1. [T]ON IDENTIFICATION NUMBER D311 CUT LENGTH 143'-5"

SHOP WASHER ID: PC 121 CR 1040 FIELD WASHER ID: PC 121 CR 636

.. GAI/QA vendor inspection cover letter number-FPC # 10357 DATE 4/30/74

2. Date tendon received on-site 4-12-74 RMR Number 38757

3. Date installed in conduit 5-22-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 10-9-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 11-11-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 3/4 / 14 1/16	4 3/4 / 14 5/8	9 1/2 / 19 5/16
Lift-Off Pressure - Predicted/Actual	6800/7000	6840/7000	N/A
Shim Thickness/80% Ultimate Pressure	6 3/8 / 7770	6 3/8 / 7790	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 3-27-75 Bulk-Filling NCR's

Time since installation 10 months Inlet Pressure 30 PSI Outlet Temp. 132°

Date end caps refilled: Shop Field

7. Data compiled by D. Waller Organization Salem

Date 4/1/77

8. Additional Comments:

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D 311 CUT LENGTH ____

SHOP WASHER ID: PC ____ CR ____ FIELD WASHER ID: PC ____ CR ____

1. CAI/QA vendor inspection cover letter number-FPC # ____ DATE ____

2. Date tendon received on-site ____ RMR Number ____

3. Date installed in conduit ____ Installation NCR's ____

   Wires removed ____ Wires replaced ____ Total Ineffective wires ____

4. Date buttonheaded ____ Buttonheading NCR's ____

   Bad wires ____ Accept. Reheads ____ Total Ineffective wires ____

5. Date stressed ____ Stressing NCR's ____

   Date restressed ____ Restressing NCR's ____

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ____ Total effective wires after stressing ____

6. Date Bulk-filled ____ Bulk-Filling NCR's ____

   Time since installation ____ Inlet Pressure ____ Outlet Temp. ____

   Date end caps refilled: Shop ____ Field ____

7. Data compiled by D. Walker Organization Salem

   Date 4/11/77

8. Additional Comments: Dome Repair —
   Degreasing — Field (7/15/76)

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D312 CUT LENGTH 145'-5 3/4"

SHOP WASHER ID: PC 121 CR 1052 FIELD WASHER ID: PC 121 CR 655

1. GAI/QA vendor inspection cover letter number-FPC # 10357 DATE 4/30/74

2. Date tendon received on-site 4-12-74 RMR Number 38757

3. Date installed in conduit 5-22-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 10-9-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 12-6-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 3/4 / 4 7/8	4 3/4 / 4 7/8	9 1/2 / 9 3/4
Lift-Off Pressure - Predicted/Actual	6840/6950	6800/6700	N/A
Shim Thickness/80% Ultimate Pressure	6 1/4 / 7790	6 1/2 / 7770	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 3-27-75 Bulk-Filling NCR's

Time since installation 10 months Inlet Pressure 25 PSI Outlet Temp. 136°

Date end caps refilled: Shop Field

7. Data compiled by D. Waller Organization Salem

Date 4/1/77

8. Additional Comments:

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER 42H17 CUT LENGTH 155'-8"

SHOP WASHER ID: PC 121 CR 674 FIELD WASHER ID: PC 122 CR 1275

1. GAI/QA vendor inspection cover letter number-FPC # 9861 DATE 2/12/74
2. Date tendon received on-site 12-28-73 RMR Number 35496
3. Date installed in conduit 1-22-74 Installation NCR's ______
   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 6-17-74 Buttonheading NCR's ______
   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0
5. Date stressed 2-6-75 Stressing NCR's ______
   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8 / 5 5/8	5 1/8 / 4 5/8	10 1/4 / 10 1/4
Lift-Off Pressure - Predicted/Actual	6870 / 7060	6810 / 6800	N/A
Shim Thickness/80% Ultimate Pressure	7 / 7810	6 / 7780	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163
6. Date Bulk-filled 7-26-74 Bulk-Filling NCR's ______
   Time since installation 6 months Inlet Pressure 9 PSI Outlet Temp. 142°
   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D. Walker Organization Gilbert
   Date 4/4/77
8. Additional Comments: ______

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 42H18 CUT LENGTH 155'-6 3/4

SHOP WASHER ID: PC 121 CR 615 FIELD WASHER ID: PC 121 CR 906

1. GAI/QA vendor inspection cover letter number-FPC # 9921 DATE 2/20/74
2. Date tendon received on-site 12-20-73 RMR Number 35528
3. Date installed in conduit 1-22-74 Installation NCR's ______
   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 6-18-74 Buttonheading NCR's ______
   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0
5. Date stressed 3-4-75 Stressing NCR's ______
   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8 / 5	5 1/8 / 5 3/8	10 1/4 / 10 3/8
Lift-Off Pressure - Predicted/Actual	6840 / 7100	6799 / 6750	N/A
Shim Thickness/80% Ultimate Pressure	6 3/8 / 7810	6 3/8 / 7750	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163
6. Date Bulk-filled 7-26-74 Bulk-Filling NCR's ______
   Time since installation 6 months Inlet Pressure 13 PSI Outlet Temp. 148°
   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D. Waller Organization Salem
   Date 4/4/77
8. Additional Comments: ______

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

Calculation S-95-0082
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TENDON IDENTIFICATION NUMBER 42H19 CUT LENGTH 155'-7 1/2

SHOP WASHER ID: PC 121 CR 555 FIELD WASHER ID: PC 121 CR 1013

1. GAI/QA vendor inspection cover letter number-FPC # 9921 DATE 2/20/74

2. Date tendon received on-site 12-28-73 RMR Number 35528

3. Date installed in conduit 1-22-74 Installation NCR's ____

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 6-18-74 Buttonheading NCR's ____

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 2-6-75 Stressing NCR's ____

   Date restressed ____ Restressing NCR's ____

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8 , 5 1/4	5 1/8 , 5	10 1/4 , 10 1/4
Lift-Off Pressure - Predicted/Actual	6870 , 6900	6810 , 6850	N/A
Shim Thickness/80% Ultimate Pressure	7 9/16 , 7810	6 5/8 , 7780	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 7-26-74 Bulk-Filling NCR's ____

   Time since installation 6 months Inlet Pressure 8 PSI Outlet Temp. 154°

   Date end caps refilled: Shop ____ Field ____

7. Data compiled by D Wallin Organization Salem

   Date 4/4/77

8. Additional Comments:

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 42H31 CUT LENGTH 155'-7 1/4"

SHOP WASHER ID: PC 121 CR 368 FIELD WASHER ID: PC 122 CR 1233

1. GAI/QA vendor inspection cover letter number-FPC # 9285 DATE 11/5/73
2. Date tendon received on-site 10-4-73 RMR Number 33356
3. Date installed in conduit 1-29-74 Installation NCR's ____

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 6-25-74 Buttonheading NCR's ____

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0
5. Date stressed 2-13-75 Stressing NCR's ____

   Date restressed ____ Restressing NCR's ____

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8, 5 1/4	5 1/8, 4 7/8	10 1/4, 10 1/8
Lift-Off Pressure - Predicted/Actual	6870, 7000	6810, 6800	N/A
Shim Thickness/80% Ultimate Pressure	6 9/16, 7810	5 3/8, 7780	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163
6. Date Bulk-filled 7-31-74 Bulk-Filling NCR's ____

   Time since installation 6 months Inlet Pressure 22 PSI. Outlet Temp. 128°

   Date end caps refilled: Shop ____ Field ____
7. Data compiled by D. Walker Organization Salem

   Date 1/4/77
8. Additional Comments: ____

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 42H32 CUT LENGTH 155'-6

SHOP WASHER ID: PC 121 CR 564 FIELD WASHER ID: PC 120 CR 123

1. GAI/QA vendor inspection cover letter number-FPC # 9920 DATE 2/20/74

2. Date tendon received on-site 1-9-74 RMR Number 35888

3. Date installed in conduit 1-17-74 Installation NCR's ______

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 6-27-74 Buttonheading NCR's ______

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 2-28-75 Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8, 5 1/4	5 1/8, 5 1/8	10 1/4, 10 3/8
Lift-Off Pressure - Predicted/Actual	6810, 6750	6790, 6800	N/A
Shim Thickness/80% Ultimate Pressure	6 3/8, 7810	6 3/8, 7750	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 8-9-74 Bulk-Filling NCR's ______

   Time since installation 7 months Inlet Pressure 15 PSI Outlet Temp. 157°

   Date end caps refilled: Shop ______ Field ______

7. Data compiled by D. Walk Organization Salem

   Date 4/4/77

8. Additional Comments: ______

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 42H33 CUT LENGTH 155'-8

SHOP WASHER ID: PC 121 CR 546 FIELD WASHER ID: PC 121 CR 934

1. GAI/QA vendor inspection cover letter number-FPC # 9920 DATE 2/20/74
2. Date tendon received on-site 1-9-74 RMR Number 35888
3. Date installed in conduit 1-18-74 Installation NCR's
   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 6-27-74 Buttonheading NCR's
   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0
5. Date stressed 2-14-75 Stressing NCR's
   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/4 / 5 3/8	5 1/8 / 5 1/4	10 1/4 / 10 5/8
Lift-Off Pressure - Predicted/Actual	6870 / 7000	6810 / 6900	N/A
Shim Thickness/80% Ultimate Pressure	7 3/8 / 7810	7 3/8 / 7780	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163
6. Date Bulk-filled 8-9-74 Bulk-Filling NCR's
   Time since installation 7 months Inlet Pressure N/A Outlet Temp. 160°
   Date end caps refilled: Shop Field
7. Data compiled by D Walker Organization Salem
   Date 4/4/77
8. Additional Comments:

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Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 42 H 43 CUT LENGTH 155'-6 3/4

SHOP WASHER ID: PC 121 CR 524 FIELD WASHER ID: PC 121 CR 978

1. CAI/QA vendor inspection cover letter number-FPC # 9920 DATE 2/20/74
2. Date tendon received on-site 1-14-74 RMR Number 36031
3. Date installed in conduit 1-21-74 Installation NCR's ____
   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 7-8-74 Buttonheading NCR's ____
   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0
5. Date stressed 2-19-75 Stressing NCR's ____
   Date restressed ____ Restressing NCR's ____

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8 / 5 1/2	5 1/8 , 5 1/8	10 1/4 / 10 5/8
Lift-Off Pressure - Predicted/Actual	6870 / 6750	6810 , 6700	N/A
Shim Thickness/80% Ultimate Pressure	7 3/16 / 7810	6 1/4 / 7780	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163
6. Date Bulk-filled 7-31-74 Bulk-Filling NCR's ____
   Time since installation 6 months Inlet Pressure 10 PSI Outlet Temp. 136°
   Date end caps refilled: Shop ____ Field ____
7. Data compiled by D Waller Organization Sal[illegible]
   Date 4/4/77
8. Additional Comments: ____

907 716

Florida Power Corporation

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 42H44 CUT LENGTH 155'-6"

SHOP WASHER ID: PC 122 CR 1230 FIELD WASHER ID: PC 122 CR 1230

1. GAI/QA vendor inspection cover letter number-FPC # 9920 DATE 2/20/74

2. Date tendon received on-site 1-14-74 RMR Number 36031

3. Date installed in conduit 1-21-74 Installation NCR's ______

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 7-10-74 Buttonheading NCR's ______

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 2-26-75 Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8, 5 1/8	5 1/8, 5	10 1/4, 10 1/8
Lift-Off Pressure - Predicted/Actual	6790 / 6600	6840, 6750	N/A
Shim Thickness/80% Ultimate Pressure	6 1/4 / 7750	7, 7790	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 7-31-74 Bulk-Filling NCR's ______

   Time since installation 6 months Inlet Pressure 14 PSI Outlet Temp. 140°

   Date end caps refilled: Shop ______ Field -

7. Data compiled by D. Walla Organization Salem

   Date 4/4/77

8. Additional Comments:

Florida Power
CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 4-2H45 CUT LENGTH 155'-7

SHOP WASHER ID: PC 121 CR 566 FIELD WASHER ID: PC 122 CR 1194

1. GAI/QA vendor inspection cover letter number-FPC # 9957 DATE 2/25/74

2. Date tendon received on-site 1-16-74 RMR Number 36035

3. Date installed in conduit 1-21-74 Installation NCR's

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 7-10-74 Buttonheading NCR's

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 2-20-75 Stressing NCR's

   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8, 5 7/16	5 1/8, 5	10 1/4, 10 7/16
Lift-Off Pressure - Predicted/Actual	6870, 7000	6810, 6900	N/A
Shim Thickness/80% Ultimate Pressure	7 1/4, 7810	6 3/8, 7780	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 7-31-74 Bulk-Filling NCR's

   Time since installation 6 months Inlet Pressure 12 PSI Outlet Temp. 140°

   Date end caps refilled: Shop Field

7. Data compiled by D. Walker Organization Salem

   Date 4/4/77

8. Additional Comments:

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 46H20 CUT LENGTH 155'-11 1/4

SHOP WASHER ID: PC 120 CR 78 FIELD WASHER ID: PC 122 CR 1138

1. GAI/QA vendor inspection cover letter number-FPC # 9245 DATE 10/31/73
2. Date tendon received on-site 9-17-73 RMR Number 32681
3. Date installed in conduit 4-15-74 Installation NCR's
   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 7-19-74 Buttonheading NCR's
   Bad wires 13 Accept. Reheads 12 Total Ineffective wires 1
5. Date stressed 3-5-75 Stressing NCR's
   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 , 5 1/4	5 1/4 , 5 1/8	10 1/4 , 10 3/8
Lift-Off Pressure - Predicted/Actual	6640 , 6930	6600 , 6600	N/A
Shim Thickness/80% Ultimate Pressure	7 3/8 , 7700	6 5/8 , 7610	N/A

   Unseated/Broken Wires 2 Total effective wires after stressing 160
6. Date Bulk-filled 11-4-74 Bulk-Filling NCR's
   Time since installation 6 1/2 months Inlet Pressure 50 psi Outlet Temp. 130°
   Date end caps refilled: Shop 4-14-75 Field 4-14-75
7. Data compiled by D. Miller Organization Salem
   Date 4/4/77
8. Additional Comments:

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER 46H21 CUT LENGTH 154'-4

SHOP WASHER ID: PC 120 CR 167 FIELD WASHER ID: PC 122 CR 1141

1. GAI/QA vendor inspection cover letter number-FPC # N/A DATE

2. Date tendon received on-site 10-15-73 RMR Number 33610

3. Date installed in conduit 4-23-74 Installation NCR's

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 7-19-74 Buttonheading NCR's

   Bad wires 1 Accept. Reheads 0 Total Ineffective wires 1

5. Date stressed 2-7-75 Stressing NCR's

   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8 / 5 1/8	5 1/8 / 5 1/4	10 1/4 / 10 3/8
Lift-Off Pressure - Predicted/Actual	6720 / 6700	6730 / 6950	N/A
Shim Thickness/80% Ultimate Pressure	5 5/8 / 7700	5 9/16 / 7640	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 162

6. Date Bulk-filled 11-4-74 Bulk-Filling NCR's

   Time since installation 6 1/2 months Inlet Pressure 50 psi Outlet Temp. 130°

   Date end caps refilled: Shop 4-14-75 Field 4-14-75

7. Data compiled by D. Waller Organization Salem

   Date 4/4/77

8. Additional Comments:

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 46 H21 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. GAI/QA vendor inspection cover letter number-FPC # ______ DATE ______
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______

   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______

   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off ~~Pressure~~ FORCE - Predicted/Actual (KIPS)	1425.6 / 1457.5	1425.6 / 1546	N/A
Shim Thickness/80% Ultimate Pressure LOCK-OFF FORCE	5¾" /	/	N/A

Unseated/Broken Wires 1 - SAO PREV. 0 - AT SURV. Total effective wires after stressing 162

6. Date Bulk-filled ______ Bulk-Filling NCR's ______

   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D. J. Griffin Organization FPC

   Date 5-16-78
8. Additional Comments: INSPECTED FIRST SURVEILLANCE (1-10-78)

   1) NO INDICATION OF RUST - CORROSION

   2) LOCK-OFF FORCE (SHOP - SAME AS LIFT-OFF; FIELD - 1524 K)

   3) NO INDICATION OF CRACKING AT ANCHORAGES

   4) SHOP END SHIM - RECORDS SHOW (5⅝") - ACTUAL (5¾")

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON SURVEILLANCE RECORD

TENDON NO. 46H21

Inspection Period and Date	Location	LIFT OFF CONDITION: Force (kips)	Avg. Force (kips)	Shim Thickness (in)	Elongation (in)	Total Effective Wires	RETENSIONING: Force (kips)	Avg. Force (kips)	Shim Thickness (in)	Elongation (in)	Total Effective Wires	Reactor Bldg. Temperature °F: Int.	Ext.	Comments
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Original Stressing	S-6	1624		5 5/8	5 1/8		N/A		N/A	N/A				
2-7-75	F-4	1682	1653	5 9/16	5 1/4	162	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1st	S-6	1458		5 3/4	N/A		1458		5 3/4	N/A				
1-10-78	F-4	1546	1502	5 9/16	N/A	163	1514	1536	5 9/16	N/A	~~163~~ 162	106	41	
5TH	S-6	1423		5 7/8	N/A		N/A		N/A	N/A				15 GALLONS OF GREASE ADDED OR REMOVED.
12/7/93	E-4	1427	1425	5 11/16	N/A	162	N/A	N/A	N/A	N/A	N/A	136°	68°	

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Florida Power CORPORATION

INTEROFFICE CORRESPONDENCE

A-C-XMTL.FRM

Nuclear Engineering	NT6D	240-1511
Office	MAC	Telephone

SUBJECT: Crystal River Unit 3
Quality Records Transmittal - Analysis/Calculation

TO: Records Management - NR2A

The following analysis/calculation package is submitted as the QA Record copy:

DOCNO (FPC DOCUMENT IDENTIFICATION NUMBER)	REV.	SYSTEM(S)	TOTAL PAGES TRANSMITTED
S 95-0082	3	MX	68

TITLE
6th Tendon Surveillance - Generation of Tendon Force Curves

KWDS (IDENTIFY KEYWORDS FOR LATER RETRIEVAL)
Tendon, Surveillance

DXREF (REFERENCES OR FILES - LIST PRIMARY FILE FIRST)	
REA 97-1975	
REA 97-2110	
REA 97-2129	

VEND (VENDOR NAME)	VENDOR DOCUMENT NUMBER (DXREF)	SUPERSEDED DOCUMENTS (DXREF)
FPC (from Parsons Power)	N/A	N/A

TAG

PART NO.

COMMENTS (USAGE RESTRICTIONS, PROPRIETARY, ETC.)
Revision by FPC to Parsons Power calculation (using FPC format).

NOTE:
Use Tag number only for valid tag numbers (i.e., RCV-8, SWV-34, DCH-99), otherwise; use Part number field (i.e., CSC14599, AC1459). If more space is required, write "See Attachment" and list on separate sheet.

FOR RECORDS MANAGEMENT USE ONLY
Quality Record Transmittal received and information entered into SEEK.
Entered by: ____________ Date ________
(Return copy of Quality Docment Transmittal to NOE Supprt Specialist.)

DESIGN ENGINEER	DATE	VERIFICATION ENGINEER	DATE	SUPERVISOR, NUCLEAR ENG.	DATE
John D. Shuber Jr.	2-2-98		2-15-98		2-18-98

cc: Nuclear Projects (If MAR/CGWR/PEERE Return to Service Related) ☐ Yes ☒ No
Supervisor, Config. Mgt. Info.
Mgr., Nucl. Operations Eng. (Original) w/attach

Calculation Review form Part III actions required ☒ Yes ☒ No
(If Yes, send copy of the form to Nuclear Regulatory Assurance and a copy of the Calculation to the Responsible Organization(s) identified in Part III on the Calculation Review form.)

2/23/98

Rev. 12/97

Florida Power CORPORATION

ANALYSIS/CALCULATION SUMMARY

A-C-SUM.FRM

DOCUMENT IDENTIFICATION NUMBER	DISCIPLINE S	CONTROL NO. 95-0082	REVISION LEVEL 3

TITLE

6th Tendon Surveillance - Generation of Tendon Force Curves

CLASSIFICATION (CHECK ONE)
☒ Safety Related
☐ Non Safety Related

MAR/SP/CGWR/PEERE NUMBER
N/A

VENDOR DOCUMENT NUMBER
N/A

	APPROVAL SIGNATURES	PRINTED NAME
Design Engineer	[signature]	John D. Shubert, Jr.
Date	2-2-98	
Verification Engineer	[signature]	Joe A. Lee
Date	2-15-98	
Supervisor	[signature]	Dan Jopling
Date	2-18-98	

ITEMS REVISED

(see "Revision Description Sheet" for revision 3)

PURPOSE SUMMARY

Determine Tendon Force losses and prepare Tendon Force Curves for additional Tendons required for the 6th Surveillance Inspection. The data for the following Tendon's is added by Revision 3:

D111, D302, D306, 42H29, 42H30, 42H34,

42H35, 42H36, 42H37, 51H28, 51H29,

62H39, 62H43 and 62H44.

RESULTS SUMMARY

Additional Force Curves are plotted and attached.

Florida Power
CORPORATION

CALCULATION REVIEW

CALC-REV.FRM

CALCULATION NO./REV.

S 95-0082 Revision 3

PART I - **DESIGN ASSUMPTION/INPUT REVIEW: APPLICABLE** ☐ Yes ☒ No

The following organizations have reviewed and concur with the design assumptions and inputs identified for this calculation:

Nuclear Plant Technical Support System Engr	N/A Signature/Date
Nuclear Plant Operations OTHER(S)	N/A Signature/Date
______________________	N/A Signature/Date
______________________	N/A Signature/Date

PART II - **RESULTS REVIEW: APPLICABLE** ☐ Yes ☒ No

The following organizations have reviewed and concur with the results of this calculation and understand the actions which the organizations must take to implement the results.

Nuclear Plant Technical Support System Engr	N/A Signature/Date
Nuclear Plant Operations	N/A Signature/Date
Nuclear Plant Maintenance ☐ Yes ☒ N/A	N/A Signature/Date
Nuclear Licensed Operator Training ☐ Yes ☒ N/A	N/A Signature/Date
Manager, Site Nuclear Services ☐ Yes ☒ N/A	N/A Signature/Date
Sr. Radiation Protection Engineer ☐ Yes ☒ N/A	N/A Signature/Date
Nuclear Plant EOP Group ☐ Yes ☒ N/A	N/A Signature/Date
OTHERS: ______________________	N/A Signature/Date

Florida Power Corporation

CALCULATION REVIEW

CALCULATION NO./REV.
S 95-0082 Revision 3

PART III - CONFIGURATION CONTROL: APPLICABLE ☐ Yes ☒ No

The following is a list of Plant procedures/lesson plans/other documents and Nuclear Engineering calculations which require updating based on calculation results review:

Document	Date Required	Responsible Organization

Upon completion, forward a copy to the Manager, Nuclear Regulatory Assurance Group for tracking of actions if any items are identified in Part III. If calculations are listed, a copy shall be sent to the original file and the calculation log updated to reflect this impact.

PART IV - NUCLEAR ENGINEERING DOCUMENTATION REVIEW

The responsible Design Engineer must thoroughly review the below listed documents to assess if the calculation requires revision to these documents. If "Yes," the change authorizations must be listed below and issued concurrently with the calculation.

Enhanced Design Basis Document	☐ Yes ☒ No	(TC#)	Vendor Qualification Package	☐ Yes ☒ No	(VQP#)
FSAR	☐ Yes ☒ No	(Letter#)	Topical Design Basis Doc.	☐ Yes ☒ No	(TC#)
Improved Tech. Specification	☐ Yes ☒ No	(Letter#)	E/SQPM	☐ Yes ☒ No	(TC#)
Improved Tech. Spec. Bases	☐ Yes ☒ No	(Letter#)	Other Documents reviewed:		
Config. Mgmt. Info. System	☐ Yes ☒ No	(CIOP#)		☐ Yes ☐ No	(CHANGE DOC. REFERENCE)
Analysis Basis Document	☐ Yes ☒ No	(TC#)		☐ Yes ☐ No	(CHANGE DOC. REFERENCE)
Design Basis Document	☐ Yes ☒ No	(TC#)		☐ Yes ☐ No	(CHANGE DOC. REFERENCE)
Appendix R Fire Study	☐ Yes ☒ No	(TC#)		☐ Yes ☐ No	(CHANGE DOC. REFERENCE)
Fire Hazardous Analysis	☐ Yes ☒ No	(TC#)		☐ Yes ☐ No	(CHANGE DOC. REFERENCE)
NFPA Code Conformance Document	☐ Yes ☒ No	(TC#)		☐ Yes ☐ No	(CHANGE DOC. REFERENCE)

PART V - PLANT REVIEWS/APPROVALS FOR INSTRUMENT SETPOINT CHANGE

PRC/DNPO approval is required if a setpoint is to be physically changed in the plant through the NEP 213 process.

PRC Review Required ☐ Yes ☒ No   N/A
PRC Chairman /Date

DNPO Review Required ☐ Yes ☒ No   N/A
DNPO /Date

DESIGN ENGINEER/DATE	DESIGN ENGINEER - PRINTED NAME
[signature] 2-2-98	John D. Shubert, Jr.

Florida Power Corporation

CALCULATION VERIFICATION REPORT

Crystal River Unit 3

CALVERRP.FRM

CALCULATION NUMBER
S 95-0082 Revision 3
PROJECT/TITLE
6th Tendon Surveillance - Generation of Tendon Force Curves

	YES	NO	N/A	
1.	X			Are inputs, including codes, standards, regulatory requirements, procedures, data, and Engineering methodology correctly selected and applied?
2.			X	Have assumptions been identified? Are they reasonable and justified? (See NEP 101, V.c, for discussion on references).
3.	X			Are references properly identified, correct, and complete? (See NEP 101, V.c., for discussion on assumptions and justification.)
4.	X			Have applicable construction and operating experiences been considered?
5.	X			Was an appropriate Design Analysis/Calculation method used?
6.			X	In cases where computer software was used, has the program been verified or reverified in accordance with NEP 135 for safety related design applications and/or are inputs, formulas, and outputs associated with spreadsheets accurate?
7.			X	Is the output reasonable compared to inputs?
8.			X	Has technical design information provided via letter, REA, IOC or telecon by other disciplines or programs been verified by that discipline or program?
9.			X	Has technical design information provided via letter or telecon from an external Engineering Organization or vendor been confirmed and accepted by FPC?
10.		X		Do the calculation results indicate a non-conforming condition exists? If "Yes," immediately notify the responsible Supervisor.
11.		X		Do the results require a change to other Engineering documents? If "Yes," have these documents been identified for revision on the Calculation Review Form?

I have performed a verification on the subject calculation package and find the results acceptable.

VERIFICATION ENGINEER	DATE	SUPERVISOR, NUCLEAR ENGINEERING	DATE
J.O. Lee Joe L. Lee	2-15-98	[signature]	2.18.98

Florida Power CORPORATION

INTEROFFICE CORRESPONDENCE

A-C-XMTL.FRM

Nuclear Engineering	NT6D	240-1511
Office	MAC	Telephone

SUBJECT: Crystal River Unit 3
Quality Document Transmittal - Analysis/Calculation

TO: Records Management - NR2A

The following analysis/calculation package is submitted as the QA Record copy:

DOCNO (FPC DOCUMENT IDENTIFICATION NUMBER)	REV.	SYSTEM(S)	TOTAL PAGES TRANSMITTED
S 95-0082	2	MX	153

TITLE
6th Tendon Surveillance - Generation of Tendon Force Curves

KWDS (IDENTIFY KEYWORDS FOR LATER RETRIEVAL)
Tendon, Surveillance

DXREF (REFERENCES OR FILES - LIST PRIMARY FILE FIRST)

VDND (VENDOR NAME)	VENDOR DOCUMENT NUMBER (DXREF)	SUPERSEDED DOCUMENTS (DXREF)
FPC (from Parsons Power)	N/A	N/A

TAG

PART NO.

COMMENTS (USAGE RESTRICTIONS, PROPRIETARY, ETC.)
Revision by FPC to Parsons Power calculation (using FPC format)

NOTE:
Use Tag number only for valid tag numbers (i.e., RCV-8, SWV-34, DCH-99), otherwise; use Part number field (i.e., CSC14599, AC1459). If more space is required, write "See Attachment" and list on separate sheet.

DESIGN ENGINEER	DATE	VERIFICATION ENGINEER	DATE	SUPERVISOR, NUCLEAR ENG	DATE
John D. Shubert, Jr.	9-15-97	Patrick A. McCarraher	9-22-97	Dan Jopling	9-22-97

cc: Nuclear Projects (If MAR/CGWR/PEERE Return to Service Related) ☐ Yes ☒ No
Supervisor, Config. Mgt. Info.
Mgr., Nucl. Operations Eng. (Original) w/attach

Calculation Review form Part III actions required ☒ Yes ☐ No
(If Yes, send copy of the form to Nuclear Regulatory Assurance and a copy of the Calculation to the Responsible Organization(s) identified in Part III on the Calculation Review form.)

3/03 HJ
KBK

Rev. 3/97

Florida Power Corporation

ANALYSIS/CALCULATION SUMMARY

A-C-SUM.FRM

DOCUMENT IDENTIFICATION NUMBER	DISCIPLINE S	CONTROL NO. 95-0082	REVISION LEVEL 2

TITLE

6th Tendon Surveillance - Generation of Tendon Force Curves

CLASSIFICATION (CHECK ONE)
- [x] Safety Related
- [ ] Non Safety Related

MAR/SP/CGWR/PEERE NUMBER
n/a

VENDOR DOCUMENT NUMBER
n/a

	APPROVAL SIGNATURES	PRINTED NAME
Design Engineer	JCD Shubert Jr	John D. Shubert, Jr.
Date	9-15-97	
Verification Engineer	Patrick A. McCarraher	PATRICK A. McCARRAHER
Date	9-22-97	
Supervisor	D. Joplin	D. JOPLIN
Date	9-22-97	

ITEMS REVISED

(see "Revision Description Sheet" for revision 2)

PURPOSE SUMMARY

Determine Tendon Force losses and prepare Tendon Force Curves for Tendons for 6th Surveillance Inspection.

RESULTS SUMMARY

Force Curves are plotted and attached.

Rev. 3/97

Florida Power CORPORATION

CALCULATION REVIEW

CALC.REV.FRM

CALCULATION NO./REV.
S 95-0082 Revision 2

PART I - **DESIGN ASSUMPTION/INPUT REVIEW: APPLICABLE** ☐ Yes ☒ No

The following organizations have reviewed and concur with the design assumptions and inputs identified for this calculation:

Nuclear Plant Technical Support System Engr ______________ Signature/Date

Nuclear Plant Operations ______________ Signature/Date

OTHER(S)

______________ ______________ Signature/Date

______________ ______________ Signature/Date

PART II - **RESULTS REVIEW: APPLICABLE** ☐ Yes ☒ No

The following organizations have reviewed and concur with the results of this calculation and understand the actions which the organizations must take to implement the results.

Nuclear Plant Technical Support System Engr ______________ Signature/Date

Nuclear Plant Operations ______________ Signature/Date

Nuclear Plant Maintenance ☐ Yes ☐ N/A ______________ Signature/Date

Nuclear Licensed Operator Training ☐ Yes ☐ N/A ______________ Signature/Date

Manager, Site Nuclear Services ☐ Yes ☐ N/A ______________ Signature/Date

Sr. Radiation Protection Engineer ☐ Yes ☐ N/A ______________ Signature/Date

OTHERS:

______________ ______________ Signature/Date

______________ ______________ Signature/Date

Florida Power CORPORATION

CALCULATION REVIEW

CALCULATION NO./REV.
S 95-0082 Revision 2

PART III - CONFIGURATION CONTROL: APPLICABLE ☒ Yes ☐ No

The following is a list of Plant procedures/lesson plans/other documents and Nuclear Engineering calculations which require updating based on calculation results review:

Document	Date Required	Responsible Organization
SP-182	11-1-97	Nuclear Engineering Programs

Upon completion, forward a copy to the Manager, Nuclear Regulatory Assurance Group for tracking of actions if any items are identified in Part III. If calculations are listed, a copy shall be sent to the original file and the calculation log updated to reflect this impact.

PART IV - NUCLEAR ENGINEERING DOCUMENTATION REVIEW

The responsible Design Engineer must thoroughly review the below listed documents to assess if the calculation requires revision to these documents. If "Yes," the change authorizations must be listed below and issued concurrently with the calculation.

Document	Yes	No	Reference
Enhanced Design Basis Document	☐	☒	(TC#)
FSAR	☐	☒	(Letter#)
Improved Tech. Specification	☐	☒	(Letter#)
Improved Tech. Spec. Bases	☐	☒	(Letter#)
Config. Mgmt. Info. System	☐	☒	(CIOP#)
Analysis Basis Document	☐	☒	(TC#)
Design Basis Document	☐	☒	(TC#)
Appendix R Fire Study	☐	☒	(TC#)
Fire Hazardous Analysis	☐	☒	(TC#)
NFPA Code Conformance Document	☐	☒	(TC#)
Vendor Qualification Package			(VQP#)
Topical Design Basis Doc.	☐	☒	(TC#)
E/SQPM	☐	☒	(TC#)

Other Documents reviewed:

Document	Yes	No	(CHANGE DOC. REFERENCE)
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	

PART V - PLANT REVIEWS/APPROVALS FOR INSTRUMENT SETPOINT CHANGE

PRC/DNPO approval is required if a setpoint is to be physically changed in the plant through the NEP 213 process.

PRC Review Required ☐ Yes ☒ No

PRC Chairman /Date

DNPO Review Required ☐ Yes ☒ No

DNPO /Date

DESIGN ENGINEER/DATE	DESIGN ENGINEER - PRINTED NAME
[signature] 9-15-97	John D. Shubert, Jr.

Florida Power CORPORATION

CALCULATION VERIFICATION REPORT

Crystal River Unit 3

CALVERRP.FRM

CALCULATION NUMBER
S 95-0082 Revision 2
PROJECT/TITLE
6th Tendon Surveillance - Generation of Tendon Force Curves

	YES	NO	N/A	
1.	☒	☐	☐	Are inputs, including codes, standards, regulatory requirements, procedures, data, and Engineering methodology correctly selected and applied?
2.	☒	☐	☐	Have assumptions been identified? Are they reasonable and justified? (See NEP 101, V.c, for discussion on references).
3.	☒	☐	☐	Are references properly identified, correct, and complete? (See NEP 101, V.c., for discussion on assumptions and justification.)
4.	☒	☐	☐	Have applicable construction and operating experiences been considered?
5.	☒	☐	☐	Was an appropriate Design Analysis/Calculation method used?
6.	☐	☐	☒	In cases where computer software was used, has the program been verified or reverified in accordance with NEP 135 for safety related design applications and/or are inputs, formulas, and outputs associated with spreadsheets accurate?
7.	☒	☐	☐	Is the output reasonable compared to inputs?
8.	☒	☐	☐	Has technical design information provided via letter, REA, IOC or telecon by other disciplines or programs been verified by that discipline or program?
9.	☒	☐	☐	Has technical design information provided via letter or telecon from an external Engineering Organization or vendor been confirmed and accepted by FPC?
10.	☐	☒	☐	Do the calculation results indicate a non-conforming condition exists? If "Yes," immediately notify the responsible Supervisor.
11.	☐	☒	☐	Do the results require a change to other Engineering documents? If "Yes," have these documents been identified for revision on the Calculation Review Form?

I have performed a verification on the subject calculation package and find the results acceptable.

VERIFICATION ENGINEER	DATE	SUPERVISOR, NUCLEAR ENGINEERING	DATE
Patrick A. McCanahy	9-22-97	[signature]	9-22-97

MAR 19 1997

Florida Power CORPORATION

INTEROFFICE CORRESPONDENCE

Nuclear Engineering Design	NA1E	240-3568
Office	MAC	Telephone

SUBJECT: Crystal River Unit 3
Quality Document Transmittal - Analysis/Calculation

TO: Records Management - NR2A

The following analysis/calculation package is submitted as the QA Record copy:

DOCNO (FPC DOCUMENT IDENTIFICATION NUMBER)	REV.	SYSTEM(S)	TOTAL PAGES TRANSMITTED
S-95-0082	1	MX	~~139~~ 138 3-17-97

TITLE
6th Tendon Surveillance - Generation of Tendon Force Curves

KWDS (IDENTIFY KEYWORDS FOR LATER RETRIEVAL)
Tendon Surveillance

DXREF (REFERENCES OR FILES - LIST PRIMARY FILE FIRST)
SP-182

VEND (VENDOR NAME)	VENDOR DOCUMENT NUMBER (DXREF)	SUPERSEDED DOCUMENTS (DXREF)
FPC (from Parsons Power)	N/A	N/A

TAG

PART NO.

COMMENTS (USAGE RESTRICTIONS, PROPRIETARY, ETC.)
Parsons Power calc revision using FPC format.

NOTE:
Use Tag number only for valid tag numbers (i.e., RCV-8, SWV-34, DCH-99), otherwise; use Part number field (i.e., CSC14599, AC1459). If more space is required, write "See Attachment" and list on separate sheet.

DESIGN ENGINEER	DATE	VERIFICATION ENGINEER	DATE	SUPERVISOR, NUCLEAR ENG.	DATE
[signature]	3-12-97	N/A		[signature]	3-17-97

cc: MAR Office (If MAR Related) ☐ Yes ☒ No
Mgr. Nucl. Config. Mgt.
Mgr., Nucl. Eng. Design
(Original) w/attach

Plant Document Updates Required ☐ Yes ☒ No (If Yes, send copy of the Calculation Review form to Nuclear Licensing and a copy of the Calculation to the Responsible Organization(s) identified in Part II on the Calculation Review form.)

A/E ________________ ☐ Yes ☒ No
(If yes, Transmit w/attach)

Florida Power Corporation

ANALYSIS/CALCULATION SUMMARY

DOCUMENT IDENTIFICATION NUMBER	DISCIPLINE	CONTROL NO.	REVISION LEVEL
	STRUCTURAL	S-95-0082	1

TITLE

PREPARATION OF TENDON FORCE CURVES FOR 6TH TENDON SURVEILLANCE INSPECTION

CLASSIFICATION (CHECK ONE)

- [X] Safety Related
- [ ] Non Safety Related

MAR/SP/CGWR/PEERE NUMBER

VENDOR DOCUMENT NUMBER

	REVISION APPROVALS	ITEMS REVISED
Design Engineer	Rusha Chang	SEE PAGE 1 OF THIS REVISION FOR DETAILED LIST
Date	1/20/97	OF CHANGES.
Verification Engineer	Patrick A. McCumaley	
Date/Method*	2/5/97 | R	
Supervisor	Samir J. Serhan	
Date	10 Feb. 97	

*VERIFICATION METHODS: R - Design Review; A - Alternate Calculation; T - Qualification Testing

DESCRIBE BELOW IF METHOD OF VERIFICATION WAS OTHER THAN DESIGN REVIEW

PURPOSE SUMMARY

DETERMINE TENDON FORCE LOSSES AND PREPARE TENDON FORCE CURVES FOR TENDONS FOR 6TH SURVEILLANCE INSPECTION

RESULTS SUMMARY

FORCE CURVES ARE PLOTTED AND ATTACHED

PARSONS POWER GROUP INC. a combination of Gilbert Commonwealth and Parsons Main

2675 Morgantown Road • Reading PA 19607 • (610) 855-2000 • Fax (610) 855-2001

February 11, 1997

FCS-14771
Contract N00821AD, WA048

Mr. W. W. Nisula
Contract Manager
Florida Power Corporation (NA1B)
15760 West Power Line Street
Crystal River, FL 34428-6708

Attention: Mr. J. Lese

Re: Crystal River Unit 3
6th Tendon Surveillance Force Curve
Calculation

Dear Mr. Nisula:

Please find attached calculation S-95-0082 Revision 1, which documents the generation of the tendon force curves to accommodate the proposed inspection date of early March 1997.

Included are disks with related electronic files used in the preparation of the data and force curves.

Should there be any questions please feel free to contact Dr. Samir Serhan at (610) 855-3209.

Very truly yours,

Samir J. Serhan, Ph.D., P.E.
Supervising Engineer

Roy W. Adler
Project Manager

RWA/SJS/bmb

Attachment

cc: W. W. Nisula (NA1B)
D. L. Jopling (NA1E)
J. A. Lese (NA1E)
R. E. Vaughn
FPC Records Management (CL Only)
R. W. Adler(2)
P. J. Hamilton
S. J. Serhan

S-95-0082
Revision #1
Cover Letter for Info

PARSONS

Florida Power CORPORATION

INTEROFFICE CORRESPONDENCE

Office	MAC	Telephone
Nuclear Engineering	NA1E	240-3568

SUBJECT: Crystal River Unit 3
Quality Document Transmittal - Analysis/Calculation

TO: Records Management - NR2A

The following analysis/calculation package is submitted as the QA Record copy:

DOCNO (FPC DOCUMENT IDENTIFICATION NUMBER)	REV.	SYSTEM(S)	TOTAL PAGES TRANSMITTED
S-95-0082	0	MX	383

TITLE

6th Tendon Surveillance - Generation of Tendon Force Curves

KWDS (IDENTIFY KEYWORDS FOR LATER RETRIEVAL)

Tendon Surveillance

DXREF (REFERENCES OR FILES - LIST PRIMARY FILE FIRST)

VEND (VENDOR NAME)	VENDOR DOCUMENT NUMBER (DXREF)	SUPERSEDED DOCUMENTS (DXREF)
FPC (from Parsons Power)	N/A	N/A

TAG

PART NO.

COMMENTS (USAGE RESTRICTIONS, PROPRIETARY, ETC.)

Force Curves for 6th Tendon Surveuillance

NOTE:
Use Tag number only for valid tag numbers (i.e., RCV-8, SWV-34, DCH-99), otherwise; use Part number field (i.e., CSC14599, AC1459). If more space is required, write "See Attachment" and list on separate sheet.

DESIGN ENGINEER	DATE	VERIFICATION ENGINEER	DATE	SUPERVISOR, NUCLEAR ENG.	DATE
J. A. Lee	4-26-96	N/A		B. Vitrantey	4/26/96

cc: MAR Office (If MAR Related) ☐ Yes ☒ No
Mgr. Nucl. Config. Mgt.
Mgr., Nucl. Eng. Design
(Original) w/attach

Plant Document Updates Required ☒ Yes ☐ No (If Yes, send copy of the Calculation Review form to Nuclear Licensing and a copy of the Calculation to the Responsible Organization(s) identified in Part II on the Calculation Review form.)

A/E ____________ ☐ Yes ☒ No
(If yes, Transmit w/attach)

CALCULATION REVIEW

CALCULATION NO./REV.

S-95-0082/Revision #0

PART I - DESIGN ASSUMPTION/INPUTREVIEW

The following organizations have reviewed and concur with the design assumptions and inputs identified for this calculation:

Nuclear Plant Technical Support System Engr — N/A
Signature/Date

Nuclear Plant Operations — N/A
Signature/Date

OTHER(S)

Signature/Date

Signature/Date

PART II - RESULTS REVIEW

The following organizations have reviewed and concur with the results of this calculation and understand the actions which the organizations must take to implement the results.

Nuclear Plant Technical Support System Engr — N/A
Signature/Date

Nuclear Plant Operations — N/A
Signature/Date

Nuclear Plant Maintenance
☐ Yes ☒ N/A
Signature/Date

Nuclear Licensed Operator Training
☐ Yes ☒ N/A
Signature/Date

Manager, Site Nuclear Services
☐ Yes ☒ N/A
Signature/Date

Sr. Radiation Protection Engineer
☐ Yes ☒ N/A
Signature/Date

OTHERS:

Signature/Date

Signature/Date

Florida Power

CALCULATION REVIEW

CALCULATION NO./REV.

S-95-0082/Revision #0

PART III - CONFIGURATION CONTROL

The following is a list of Nuclear Engineering and Plant procedures/lesson plans/other documents which require updating based on calculation results review:

Document	Date Required	Responsible Organization
SP-182	3/1/98	Nuclear Engineering Design
		(A. Petrowsky)

Upon completion, forward a copy to the Manager, Nuclear Licensing for tracking of actions if any items are identified in Part III.

PART IV - PLANT REVIEWS/APPROVALS FOR FIELD SETPOINT CHANGE

PRC review is required if a full 10CFR50.59 Safety Evaluation is performed. DNPO approval is required if a setpoint is to be physically changed in the plant.

PRC Review Required ☐ Yes ☒ No

PRC Chairman /Date

DNPO Review Required ☐ Yes ☒ No

DNPO /Date

DESIGN ENGINEER/DATE 4.26.96

Florida Power Corporation

ANALYSIS/CALCULATION SUMMARY

DOCUMENT IDENTIFICATION NUMBER	DISCIPLINE STRUCTURAL	CONTROL NO. S-95-0082	REVISION LEVEL 0

TITLE	CLASSIFICATION (CHECK ONE)
PREPARATION OF TENDON FORCE CURVES FOR 6TH TENDON SURVEILLANCE AND SUPPORT OF SP-182.	Safety Related ✓ Non Safety Related
	MAR/SP/CGWR/PEERE NUMBER
	VENDOR DOCUMENT NUMBER

	REVISION APPROVALS		ITEMS REVISED
Design Engineer	Ruoka Chang		INITIAL ISSUE
Date	4/15/96		
Verification Engineer	M. Marcellus		
Date/Method*	4/15/96	R	
Supervisor	Sami J. Jordan		
Date	22 April 96		

*VERIFICATION METHODS: R - Design Review; A - Alternate Calculation; T - Qualification Testing

DESCRIBE BELOW IF METHOD OF VERIFICATION WAS OTHER THAN DESIGN REVIEW

PURPOSE SUMMARY

DETERMINE TENDON FORCE LOSSES & PREPARE TENDON FORCE CURVES FOR TENDONS FOR NEXT SURVEILLANCE. ALSO PREPARE SUPPORTING CALCULATIONS FOR SP-182 ENCLOSURE 30.

RESULTS SUMMARY

FORCE CURVES ARE PLOTTED & ATTACHED. CALCULATIONS SUPPORTING SP-182 ARE ATTACHED

Florida Power CORPORATION

DESIGN ANALYSIS/CALCULATION

Crystal River Unit 3

DESA-C.FRM

DOCUMENT IDENTIFICATION NO.	REVISION
S-95-0082	3

Revision No.: 3 This page followed by page 1A

The following items have been revised in the current revision:

Revised Pages	Affected Sections	Add	Replace	Remove	Description/Purpose of Revision
1		X			add "Revision Description Sheet" for revision 3
1A			X		change page number on revision 2 "Revision Description Sheet" from page 1 to page 1A and state that "page 1B follows"
1B			X		change page number on revision 1 "Revision Description Sheet" from page 1A to page 1B and state that "page 1C follows"
1C			X		change page number of Table of Contents from page 1B to page 1C and add item for Revision 3 Description Sheet
11			X		change data input file names to correspond to current names (i.e. DOMER3.XLW, etc) and add note
20			X		change data input file name to correspond to current name (DOMER3.XLW), add data for Tendons D111, D302, D306 and state that "page 20A follows"
20A-20B		X			add spreadsheet and curve for Tendon D111
49			X		state that "page 49A follows"
49A-49B		X			add spreadsheet and curve for Tendon D302
55			X		state that "page 55A follows"
55A-55B		X			add spreadsheet and curve for Tendon D306
63-64			X		change data input file name to correspond to current name (HOOPER3.XLW) and add data for Tendons 42H29, 42H30, 42H34 thru 42H37, 51H28, 52H29, 62H39, 62H43 and 62H44
70			X		state that "page 70A follows"
70A-70D		X			add spreadsheets and curves for Tendons 42H29 and 42H30
76			X		state that "page 76A follows"
76A-76H		X			add spreadsheets and curves for Tendons 42H34 thru 42H37
94			X		state that "page 94A follows"
94A-94D		X			add spreadsheets and curves for Tendons 51H28 and 51H29
112			X		state that "page 112A follows"
112A-112B		X			add spreadsheet and curve for Tendon 62H39
118			X		state that "page 118A follows"
118A-118D		X			add spreadsheets and curves for Tendons 62H43 and 62H44
159			X		include "Original Stresses data" for Tendons D111, D302 and D306 and change data input file name to correspond to current name (DOMER3.XLW)
160			X		include "Original Stresses data" for Tendons 42H29, 42H30, 42H34 thru 42H37, 51H28, 52H29, 62H39, 62H43 and 62H44 and change data input file name to correspond to current name (HOOPER3.XLW)
B94-B110		X			add Tendon History Sheets for Tendons D111, D302, D306, 42H29, 42H30, 42H34 thru 42H37, 51H28, 52H29, 62H39, 62H43 and 62H44
K2			X		change data input names to correspond to current names (i.e. DOMER3.XLW, etc...) and add note

REVISION TYPE: ☐ Superseded by Calculation Number ______________
(check one) ☐ Full Revision ☒ Page for Page

Florida Power Corporation

DESIGN ANALYSIS/CALCULATION

Crystal River Unit 3

DESA-C.FRM

DOCUMENT IDENTIFICATION NO.	REVISION
S-95-0082	3

Revision No.: 2 This page followed by page 1B

The following items have been revised in the current revision: R3

Revised Pages	Affected Sections	Add	Replace	Remove	Description/Purpose of Revision
1		X			add "Revision Description Sheet" for revision 2
1A			X		change page number on revision 1 "Revision Description Sheet" from page 1 to page 1A and state that "page 1B follows"
1B			X		change page number of Table of Contents from page 1A to page 1B and add item for Revision 2 Description Sheet
3			X		change start date from Spring 1997 to Fall 1997
8			X		change start date from Spring 1997 to Fall 1997
9			X		change reference to Enclosure 30 to just state "Original Stressing Data"
10			X		change start date from March 1997 to November 1997 and change numerical values to correspond to November 1997
11			X		change data input file names to correspond to current names (i.e. DOMER2.XLW, etc...)
18			X		revise the discussion about the interpolation between data on the spreadsheets
20			X		change data input file name to correspond to current name (DOMER2.XLW)
21			X		revise spreadsheet for November 1997 start date
23-61			X		revise spreadsheets and curves for November 1997 start date
64			X		change data input file name to correspond to current name (HOOPER2.XLW)
65-124			X		revise spreadsheets and curves for November 1997 start date
126			X		change data input file name to correspond to current name (VERTR2.XLW)
127-156			X		revise spreadsheets and curves for November 1997 start date
157			X		change reference to Enclosure 30 to just state "Original Stressing Data" and Enclosure 29 to just state "data sheets"
159-161			X		change reference to Enclosure 30 to just state "Original Stressing Data" and change data input file names to correspond to current names (i.e. DOMER2.XLW, etc...)
162			X		change reference to Enclosure 30 to just state "Original Stressing Data" and Enclosure 29 to just state "data sheets"
K2			X		change data input file names to correspond to current names (i.e. DOMER2.XLW, etc...)

REVISION TYPE: (check one)

☐ Superseded by Calculation Number ____________

☐ Full Revision ☒ Page for Page

Revision No.: 1

This page followed by page 1C

R3

This form shall be used to record the purpose or reason for the revision, indicate the revision pages and/or affected sections and give a short description of the revision. Check (X) the appropriate function to add, replace or remove the affected pages.

Revised Pages	Affected Sections	Add	Replace	Remove	Description/Purpose of Revision
1		X			Add revision description sheet.
1A			X		Change page number from 1 to 1A. Add item for revision description sheet.
3			X		To change start date for the 6th surveillance inspection from March 1998 to March 1997
10			X		To change start date for the 6th surveillance inspection from March 1998 to March 1997
18			X		To change start date for the 6th surveillance inspection from March 1998 to March 1997
21			X		To change start date for the 6th surveillance inspection from March 1998 to March 1997
23-61			X		To change start date for the 6th surveillance inspection from March 1998 to March 1997
65-124			X		To change start date for the 6th surveillance inspection from March 1998 to March 1997
127-156			X		To change start date for the 6th surveillance inspection from March 1998 to March 1997
~~K1~~			~~X~~		~~[illegible]~~

REVISION TYPE: [ ] SUPERSEDED BY CALCULATION NUMBER

(check one) [ ] FULL REVISION [X] PAGE FOR PAGE

R3

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R3

1.0 PURPOSE AND OBJECTIVE

File CR3C6TSP.DOC (Word 6.0)

The purpose of this calculation is to provide tendon force curves for Florida Power Corporation for the Crystal River Unit 3 facility in support of the upcoming 6th tendon surveillance period scheduled for the Fall of 1997. Specific tasks to be performed as part of this scope include the following: R2

A.) Determine the predicted tendon losses and develop force/time curves for each of the selected tendons for the upcoming sixth surveillance period. Generate the tendon force curves for the selected tendons, the tendons adjacent to the selected tendons, and alternate tendons. Alternate tendons are tendons not specifically scheduled for this surveillance but force curves are prepared to be available in case a substitute tendon should be required during the surveillance. In addition, force curves for a group of tendons deferred/exempted from the previous surveillance will also be prepared. These are discussed in detail in Section 5.0.

B.) In addition to the force curve development, other calculations which are required to support Enclosures included within Surveillance Procedure SP-182 will also be prepared within this same calculation.

2.0 DESIGN INPUT

Design input information has been reviewed and is included as Attachment A to this calculation. Note that there are no significant changes to the basic criteria and related documentation which address the licensing of the CR3 plant with respect to the tendon surveillance program. The previous surveillance efforts completed various studies and addressed the CR3 tendon program and its' compliance with U.S. Regulatory Guide 1.35, Revision 3, since it was formally issued in July 1990. Based on FPC licensing efforts and Technical Specification revisions performed at the time of the last surveillance period, as well as recent discussions with the NRC, FPC has now committed the CR3 tendon surveillance program to be performed in accordance with U.S. NRC Regulatory Guide 1.35, Revision 3 (Reference 3).

U.S. Regulatory Guide 1.35.1, Revision 0 (Reference 4) is a daughter document referred to by the above Reg. Guide and deals specifically with the calculation of individual tendon losses and the generation of tendon force curves. While calculation efforts for the CR3 tendon force curves have followed closely with both of these Regulatory Guides as they evolved through the 1970's and 1980's, the format and current procedure for the preparation of the force curves is not in exact compliance with Regulatory Guide 1.35.1 Revision 0 as issued in 1990. The method and approach used in the generation of the CR3 force curves is superior to that of the Reg. Guide in that a specific curve is generated for each individual tendon. Based on the discussions held with the NRC and the results of their review, the method and approach used for these calculations shall be the same as used for previous surveillances. See the Attachment A information for further discussion and references to recent correspondence and documentation with the NRC on various issues related to the tendon surveillance program.

Applicable Technical Specification sections, as well as FSAR sections were also reviewed for this effort. They support the position noted above on the FPC commitment to R.G. 1.35, Rev. 3 and are discussed and referenced within the Attachment A information.

3.0 COMPUTER CODES

This calculation package is being prepared using Microsoft Word, Version 6.0 and Microsoft Excel, Version 5.0. Spreadsheets from earlier surveillance efforts were prepared using Lotus 123, Release 2.01 and 3.0 and were converted to Excel format for this calculation. All input and calculations are manually checked and verified, therefore, verification of computer programs is not applicable or necessary.

4.0 ASSUMPTIONS

Any assumptions made are noted and contained within the calculation package. None require future confirmation.

5.0 SCOPE AND TENDON SELECTION

Tendons were selected for the sixth surveillance period in accordance with the requirements of Reg. Guide 1.35, Revision 3 and using the same methodology as was used in the past surveillance. Basically, a random but representative sample was selected and checked at the site for accessibility. Specific criteria used for this selection process is summarized as follows:

<u>Tendon Selection Process</u>

The tendon selection process has remained the same as that completed for the last several surveillances where a random but representative sample is selected for inspection and testing. The intent is to get as many new and never tested tendons in the sample population, but still keeping one control tendon from each major tendon group to be investigated in each surveillance. Note that this current method differs from methods used during the early life of the plant where some tendons were repeated for inspection every third surveillance. Basically, the selection criteria and process used considers the following:

1.) Select tendons based on Reg. Guide 1.35 Revision 3
Based on the good results of prior surveillances, the Reg. Guide requires a minimum of 11 tendons to be inspected, including 5 hoop, 3 vertical and 3 dome. Tendons should be selected which were never previously inspected or tested. Previously detensioned and retensioned tendons should not be included (unless there is a specific need to investigate the tendon per item 3 below). In addition to being selected at random, tendon selection should be representative of various areas and conditions. For example, the hoop tendons selection was based on random selection but also considered what tendons were inspected in the past and in what hoop area. A plot of previously inspected hoop tendons was prepared to track tendons inspected by grouping (i.e. 13's, 42's, 35's, 46's, 51's, and 62's). Therefore, the selection process considered those sections not equally represented by as many tendons as completed within other sections from prior surveillances. See Attachment J for various plots and information of the hoop group. The same procedure was applied to the dome group (i.e. 100's, 200's & 300's groups) and to the vertical group (i.e. 12's, 23's, 34's, 45's, 56's & 61's & quadrants). See Attachment D for groups information.

2.) Maintain Control Tendons to be completed each surveillance.
The Reg. Guide also requires a control tendon from each group to be inspected every surveillance for comparative purposes. CR3 has not had control tendons since the first surveillance. The concept was introduced probably in the fourth surveillance. Tendons D212, 12V1 and 51H26 were probably the original control tendons since about the time of the fourth surveillance. They were intended to be inspected during the fifth surveillance but the group of tendons selected was based on the surveillance being performed during an outage. FPC decided to complete the 5th surveillance during normal plant operation and the original tendons selected were affected because many tendons were located within the area of the plant steam vent zone. This included the above three control tendons, and three new control tendons, D215, 34V6 and 46H29 were selected for completion of that surveillance. A problem with 46H29 during the 5th surveillance forced the selection of another control tendon, 46H21, for the hoop group. New control tendons may need to be selected periodically if the tendon has a problem and is ever detensioned and/or retensioned. As earlier surveillances on CR3 did repeat some tendons, the selection of these other control tendons was easily done from several good candidates. New control tendons should be selected from those previously inspected as far back as possible and cannot be one previously detensioned and/or retensioned. A tendon inspected in more than one prior surveillance is preferred.
Based on the above, it is recommended that both of the above two sets of control tendons be used by FPC as control tendons, with one set of three to be utilized in the 6th surveillance during a plant outage, and for the other three to be used in any future inspections scheduled to be performed on-line.

3.) Consider any tendons with problems or abnormal conditions as reported by plant personnel.
Any leaking tendons or tendons with any reported problems should be considered within the scope of the surveillance. Also, past inspection reports and records should be checked for open items, recommendations, or noted problem tendons.

4.) In the selection of tendons for detensioning, (one per group is required per R.G.) consider the number of effective wires as recorded in the tendon history sheets and summarized in the effective wire summary in Attachment D to this calculation. As any tendon is to be considered ineffective if it has less than 155 effective wires per the FSAR, it is therefore not desirable to select a tendon with many missing, cut or ineffective wires. Unless there was a specific need to detension that particular tendon, doing so could therefore render the entire tendon as out of service. Only a maximum of 3 tendons are allowed out of service at one time per criteria in the FSAR.

5.) The reduced force dome tendons are not normal candidates for normal liftoff testing per SP-182, Enclosure 8.

6.) Tendons adjacent to the selected tendon may require testing and should also be feasible to inspect and test. Adjacent tendons in the dome should not include any reduced force dome tendons. Jump to the next regular dome tendon for the required adjacent tendon. Also, adjacent tendons of the lowest hoop tendons (#1) shall be considered as the two directly above the selected tendon. Adjacent tendons of the highest hoop tendons (#47) shall be considered as the two directly below the selected tendon.

7.) One alternate tendon should be selected from each group, and the two adjacent tendons of these alternates at least considered for possible inclusion.

In addition to the above selection criteria, there are several other factors which have influenced the scheduling of actual field inspection and testing. These include:

A.) Steam Vent Zone -
Plant steam venting can impose a safety hazard to personnel during plant operation and early modes of shutdown. Tendon work in the range between 0 and 120 degrees is affected during plant operation by the potential steam venting of the plant. Tendon work in this area must be held off until the potential hazard is eliminated or other approval is obtained from plant operations. Note that for the fifth surveillance per FPC operations, this even includes the outside tendon caps of the affected butresses at 0 and at 120 degrees.

B.) Fuel Pool Area -
Work over the fuel pool can only be performed while missile shields are in place. (Nureg 0612 reqmt.)

C.) Plant Interior Work -
Work inside some plant areas is difficult due to access problems, high radiation areas, interferences, ram accessibility, etc.

Deferred/Exempted Tendons

After the tendons were selected for the fifth surveillance for an outage surveillance, it was decided that the 5th surveillance would be completed during normal plant operation. A group of tendons originally selected for inspection during that surveillance had to be exempted from that surveillance due to their proximity to the main steam vent zone and the associated hazards with working in that area. FPC discussed this issue with the NRC and has documented the following 8 tendons as deferred tendons:

EXEMPTED TENDON	COMMENTS
D115	Never inspected in any surveillance.
D212	Inspected in Surveillance 3 and 4. Considered as Control Tendon for outage condition.
D311	Never inspected in any surveillance.
12V1	Previously included for liftoff testing in the 3rd and 4th surveillances. Considered as Control Tendon for outage condition.
42H44	Never inspected in any surveillance.
51H26	Previously included for liftoff testing in the 3rd and 4th surveillances. Considered as Control Tendon for outage condition.
53H46	Never inspected in any surveillance.
62H46	Never inspected in any surveillance.

As FPC has committed to the NRC to address the above tendons within the upcoming 6th surveillance, these tendons were considered in the scope of this calculation. The 6th surveillance is scheduled to be completed during an outage. Since three of the above exempted tendons were also previous control tendons, it was considered that these tendons can again be used as control tendons for this surveillance instead of the 3 control tendons used in last surveillance (when the surveillance was done on-line). Therefore, the three exempted control tendons can be considered as three of the 11 tendons required per Reg. Guide. A total of 16 tendons should be inspected during the surveillance with three additional alternates selected. Note however that the scope of this calculation will include force curves to be regenerated for the other control tendons, D215, 34V6 and 46H21.

A complete historical record of all tendons included in all prior surveillances, along with the list of selected adjacent, exempted and alternate tendons which are planned for in the 6th surveillance is provided on the following Table.

Florida Power Corporation

DESIGN ANALYSIS/CALCULATION

Crystal River Unit 3

DOCUMENT IDENTIFICATION NO. Calculation S-95-0082

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REVISION 2

********** CR3 TENDON SURVEILLANCE HISTORICAL RECORD **********

8-Sep-97
FILE-CR3R6TSP.XLS

TENDONS INSPECTED THROUGH THE 5TH SURVEILLANCE & PLANNED FOR IN 6TH SURVEILLANCE

SURVEILLANCE PERIOD	1ST SURVEILLANCE 11/27/77 TO 2/9/78		2ND SURVEILLANCE 3/5/80 TO 5/9/80		3RD SURVEILLANCE 9/28/81 TO 12/7/81		4TH SURVEILLANCE 9/15/87 TO 11/17/87		5TH SURVEILLANCE 11/93 TO 1/94		PLANNED 6TH SURVEILLANCE FALL 1997		PRIOR TENDON INSPECTION SUMMARY DATA
YEARS AFTER SIT SIT 11/76	1 YEAR		3.5 YEARS		5 YEARS		11 YEARS		17 YEARS		21 YEARS		
REQUIRED TO INSPECT	21 TOT-10H,6V,5D		21 TOT-10H,6V,5D		21 TOT-10H,6V,5D		11 TOT-5H,3V,3D		11 TOT-5H,3V,3D		11 TOT-5H,3V,3D		83 TOT-40H,24V,21D
ACTUALLY INSPECTED	23 TOT-10H,7V,6D		22 TOT-10H,7V,5D		21 TOT-10H,6V,5D		11 TOT-5H,3V,3D		14 TOT-8H,3V,3D		INCL 8 DEFERRED		91 TOT-43H,26V,22D
SP BASIS	SP-5583, SP-5909		SP-182		SP-182		SP-182		SP-182		TOTAL = 16		
	SP-395, SP-6456		REV -		REV 4		REV 7		REV 10 & 11				
G/C REPORT DATE	3-27-80 & 4/80		5/80		5/19/82		3/10/88		5/94				
DOME TENDONS	D139		D122		D123		D105	D	D215	R,C	D212	R,C,E	22 DOME TENDONS
123 TOTAL	D215		D140		D215	R	D212	R,C	D231	D	D304	D	INSPECTED
3 GROUPS OF 41	D221	D	D208	D	D212		D328		D224	A	D113		TO DATE
D100'S, D200'S, D300'S	D228		D323		D322	D					D115	E	
	D234		D331		D329						D311	E	
	D340										D131	A	
VERTICAL TENDONS	12V19		12V12		12V1		12V1	R,C	34V6	R,C	12V1	R,C,E	26 VERT. TENDONS
144 TOTAL	12V20		12V20	R	34V6	R	34V4		56V15	D	61V21	D	INSPECTED
6 GROUPS OF 24	12V21		23V5		34V19	D	56V2	D	61V14		23V2		TO DATE
12, 34, 56, 23, 45, 61	23V15		34V1		45V16						61V10	A	
	34V6		45V6		56V11								
	45V3	D	56V20		61V5								
	56V1		56V1	D,R									
HORIZONTAL TENDONS	13H10		53H22		13H19	R	13H20		35H1		51H26	R,C,E	43 HOOP TENDONS
282 TOTAL	13H19		53H32	D	13H46		13H40	D	42H1		42H18		INSPECTED
6 GROUPS @ 47 HIGH	13H37		53H43		42H20		51H26	R	46H21	C(New)	42H32		TO DATE
13, 24, 35, 46, 51, 62	13H47		51H10		42H46		51H41		46H28	ADJ.,T	42H44	E	
3 TENDONS PER HOOP	51H11		51H23		51H26		46H19		46H29	R,C(OLD),D	62H22		
	62H19		51H37		51H45				46H30	ADJ.	62H41	D	
	46H21		53H24		53H35				46H17	D	62H46	E	
	46H29		53H28		53H40				62H1		53H46	E	
	46H37	D	53H44		62H34						53H2	A	
TOTAL TENDONS = 549	46H46		46H42		46H10	D							
TOTAL INSPECTED	23		22		21		11		14		16 + 3 ALT.		91 TOTAL INSPECTED

LEGEND - A, ALTERNATE; ADJ.,ADJACENT; C, CONTROL; D, DETENSIONED & RETENSIONED; E, EXEMPTED/DEFERRED FROM 5TH SURV.; R, REPEATED; T, RETENSIONED

R2

6.0 CALCULATIONS

6.1 General Background and Schedule Information

General Background

Tendon forces curves are to be prepared for the upcoming 6th tendon surveillance period at CR3. From the basic criteria as presented in the Design Input Section, as well as from several discussions with Mr. Joe Lese of Florida Power & Light, it was determined that the criteria for this surveillance period has not changed since the last surveillance efforts. A review of Tech Spec and FSAR criteria confirms the FPC positions with respect to the tendon program. Supporting work for this surveillance period will be based on the same criteria that was used and accepted in the previous surveillance periods.

Tendon losses have been calculated in the past per the Reference 8, 9, 10 and 11documentation. Individual tendon losses include the following:

- Force loss due to elastic shortening of the containment as a result of the prestressing process and the particular sequence of tendon stressing.
- Force loss due to the stress relaxation of the tendon wires.
- Loss of prestress force due to the creep characteristics of the concrete structure.
- Loss of prestress force due to the shrinkage of the concrete structure.

Based on some earlier calculations made for tendon losses per the Reference 11 document, Lotus spread sheet templates were prepared for tendon losses calculations for the 4th tendon surveillance calculations. See References 9 & 10. These templates were reran and tested for their accuracy and validity for the fifth surveillance. In addition, the procedure for the gathering of all input data was automated in the fifth surveillance to the format presented herein. Numerous test cases were ran to duplicate force curves prepared in the past. There were four master templates prepared for the fourth surveillance; one for the hoop tendons, one for the vertical tendons, and two for the dome tendons. The dome tendons are divided into two groups; one for tendons with an original stressing sequence below 27, and the other for tendons with stressing sequences above 27.

Based on the work previously accomplished in the prior surveillances, new spreadsheets were prepared this surveillance using Microsoft Excel for the collection of input data and for the calculation of tendon losses needed for generation of force curves. The generation of the force curves was also automated this surveillance by using Excel to plot the graphs. The organization of most data used for this calculation was setup into Excel workbooks with subfiles built and included in each workbook. There is a separate workbook for each of the three tendon groups and each one contains the following:

- Tabulated input data
- Original tendon stressing sequences.
- Effective wire summaries.
- "Original Stressing Data" calculations for SP-182.
- Separate files including each tendon loss spreadsheet, plot data and an individual force curve. R2

Additional information on electronic file names etc. used in this calculation is provided in Attachment K.

Schedule Information

The expected timing for the sixth surveillance is Fall 1997. A date of November 1, 1997 will be used as a bases for determining the predicted values of base, 95% base and 90% base and labeling this information on the force curves. This allows for field use and decisions to be made based on the requirements of Surveillance Procedure, SP-182. R2

The scales of the force curves are based upon previous surveillance efforts. The x axis is a log scale in time representing the time after average date of dome or wall concrete placement, in years. This scale is labeled at the top of each curve. Force curves are plotted using the actual log scale points for the x axis (not the scheduled surveillance years after SIT) versus the calculated tendon forces in kips on the y axis. The scale at the bottom of the curve for scheduled surveillance periods after SIT are for ease and readability relative to regular scheduled surveillances per Reg. Guide 1.35, Revision 3.

Most of the CR3 surveillances were performed on the regularly scheduled years, however, the 5th surveillance was actually performed in the 17th year after SIT. Note that the containment Structural Integrity Test (SIT) was performed in November 1976.

For the dome tendons force curves, the point on the bottom scale at SIT corresponds to the log scale at the top of 2.5 years. Therefore, a corresponding log scale data point must be determined for curve plotting for the period of the 6th surveillance.

Based on a date of November 1, 1997 for the Fall 1997 surveillance, the length of time between November 1976 (@ SIT) and November 1, 1997 is 21 years. Since the dome group at SIT is at year 2.5 on the log scale, the 6th surveillance will correspond to (21.0 + 2.5) or 23.5 years on the log scale. R2

The same procedure must be performed for the hoop and vertical groups as they have different reference points on the log scale for time after concrete wall placement. Both hoop and vertical groups are the same with SIT corresponding to year 4.4 on the log scale. Therefore, the 6th surveillance period will correspond to (21.0 + 4.4) or 25.4 years on the log scale. R2

A vertical line will be shown on the force curves at the point of the next surveillance and the calculated values of base, 95% base and 90% base representing points on the curves at that time will be included on each of the curves.

6.2 General Procedure for Force Curve Generation

The same procedure within the calculation for the preparation of the force curves for the fourth and fifth surveillance periods will be followed.

6.2.1 Preparation of Data Input Spreadsheets

In each of the Excel workbooks is a data input file where data from source calculations and current tendon history sheets has been tabulated. See DOMER3.XLW (DOMEINP), HOOPR3.XLW (HOOPINP) & VERTR2.XLW (VERTINP). R3

The compiled books of tendon surveillance historical information, as updated to include the results of the fifth surveillance, provide key input data for the development of force curves. See References 12, 13 & 14. The selected tendon history sheets related to this surveillance have been included herein as Attachment B of this calculation. The Reference 11 calculation is essentially a source calculation for this procedure with the Reference 8 & 10 calculations also providing information.

Notes and references related to the tabulation of the data on these spreadsheets are shown on the individual sheets. The data input tabulations are presented as the first sheet within the following Sections 6.3, 6.4 & 6.5.

6.2.2 Procedure for Determination of Individual Tendon Losses

The procedure for the tendon loss calculations, as derived from the reference documentation, is as follows:

1.) Calculate original force in the tendons

The original force in the tendons is determined as follows:

$$ORIG.FORCE = 0.7 * F_{UT} * \left[\frac{ActualLiftoff\ Pressure}{PredictedLiftoff\ Pressure}\right] \times WireFactor$$

Where:
f_{uh} = 240 Ksi, typical for all CR3 wires.

Wire area = 0.07685 in2 per Appendix F of the Reference 11 calculation.

F_{uh} (Kip Force)= Tendon Area (in2) x f_{uh} (Ksi) = 0.05985 * 240

Tendon Area (in2) = Area/Wire (in2) x No. of Wires. (Considered by wire factor.)

Actual and predicted original liftoff pressures are obtained from Tendon History Sheets References 12, 13, 14, with those within the scope of this calculation attached in Attachment B.

Refer to the Appendix F part of the Reference 11 calculation, for source data of above formula. The above expression was used as the basis for the calculations for all the shop and field end forces calculated on the Data Input Spreadsheets. This procedure does not apply to retensioned tendons.

Note that the wire factor as shown in the various spreadsheets is a value representing the tabulated number of effective wires over a total of 163. The number of wires is usually 163 unless cut, loose or considered ineffective. The number of effective wires as recorded from the original installation is documented on the tendon history sheets. The number of effective wires for each tendon has been updated, tabulated and presented in the Effective Wires Summary for each individual group within Attachment D. This tabulation was updated to include the results of all previous surveillances. It does not imply each of the tendons was specifically checked for the numbers of effective wires as presented in the table. It represents only data from the original records and as made available from surveillance records and subsequent inspections.

Note that the wire factor used is based on current information and is not based on the number of wires at the time of original installation, therefore the original Force calculated may not be the "original force" in the tendon back at that time. The effect of less effective wires lowers the curve vertically. This is insignificant at the current time as the curve of interest will be correct for use at this time. Another method would have been to plot the original value using the wire factor then and then to show a step down on the curve should a lower wire factor occur at some point later on the graph.

2.) Calculate Elastic Shortening Losses

The elastic shortening losses are a function of the stressing sequence number for the individual tendon. In addition, the tendon wire factors are also considered and used. The base expression used to calculate these forces is the same as used in previous calculations and is already built into the basic spreadsheet templates. All the equations for elastic shortening were confirmed as being the same as established in prior calculations. Based on the review of the procedure for calculating these losses, it is concluded that the existing templates are still appropriate and correct with the additional input of stressing sequence data and wire factors to be input for the current group of tendons for this surveillance.

Reference 10 & Reference 11 data and information on elastic shortening was included in Attachment E to these calculations. See Attachment C for original stressing sequences for all tendons and see the Data Input Worksheets & Attachment D information for tendon wire factors and source data.

Elastic Shortening Losses for Dome Tendons

Note there are two expressions used for elastic shortening for the dome tendons depending on the stress sequence numbers. For dome tendons in sequences 1 through 27, the Domelow template is used. For dome tendons in sequences 28 through 32, the Domehigh template is to be used. This is because of the two separate expressions used for the calculation.

Elastic Shortening Losses-
For Dome Tendons in Sequences 1 through 27-

N = 27 Total Sequences
n = Sequence of particular tendon.

Force Loss due to elastic shortening = F_{les}

$$F_{les} = \left[\frac{N-n}{N} \times 82.7 + 75\right] \times WireFactor$$

Elastic Shortening Losses-
For Dome Tendons in Sequences 28 through 32-

N = 5 (Sequences 28 through 32)
n = Sequence number less 27

i.e. for sequence 28, n = 1
for sequence 29, n = 2
for sequence 30, n = 3
for sequence 31, n = 4
for sequence 32, n = 5

$$Fles = \left[\frac{N-n}{N} \times 47.4 - 13.7\right] \times WireFactor$$

The value for elastic shortening in kips declines as the stressing sequence increases. A review of the data for the dome group shows that values for the dome group go from 154.6 kips for sequence 1 tendons down to 75 kips for sequence 27 tendons, and further going down to -13.7 kips for the last sequence, sequence 32. Note that wire factor differences between individual tendons will cause the calculated result to vary slightly for two tendons within the same stressing sequence.

Elastic Shortening Losses for Hoop Tendons -

N = 60 Total Sequences
n = Sequence of particular tendon.

Force Loss due to elastic shortening =

$$Fles = \left[\frac{(N-n)}{N} \times 134.0\right] \times WireFactor$$

A review of the data for the hoop tendon group shows that the range of values for the calculated elastic shortening go from 127.3 kips for sequence 3 tendons down to 0 kips for the last tendon sequence, sequence 60.

Elastic Shortening Losses for Vertical Tendons -

N = 31 Total Sequences
n = Sequence of particular tendon.

Force Loss due to elastic shortening =

$$Fles = \left[\frac{(N-n)}{N} \times 73.5\right] \times WireFactor$$

A review of the data for the vertical tendon group shows that the range of values calculated for elastic shortening go from 71.1 kips for sequence 1 tendons down to 4.7 kips for sequence 29 tendons. There are a total of 31 stressing sequences for the vertical tendons.

3.) Calculate Wire Stress Relaxation Losses

Wire stress relaxation losses and the procedure for the determination of these losses for the 4th and 5th surveillances are addressed in the Reference 10 and 11 calculations. The original wire relaxation curve, as provided by test data from the wire vendor forms the bases for wire relaxation loss values (See also FSAR Figure 5-23). It was determined that the same procedures and figures as calculated in those prior calculations are still applicable for this surveillance. Applicable data from the reference sources was attached and included within this calculation as Attachment F.

Note that there were adjustments made to the original stress relaxation values from the vendor relaxation curve to allow for some conservatism and for temperature consideration of 100 degrees vs. 68 degrees F. Also, per the original design the wire factor or actual number of effective wires was considered as negligible for these losses and was not included. Note that values for stress relaxation range between 40 and 50 kips for the surveillance period for all three tendon groups.

4.) Calculate Creep Losses

Concrete creep calculations in the Reference 11 document are attached in Attachment G. The losses are based on the curve contained in the reference calculation. Creep values are different for each of the three groups of tendons. For the dome tendons in the coming surveillance period, creep values are the same and are about 152 to 158 kips, hoop values are between 79 and 83 kips, verticals are 36 to 38 kips.

5.) Calculate Shrinkage Losses

Attachment H contains source information for concrete shrinkage from Reference 10, pg. 11 and Reference 11, cover page & Pages 13 & 14. The straight line shrinkage losses in micro inches per inch as calculated in the above two references are still applicable for this surveillance period. Tabulated values from these references were input into the dome, hoop and vertical spreadsheets. There are no additional variables or considerations and the same values are to be used for this calculation. From a review of the output information, the dome values are constant at 8 to 9 kips, hoop values are above 5 kips, verticals are also slightly above 5 kips.

6.) Total Losses

Calculated force losses for elastic shortening, wire stress relaxation, creep and shrinkage are added for a total of all losses. Also, a percent of this total of all losses is calculated based on the original average force in the tendon.

7.) Determine Predicted Forces for Base, 95% Base and 90% Base values

The original force less the total of losses calculated yields the base predicted value for the subject period of surveillance inspection. The 95% and 90% values are then calculated based on the calculated predicted base value.

8.) Normalization Factors

Normalization factors are calculated based on the expressions and the source article contained in Attachment I of this calculation. This factor usually does not change much over the forty year time span of the calculation. The base expression for the dome normalization factor value is presented as follows:

$$(A-B)\times(1-C)+(D-97.7)$$

Where:

A = Average of all Domes group
B = Original average tendon force
C = Wire Stress Relaxation Percentage
D = Elastic Shortening

As an example, Dome tendon D112 calculates as follows:

$$NormalizationFactor=(1639-1676)\times(1-0.0257)+(D-97.7) \text{ or}$$

$$NF=(-37)\times(0.9743)+(-101.9) \text{ or}$$

NF = -138 which matches the spreadsheet calculation.

Similar expressions are shown for the hoop and vertical tendons in the information in Attachment I.

9.) Plotting of Data

Only the data from Column B, L, M, & N are tabulated on a separate area on the side of the spreadsheet. See Columns R, S, T & U; Rows 40 through 50. Only these values are selected for plotting on the force curves. This is for ease of plotting and has no affect on the quality or accuracy of the plots. An example copy of this data immediately follows the first dome tendon.

The plots of all dome curves with all the data points showed the force curve plot line as slightly crooked from a true linear plot. The large scale used showed some inflection points slightly off of linear. After investigation, the condition was avoided by omitting data points at year 10 and 15 after SIT for the final plotted figures. This was done only for presentation purposes and there is no affect on the accuracy of the plot or the base values calculated and presented on each curve.

A column by column explanation of the losses calculation worksheet follows:

INDIVIDUAL TENDON LOSSES
LOSSES CALCULATION WORKSHEET
NOTES AND LEGEND

Individual tendon losses are calculated based on the procedure presented in the preceding section. The following notes explain the spreadsheet process, input and calculations performed for each of the columns presented. The shaded values on the losses worksheet are extracted from the data input worksheet.

<u>Column</u> <u>Description</u>

A. Inspection Period after SIT
Scale based on years after SIT which is shown on the bottom scale of each individual plot. Note that this information is provided for easier readability with respect to SIT but is not the actual log scale used to construct the x axis of the plots.

B. Years after Concrete Placement
Scale of years after concrete placement as used for the x axis for plotting of the force curves and shown as the upper log scale at the top of each plot.. Note that one year after SIT for the dome tendons is 3.5 years on the log scale and for the hoop and vertical tendons is 5.4 years. See Section 6.1 of this calculation for further information.

C. Elastic Shortening
Calculated based on formulas presented in Section 6.2.2 and Attachment E information.

D. Stress Relaxation Percent
Calculated based on original wire loss curve percentages modified per the information presented in Attachment F of this calculation.

E. Stress Relaxation Forces
Data input from the Reference 11 calculation page 12. See Attachment F.

F. Creep Strain
Strain value (x 0.0001Data input from the Reference 11 calculation. See Attachment G of this calculation for data.

G. Creep Strain Force
Data input from the Reference 11 calculation. See Attachment G of this calculation for data.

H. Shrinkage Values
Data input from the Reference 11 calculation based on the shrinkage curve. See Attachment H of this calculation for data.

I. Shrinkage Force
Data input from the Reference 11 calculation. See Attachment H of this calculation for data.

J. Total Force Loss
Calculated value, Sum of columns C, E, G,& I.

K. Total Percent Loss
Total loss in percentage, Column J / Average of original forces for shop & field ends calculated and shown above on the spreadsheet.

L. Base
The average original force for the tendon noted above on the spreadsheet, less the total losses calculated in Column J. Note that total losses were not calculated on the row for the 17 year period, the 21 year 3 month period, as well as the 21 year period after SIT. These rows represent the fifth, the originally planned sixth and the current sixth surveillance periods and the values of Base were derived through linear interpolation of above and below data presented on the spreadsheet. The quality and accuracy is not affected by this procedure. R2

M. 95% Base
0.95 x Column L for the same row.

N. 90% Base
0.90 x Column L for the same row.

O. Normalization Factor -
Calculated based on formula presented in this calculation and in the information presented in Attachment I.

Column H & I — Calculated force values in Kips which represent ram pressure @ 1500 psi. These forces represent a zero slack starting point for both shop and field ends of each tendon and provide a basis for the start of any retensioning effort. The following expression is used to calculate these values:

0.7 * Tendon Ultimate Strength * 1500 / Predicted Lift-Off Pressure at 0.7 Tendon Ultimate Strength. See Reference 10 Calculation, page 34.

Column J & K — Calculated force values in Kips which represent forces at 80% ultimate based on the following expression:

(Actual pressure @ 80% ultimate strength (Columns F or G) * 0.7 Tendon Ultimate Strength) / Predicted pressure @ 70% Ultimate Strength.

Column L & M — Actual elongation data, repeated from columns B and C.

In addition, the following calculations support the ultimate strength values provided on these spreadsheets:

Tendon wire ultimate strength = f_{uk} for wire = 240 ksi
Tendon Ultimate Strength = F_{uk} = [f_{uk} for wire * Tendon wire area] =
= 240 ksi * (0.05985 * 163 wires) = 2341.3 Kips

0.7 * F_{uk} = 0.7 *2341.3 = 1638.9 Kips
0.8 * F_{uk} = 0.8 *2341.3 = 1873 Kips

CALCULATIONS SUPPORTING SP-182 "ORIGINAL STRESSING DATA" FOR THE DOME TENDONS GROUP

0.7 Tendon Ultimate Strength = 1639 Kips
0.8 Tendon Ultimate Strength = 1873 Kips

File: DOMER3.XLW

Tendon ID	Actual Elongation (In.)		Predicted Lift-Off Pressure (psi)		80% Ultimate Pressure (psi)		For SP-182 "Original Stressing Data"					
							Row 1 (Kips)		Row 2 (Kips)		Row 3 (In.)	
	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
D111	5	5	6810	6810	7780	7780	361	361	1872	1872	5	5
D112	4-3/4	5	6800	6840	7770	7790	362	359	1873	1867	4-3/4	5
D113	4-7/8	4-3/4	6800	6840	7770	7790	362	359	1873	1867	4-7/8	4-3/4
D114	5-1/8	4-5/8	6800	6840	7770	7790	362	359	1873	1867	5-1/8	4-5/8
D115	5	5	6840	6800	7790	7770	359	362	1867	1873	5	5
D116	4-3/4	5-1/8	6760	6800	7720	7750	364	362	1872	1868	4-3/4	5-1/8
D130	5	5	6870	6810	7810	7780	358	361	1863	1872	5	5
D131	4-1/2	4-7/8	6710	6740	7660	7700	366	365	1871	1872	4-1/2	4-7/8
D132	4-1/2	4-7/8	6760	6800	7720	7750	364	362	1872	1868	4-1/2	4-7/8
D211	5-1/4	5-1/2	6810	6870	7780	7810	361	358	1872	1863	5-1/4	5-1/2
D212	4-5/8	4-7/8	6770	6770	7730	7720	363	363	1871	1869	4-5/8	4-7/8
D213	4-3/4	4-3/4	6840	6800	7790	7770	359	362	1867	1873	4-3/4	4-3/4
D214	4-3/4	4-7/8	6670	6740	7600	7680	369	365	1868	1868	4-3/4	4-7/8
D215	4-1/2	5-1/8	6800	6870	7800	7810	362	358	1880	1863	4-1/2	5-1/8
D216	5	5	6800	6810	7770	7780	362	361	1873	1872	5	5
D302	3-5/8	3-7/8	6530	6510	7450	7430	376	378	1870	1871	3-5/8	3-7/8
D303	4-1/4	3-3/4	6760	6770	7720	7730	364	363	1872	1871	4-1/4	3-3/4
D304	4-1/8	4	6840	6800	7790	7770	359	362	1867	1873	4-1/8	4
D305	4-1/8	4-3/16	6700	6680	7630	7620	367	368	1867	1870	4-1/8	4-3/16
D306	4-3/4	4-3/4	6810	6810	7780	7780	361	361	1872	1872	4-3/4	4-3/4
D310	5	4-1/2	6770	6770	7720	7730	363	363	1869	1871	5	4-1/2
D311	4-11/16	4-5/8	6800	6840	7770	7790	362	359	1873	1867	4-11/16	4-5/8
D312	4-7/8	4-7/8	6840	6800	7790	7770	359	362	1867	1873	4-7/8	4-7/8

R3

R3

R3

R3

5

4.1

Notes -
See the same calculations completed for the vertical group for notes and explanation of data & expressions used in Columns A through M.

CALCULATIONS SUPPORTING SP-182 "ORIGINAL STRESSING DATA" FOR THE HOOP TENDONS GROUP

0.7 Tendon Ultimate Strength = 1639 Kips
0.8 Tendon Ultimate Strength = 1873 Kips

File: HOOPR3.XLW

Tendon ID	Actual Elongation (in.)		Predicted Lift-Off Pressure (psi)		80% Ultimate Pressure (psi)		For SP-182 "Original Stressing Data"					
							Row 1 (Kips)		Row 2 (Kips)		Row 3 (in.)	
	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
42H17	5-5/8	4-5/8	6870	6810	7810	7780	358	361	1863	1872	5-5/8	4-5/8
42H18	5	5-3/8	6840	6799	7810	7750	359	362	1871	1868	5	5-3/8
42H19	5-1/4	5	6870	6810	7810	7780	358	361	1863	1872	5-1/4	5
42H29	5-1/2	5-1/8	6870	6810	7810	7780	358	361	1863	1872	5-1/2	5-1/8
42H30	4-7/8	5-3/4	6870	6790	7810	7750	358	362	1863	1871	4-7/8	5-3/4
42H31	5-1/4	4-7/8	6870	6810	7810	7780	358	361	1863	1872	5-1/4	4-7/8
42H32	5-1/4	5-1/8	6870	6790	7810	7750	358	362	1863	1871	5-1/4	5-1/8
42H33	5-3/8	5-1/4	6870	6810	7810	7780	358	361	1863	1872	5-3/8	5-1/4
42H34	5-1/2	5-3/8	6750	6660	7680	7600	364	369	1865	1870	5-1/2	5-3/8
42H35	5	5-1/4	6830	6770	7760	7720	360	363	1862	1869	5	5-1/4
42H36	5-1/8	5-1/8	6870	6790	7810	7750	358	362	1863	1871	5-1/8	5-1/8
42H37	5-5/16	4-7/8	6870	6810	7810	7780	358	361	1863	1872	5-5/16	4-7/8
42H43	5-1/2	5-1/8	6870	6810	7810	7780	358	361	1863	1872	5-1/2	5-1/8
42H44	5-1/8	5	6790	6840	7750	7790	362	359	1871	1867	5-1/8	5
42H45	5-7/16	5	6870	6810	7810	7780	358	361	1863	1872	5-7/16	5
46H20	5-1/4	5-1/8	6640	6600	7700	7610	370	373	1901	1890	5-1/4	5-1/8
46H21	5-1/8	5-1/4	6720	6730	7700	7640	366	365	1878	1861	5-1/8	5-1/4
46H22	5-5/8	5-1/4	6720	6730	7700	7640	366	365	1878	1861	5-5/8	5-1/4
51H25	5	5-1/8	6770	6800	7720	7750	363	362	1869	1868	5	5-1/8
51H26	5-1/2	5-1/4	6760	6760	7750	7700	364	364	1879	1867	5-1/2	5-1/4
51H27	5-1/8	4-7/8	6740	6670	7680	7600	365	369	1868	1868	5-1/8	4-7/8
51H28	5-1/8	5	6760	6750	7750	7700	364	364	1879	1870	5-1/8	5
51H29	5-1/2	4-3/4	6810	6750	7780	7700	361	364	1872	1870	5-1/2	4-3/4
53H1	5-3/4	5-1/8	6700	6760	7650	7720	367	364	1871	1872	5-3/4	5-1/8
53H2	5-3/4	4-5/8	6800	7770	7760	7720	362	316	1870	1628	5-3/4	4-5/8
53H3	5-3/8	4-1/8	6670	6710	7600	7660	369	366	1868	1871	5-3/8	4-1/8
53H45	5-1/4	5-1/4	6840	6800	7790	7770	359	362	1867	1873	5-1/4	5-1/4
53H46	4-7/8	5-3/8	6760	6730	7750	7660	364	365	1879	1865	4-7/8	5-3/8
53H47	4-3/4	5-1/2	6840	6800	7790	7770	359	362	1867	1873	4-3/4	5-1/2
62H21	5-1/8	4-3/4	6760	6700	7720	7650	364	367	1872	1871	5-1/8	4-3/4
62H22	5-5/16	5	6800	6750	7770	7700	362	364	1873	1870	5-5/16	5
62H23	5-1/8	5-1/4	6800	6750	7770	7700	362	364	1873	1870	5-1/8	5-1/4
62H39	5-7/16	5-1/4	6800	6750	7770	7700	362	364	1873	1870	5-7/16	5-1/4
62H40	5-3/8	4-7/8	6800	6750	7770	7700	362	364	1873	1870	5-3/8	4-7/8
62H41	5-1/4	5	6800	6750	7770	7700	362	364	1873	1870	5-1/4	5
62H42	5-3/8	5-1/16	6800	6750	7770	7700	362	364	1873	1870	5-3/8	5-1/16
62H43	5-3/8	4-7/8	6710	6670	7660	7600	366	369	1871	1868	5-3/8	4-7/8
62H44	5-1/2	4-7/8	6800	6750	7770	7700	362	364	1873	1870	5-1/2	4-7/8
62H45	5-3/16	5-1/8	6760	6700	7770	7700	364	367	1884	1884	5-3/16	5-1/8
62H46	5-1/8	5-3/8	6800	6750	7770	7700	362	364	1873	1870	5-1/8	5-3/8
62H47	5-5/8	4-1/2	6680	6640	7620	7550	368	370	1870	1864	5-5/8	4-1/2

Notes -
See the same calculations completed for the vertical group for notes and explanation of data & expressions used in Columns A through M.

28-Jan-98
3:24 PM

CALCULATIONS SUPPORTING SP-182 "ORIGINAL STRESSING DATA" FOR THE VERTICAL TENDONS GROUP R2

0.7 Tendon Ultimate Strength 1639 Kips
0.8 Tendon Ultimate Strength 1873 Kips R2

File: VERTR2.XLW

Tendon ID	Actual Elongation (In.)		Predicted Lift-Off Pressure (psi)		80% Ultimate Pressure (psi)		For SP-182 "Original Stressing Data" Row 1 (Kips)		Row 2 (Kips)		Row 3 (In.)	
	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
23V24	12-7/8	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-7/8	N/A
12V1	12-1/2	N/A	6800	N/A	7770	N/A	362	N/A	1873	N/A	12-1/2	N/A
12V2	12-1/2	N/A	6800	N/A	7770	N/A	362	N/A	1873	N/A	12-1/2	N/A
23V1	12-1/4	N/A	6800	N/A	7770	N/A	362	N/A	1873	N/A	12-1/4	N/A
23V2	13-1/8	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	13-1/8	N/A
23V3	13	N/A	6760	N/A	7750	N/A	364	N/A	1879	N/A	13	N/A
34V5	12-5/8	N/A	6800	N/A	7770	N/A	362	N/A	1873	N/A	12-5/8	N/A
34V6	13	N/A	6810	N/A	7780	N/A	361	N/A	1872	N/A	13	N/A
34V7	12-3/4	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-3/4	N/A
61V9	12-5/16	N/A	6860	N/A	7840	N/A	358	N/A	1873	N/A	12-5/16	N/A
61V10	12-3/4	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-3/4	N/A
61V11	12-5/8	N/A	6710	N/A	7660	N/A	366	N/A	1871	N/A	12-5/8	N/A
61V20	12-1/2	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-1/2	N/A
61V21	12-1/8	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-1/8	N/A
61V22	12-7/8	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-7/8	N/A

Notes -
Columns A through G are data input extracted from the tendon history books (applicable sheets contained in Attachment B).
Columns H through M are calculated using the expressions noted below.

Column Tendons within the scope of this surveillance.
Col.B&C Actual elongation data taken from tendon history sheets for shop and field ends respectively.
For the vertical tendons, only the shop end applies.
Col.D&E Predicted Liftoff Pressures taken from tendon history sheets for shop and field ends respectively.
Col.F&G 80% Ultimate pressures taken from tendon history sheets for shop and field ends respectively.
Col.H&I Columns H & I - Calculated force values in Kips for "Original Stressing Data" Row 1 which represent ram pressure @ 1500 psi. R2
These forces represent a zero slack starting point for both shop and field ends of each tendon and provide a basis for retensioning efforts.
The following expression is used to calculate the values for Row 1 data:
0.7 * Tendon Ultimate Strength * 1500 / Predicted Lift off Pressure at 0.7 tendon Ultimate Strength.
ie. for 23V24: 1639 * 1500 / 6870 = 358
Col.J&K Calculated force values in Kips for Original Stress Data" Row 2 data which represent forces at 80% Ultimate based on the following expression: R2
Actual pressure @ 80% Ultimate Strength (Cols. F or G) * 0.7 Ultimate Strength / Predicted pressure @ 70% Ult. from Cols. D or E.
ie. for 23V24: 7810 * 1639 / 6870 = 1863
Col.L& Actual elongation values repeated from Columns B & C for Row 3 of "Original Stressing Data". R2

12-Sep-97
9:49 AM

7.0 CONCLUSIONS

Tendon Force/Time Curves have been generated from the results of this calculation. Final force curves are presented and attached in Section 6.0 of this calculation.

Force curves for the three control tendons were also generated by this calculation and were used for comparison and verification of data and spread sheets with the same curves generated previously for the same tendons. The comparison was completed and the data sheets and force curves were found to be the same as that previously generated.

Other calculations supporting the "Original Stressing Data" and "Data Sheets" in SP-182 were completed and are presented in Section 6.6 of this calculation. R2

8.0 REFERENCES

The following references are used in the preparation of this calculation:

1. G/C Letter to FPC, FCS-14594, Scope Document, November 24, 1995, for Preparation of Tendon Force Curves for the 6th Surveillance and site trip to CR3.

2. G/C Letter to FPC, FCS-12439, August 13, 1991, Tendon Selection and Recommendations for the Fifth Surveillance.

3. Reg. Guide 1.35, Revision 3

4. Reg. Guide 1.35.1, Revision 0

5. CR3 FSAR, Section 5.2

6. Technical Specification, Section 3.6.1.6 & Section 4.6.1.6.

7. Design Input for the 5th Surveillance, DI-55220-152.0 SE, Revision 2.

8. G/C Calculation of Force curves for the 5th Surveillance for SP-182, Revision 11.

9. Design Input 5500-528-1, Revision to SP-182 Procedure for Tendons and Calculations for Force-Time Curves for Surveillance 4, Revisions 0 and 1, Jan.87 and Sept.87.

10. G/C Calculation 5500-528-1, Tendon Loss Calculations for Surveillance 4, Revisions 0 and 1, Jan.87 and Sept.87.

11. G/C Calculation 04-4762-099, Tendon Loss Calculations and Appendices for CR3 Tendons, J.Fulton and G.T.DeMoss, 3/6/87 and 1980 calculations.

12. Dome Tendon History Sheets updated to the 5th surveillance.

13. Hoop Tendon History Sheets updated to the 5th surveillance.

14. Vertical Tendon History Sheets updated to the 5th surveillance.
15. Effective Wire Summary information, letter to FPC
16. Prescon Vendor Drawings
17. SP-182, Rev 11.
18. Surveillance Report for the Fifth Inspection Period, VSL.
19. Engineering Report for the Fifth Tendon Surveillance, G/C Letter to FPC, FCS 14401, 6/20/94.

ATTACHMENT A

DESIGN INPUT DATA
FOR 6TH SURVEILLANCE

Design Input Information for the 6th Surveillance

The Gilbert/Commonwealth Design Input document prepared for the 5th surveillance is still applicable since it was prepared at the time FPC addressed new licensing and Tech Spec revisions concerning the CR3 Tendon Surveillance Program. The document and some of it's attachments are attached herein. Also, correspondence from the NRC resulting from it's review of CR3 tendon program issues is attached for reference.

The following Tech Spec sections were reviewed and are applicable to the tendon surveillance program.

Section 3.6.1.2, Amendment 149
Section 5.6.2.7, Amendment 149

FSAR Sections applicable include:
Sections 5.2 & 14.2.2
Figures 5-24 and 5-25

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 28, 1995

SUBJECT: [illegible]
FILE NO.: 3N0795-11
RECEIVED: 8/07/95
[illegible] BY: L.V. CECILIA
DUE DATE: T.B.D.

Mr. Percy M. Beard, Jr.
Senior Vice President,
Nuclear Operations (NA2I)
Florida Power Corporation
ATTN: Manager, Nuclear Licensing
15760 W Power Line Street
Crystal River, Florida 34428-6708

SUBJECT: REVIEW OF THE FIFTH TENDON SURVEILLANCE REPORT - CRYSTAL RIVER NUCLEAR GENERATING PLANT UNIT 3 (TAC NO. M90195)

Dear Mr. Beard:

By letter dated August 12, 1993, as supplemented December 15, 1994, and May 15, 1995, you submitted for staff review a report on the results for the fifth (seventeenth year after structural integrity test (SIT)) physical surveillance of the Crystal River 3 (CR3) Plant containment building post-tensioning system. You performed the surveillance in accordance with the requirements of the original plant technical specifications (TS) for tendon surveillance and Regulatory Guide (RG) 1.35 Revision 3. On the basis of your surveillance and inspection of the various elements of the post-tensioning system, you concluded that the surveillance results demonstrate the integrity of the containment tendon system.

We have completed our review of your submittal and we concur with your conclusion with certain exceptions. Your surveillance revealed grease leakage, corrosion of anchorheads and bearing plates and spalling and cracking of concrete, all of which could be detrimental to the containment tendon system. Please submit an action plan to rectify the undesirable conditions as identified and to implement appropriate actions to rectify them before the next scheduled inspection. Our evaluation is enclosed.

This completes our review under the TAC No. M90195 and, therefore, the TAC is closed.

This requirement affects nine or fewer respondents, and therefore, it is not subject to Office of Management and Budget review under P.L. 96-511.

Sincerely,

L. Raghavan, Project Manager
Project Directorate II-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket No. 50-302

Enclosure: As stated

cc w/enclosure:
See next page

Mr. Percy M. Beard
Florida Power Corporation

Crystal River Unit No. 3
Generating Plant

cc:

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Corporate Counsel
Florida Power Corporation
MAC-A5A
P.O. Box 14042
St. Petersburg, Florida 33733

Mr. Bruce J. Hickle, Director
Nuclear Plant Operations (NA2C)
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Crystal River Energy Complex
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Crystal River, Florida 34428-6708

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Tallahassee, Florida 32304

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Division of Emergency Preparedness
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Tallahassee, Florida 32399-2100

Chairman
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Citrus County
110 North Apopka Avenue
Inverness, Florida 32650

Mr. Larry C. Kelley, Director
Nuclear Operations Site Support
(SA2A)
Florida Power Corporation
Crystal River Energy Complex
15760 W Power Line Street
Crystal River, Florida 34428-6708

Senior Resident Inspector
Crystal River Unit 3
U.S. Nuclear Regulatory Commission
6745 N. Tallahassee Road
Crystal River, Florida 34428

Mr. Gary Boldt, Vice President -
Nuclear Production (SA2C)
Florida Power Corporation
Crystal River Energy Complex
15760 W Power Line Street
Crystal River, Florida 34428-6708

Enclosure

The Crystal River 3 (CR3) plant technical specifications (TS) require performing periodic tendon surveillance consisting of sheathing filler material inspection, tendon lift-off force measurement, anchorage component inspection, tendon wire inspection and tensile testing, grease leakage check, and tendon detensioning and retensioning and resealing for a number of selected tendons. For the fifth surveillance, in addition to the three control tendons (one for each group), you randomly selected two dome, two vertical and four hoop tendons and subjected them to lift-offs, with one tendon in each group being detensioned and retensioned. You performed the surveillance in accordance with the requirements of the original plant TS for tendon surveillance and Regulatory Guide (RG) 1.35 Revision 3. On the basis of your surveillance and inspection of the various elements of the post-tensioning system, you concluded that the surveillance results demonstrate the integrity of the containment tendon system.

On the basis of our review of your submittal, we concur with your conclusion with certain exceptions. Your surveillance revealed grease leakage, corrosion of anchorheads and bearing plates and spalling and cracking of concrete, all of which could be detrimental to the containment tendon system. These conditions are evaluated below.

1. Grease Voids

From the data on grease removed from and grease replaced into the tendon sheathings, there appeared to be an unusually high amount of grease voids or leakage. The amount of grease added ranged from 9.5% to as high as 30.5%. In a letter dated September 22, 1994, we indicated that the loss of grease appears to be unusually high in comparison to other plants with similar prestressed concrete containments and post-tensioning systems. Your response indicated that the losses closely match those of previous surveillances, and a thorough investigation had not determined a root cause for the abnormality. However, from the physical test of individual tendon wires, the chemical tests of the grease itself, and the lift-off tests, the tendon system is maintaining its integrity. Furthermore, there has been no grease leakage observed on the outside surface of the containment. On the basis of these observations, you reiterated that, in spite of the abnormally high amount of grease voids, the structural integrity of the tendons has not been affected.

We find your response to be reasonable. However, in view of the detrimental effects of potential grease leakage, you should monitor more closely the grease injection procedure in future surveillances and perform a thorough root cause investigation for grease loss.

2. Anchorage Assembly and Tendon Wire

Your surveillance revealed high levels of corrosion on the anchor heads on five of the tendons (three on the field and and two on both ends) under surveillance. A pitting condition existed on localized areas of these anchor heads, with no signs of active oxidation or buildup of crust or rust. No free moisture was observed within the sealed caps of any tendon. The bulk filler grease covered all tendon stressing anchor heads except for the top end of one vertical tendon. You believe that this condition has existed since original installation. You concluded that the observed conditions do not indicate abnormal degradation and will not affect the function of the anchor heads.

Your surveillance also discovered high levels of corrosion on bearing plates outside the sealed area of the tendon end caps of six tendons (on one end of three tendons and on both ends of another three). The corrosion occurred exterior to the O-ring seal and has not progressed to the point of breaching the integrity of the O-ring and affecting the tendon anchorage components. Repairs were made to the bearing plates to stop further degradation. The protection of the anchorage components is assured and the function and integrity of the bearing plates is maintained.

However, based on our review of tendon surveillance reports of a number of plants, we find that the types of corrosion of anchorage components have not been observed in other facilities and are unique to CR3. Therefore, we believe that it is necessary for you to expand the inspection to anchorage assemblies, especially the bearing plates, of other tendons not under surveillance to ensure timely repair of any adverse conditions.

You indicated that the cracking and spalling of concrete are insignificant. However, this requires repair before causing a further deterioration of concrete and reinforcement. It should also be also noted that your report provided only general statements regarding moisture content and the detrimental chemical contents and does not give details of water content for each of the grease samples taken from the specific tendons and free water discovered at end anchorages and grease cans. RG 1.35 requires such detailed information and should be provided in future surveillance reports.

One wire from each of the detensioned dome, hoop and vertical tendons was tested. In addition, ineffective wires and broken wires were removed for sample selection and testing. All of the tested samples exceeded the required minimum values for yield strength and elongation. All but one exceeded the required minimum ultimate strength. The cause for the broken wires was determined to be of a mechanical nature not due to stress corrosion. The buttonheads were inspected for their physical condition and were found to be effective and acceptable.

3. Tendon Lift-off Forces

We have reviewed the lift-off forces of three dome, three vertical and five hoop tendons and also the information on the correlation of force and elongation of the three detensioned and retensioned tendons. With the exception of one hoop tendon (46H29) which had only 88.1% of the base value (less than the 90% of the base value as required), the lift-off forces of other tendons were above the lower bound values established for these tendons. Additional hoop tendons were lifted off to meet the requirements in RG 1.35 under such a situation. The forces and the corresponding elongations for the three detensioned and retensioned tendons were reviewed, and for each tendon there is no linearity relation between the two. It appears to us that more careful elongation measurements could have provided the required correct information and assurance of the quality of the overall tendon surveillance performed.

The purpose of tendon surveillance is to determine if the time dependent prestress losses such as creep and shrinkage of concrete and relaxation of tendon wires are within the predicted range. The trend of such losses can be obtained by performing a regression analysis of the tendon lift-off forces for the tendons in a group from all the surveillances conducted to date after the SIT. Before performing the analysis it is necessary to correct the tendon seating force. This is because during tendon installation and tensioning it is not possible to anchor all the tendons in a group at the same force level and at the same time. The tendons are installed sequentially. When the containment is subjected to the tendon force, there will be elastic deformation. The tendon tensioned first will have lower force at completion of tensioning for the group than those tensioned last. Therefore, the seating force must be corrected to reflect the tendon anchor force for the elastic shortening, taking into consideration the tendon tensioning sequence. On the theory that the containment design is based on the average tendon force of the group, an average of the corrected tendon anchor forces is determined. By dividing this average force by each individual corrected tendon force, a so-called normalizing factor (NF) is obtained. This NF is used to modify the lift-off force of the tendon to obtain the average force which should be compared with the required tendon force. The NF for each tendon is a constant and will be used throughout all the surveillances. This appears to be the procedure used by a number of utilities. Theoretically, after normalization, all tendons in a group should have the same average value. Due to the method used in establishing the NF and in obtaining the lift-off forces, the normalized tendon force is at best approximate; but it should not vary appreciably from the average value for the group.

In contrast to the NF approach, the RG 1.35 approach to consider the prestress losses is through the use of upper bound and lower bound of tendon forces as discussed in RG 1.35.1 and shown in Fig.2 therein. The average of the tendon anchor forces which are the tendon seating forces corrected for elastic losses can be used as the initial prestressing force. A graph similar to that shown in Fig.2 of RG 1.35.1 should be first constructed. The lift-off force obtained for the group of tendons represented by the graph should be plotted on the graph without any correction. By plotting the lift-off forces from consecutive tendon surveillance of the group of tendons, it becomes possible to perform a trending analysis of the tendon forces.

In response our request for additional information on normalization, you provided a formula for the NF, which is actually a tendon force correction and includes not only prestress loss due to elastic deformation, but also the relaxation of the tendon wire. In view of this, the NF will be different for each surveillance since it involves the time factor. This only complicates the normalization procedure and does not improve the accuracy. If the NF involves relaxation of tendon wire, it appears the other time-dependent prestress loss due to creep and shrinkage should also be included. It is to be noted that correction is made to the seating force only for the elastic loss which is not time dependent and the normalization factor which is based on the corrected tendon anchor forces is used to modify the lift-off force to the average tendon force of the group. The NF procedure is based on the fact that after correction for elastic shortening loss each of the tendon forces and the average of these tendon forces for the group of tendons are large compared to the time-dependent prestress losses. Therefore, the ratio, i.e. the NF, between each tendon force and the average tendon force for the group after correction for elastic shortening loss will not vary significantly from that after correction for the time-dependent losses. The NF procedure is based on this premise.

In response to our concerns regarding your normalization procedure and use of the average of lift-off forces for the trend analysis, you performed analyses for each of the following cases for each group of tendons:

1) Using lift-off averages, normalized
2) Using all data points, normalized
3) Using lift-off averages, unnormalized
4) using all data points, unnormalized

The information for each case was plotted on a graph the same as that shown in Fig. 2 of RG 1.35.1 and a regression analysis was performed for each case in each group. From the results of these analyses, we observed insignificant differences between the normalized cases (1) and (2) or the unnormalized cases (3) and (4), and appreciable differences between the normalized and the unnormalized cases. However, based on the trend of all groups of tendons, no group of tendons would be expected to go below its minimum required during the 40-year plant life.

In spite of the favorable outcome of the results as summarized above, we believe that for future surveillances, the lift-off forces should be used for the trend analysis without averaging and normalization. Each tendon lift-off force should be compared with the predetermined values of base, 95% base, and 90% base as required by RG 1.35.

In conclusion, we concur with your conclusion that the results of the surveillance demonstrated the integrity of the containment tendon system. However, before the next surveillance you should resolve the problem of missing grease and should undertake a program of inspection of the anchorage system which consists of the anchor heads and the bearing plates to assure that the pitting of the anchor heads and the corrosion of the bearing plates uncovered in the surveillance are not widespread and would not jeopardize the integrity of the tendon anchorage system. You should repair the cracking and spalling of concrete so that there will be no further deterioration of concrete or reinforcement. For future surveillances, the trend study of the tendon forces should be based on the lift-off forces without averaging and normalization. In retensioning tendons, the elongations corresponding to the forces should be carefully measured so ~~that the linearity between~~ the two is preserved. This can serve as an additional check on the accuracy of the measurements performed.

Joe:

This is a copy of the electronic file from the NRC approval letter for postponement of the Eight exempted tendons.

Luethe

Mr. Percy M. Beard, Jr.
Senior Vice President,
Nuclear Operations (SA2A)
Florida Power Corporation
ATTN: Manager, Nuclear
Licensing
15760 W Power Line Street
Crystal River, Florida 34428-6708

SUBJECT: CRYSTAL RIVER NUCLEAR GENERATING PLANT UNIT 3 - POSTPONEMENT OF SURVEILLANCE OF EIGHT TENDONS EXEMPTED FROM THE FIFTH TENDON SURVEILLANCE (TAC NO. M94056)

Dear Mr. Beard:

By letter dated October 23, 1995, you requested staff approval for postponing surveillance of eight tendons which were exempted from the fifth tendon surveillance performed in 1993 to the sixth tendon surveillance. You had committed to include the eight tendons in your sixth tendon surveillance which was originally scheduled to be performed in 1996. You now propose to perform the sixth tendon surveillance in 1998 which is less than 5 years from the fifth tendon surveillance which was performed in November 1993. Accordingly, you are requesting staff approval to postpone the surveillance of the eight tendons to the 1998 sixth tendon surveillance.

By letter dated May 15, 1995, you submitted results of your fifth tendon surveillance to demonstrate integrity of the containment tendon system. In a letter dated July 28, 1995, we forwarded our evaluation of the Fifth Tendon Surveillance Report, and concluded that the trend of all groups of tendons is such that no group of tendons will go below its minimum required lift-off forces before the 40-year plant life. Our July 28, 1995 letter also identified certain undesirable conditions such as grease leakage, anchorage bearing plate corrosion, cracking and spalling of concrete. In response to these concerns, you committed to perform, during Refuel 10 (in 1996), a complete walkdown of 549 tendons comprising the containment post-tensioning system. You also committed to perform visual inspection to monitor external corrosion, grease leakage, and monitor for spalling of concrete and take appropriate corrective actions where warranted.

On the basis of the fifth tendon surveillance results and your commitment to perform visual inspection during the Refuel 10, we find it acceptable to perform the surveillance of the eight tendons during the sixth tendon surveillance scheduled for Refuel 11 in 1998, which is within the 5 year surveillance frequency.

In this matter, we also would like to draw your attention to the following. In November 1976, you performed the structural integrity test (SIT) on the Crystal River 3 (CR3) prestressed concrete containment. Per Regulatory Guide

(RG) 1.35, the tendon surveillances are to be performed 1, 3, and 5 years after SIT and every 5 years thereafter. You have committed to follow the RG 1.35 criteria. However, a review of the history of your tendon surveillance indicates that your 3rd, 4th and 5th tendon surveillances have been performed on an approximately 6-year interval. While plant technical specifications allow schedule flexibility (a 25% inspection interval extension for conducting surveillances), such a schedule extension should not be continued on a long-term basis. Also, the general industry practice has been a plus or minus 6 months schedule variance.

This completes our effort under TAC No. M94056 and the TAC is closed. If you have any questions, please call me at (301) 415-1471.

Sincerely,

L. Raghavan, Project Manager
Project Directorate II-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket No. 50-302

cc: See next page

Engineering Instruction No. 1

DESIGN INPUT RECORD	PROJECT Crystal River Unit 3	W.O. 04-5520-152	IDENTIFIER DI-6520-152.0 SE
	SUBJECT Tendon Surveillance Program - Preparation of Misc. Calculations and Surveillance Procedure SP-182		
	DISCIPLINE Structural 2241		PAGE 1 OF 6

REVISION	0	1	2	3
ITEM(S) REVISED				
ORIGINATOR	M. Marcellus	M. Marcellus	M. Marcellus	
DATE	8 Oct 93	27 OCT 93	17 NOV 93	
REVIEW				
DATE	8 OCT 93	27 OCT 93	21 NOV 93	
APPROVAL (DCE)				
DATE	10-8-93	10-27-93	NOV. 21, 1993	
FUTURE CONFIRMATION REQUIRED?	No	No	No	
MICROFILMED / DATE				

INSTRUCTIONS: USE "N/A" FOR ITEMS NOT APPLICABLE. IDENTIFY ITEMS REQUIRING FUTURE CONFIRMATION BY CIRCLE OR CLOUD. IDENTIFY REVISED INFORMATION BY VERTICAL LINE IN RIGHT MARGIN AND REVISION NUMBER. USE ADDITIONAL SHEETS AS NECESSARY.

REVISION 1 – REVISED TEXT AS NOTED, REVISED ATTACHMENT 2 & ADDED ATTACHMENTS 3, 4.
REVISION 2 – REVISED TEXT AS NOTED, REVISED ATTACHMENT 2

DISTRIBUTION RECORD

REV.	DISCIPLINE ENGINEERS				OTHERS						DCE	MECH DRAFT	ELEC DRAFT
	MECH	C/S	ELEC	STR/PIP	LAYOUT	RE-CORDS	PM						
REVIEW													
0						X							
1						X							
2						X							
3						X							

THIS IS A PERMANENT DESIGN RECORD DO NOT DESTROY

DESIGN INPUT RECORD	IDENTIFIER DI-5520-152.0 SE
DESIGN INPUT FOR: CR3 5TH TENDON SURVEILLANCE PERIOD	PAGE: 2 of 6
	REVISION: 2
	DATE: 17NOV93

1. SCOPE OF THIS DIR; BASIC FUNCTIONS OF SYSTEM, STRUCTURE, OR COMPONENT:

This DIR presents Design Input documentation related to the 5th Tendon Surveillance Program for Crystal River Unit 3. The scope of this DIR is for the preparation of Force/Time Curves for individual tendons, misc. calculations supporting surveillance activities, as well as for the revision of Surveillance Procedure, SP-182, for the performance of site inspection activities.

Revision 1 of this DIR will address the change in inputs required as a result of the NRC not accepting the FPC proposed Tech Spec revision for the CR3 Tendon Surveillance Program to comply with the requirements of ASME Section XI, Subsection IWL. FPC's discussions with the NRC concluded that the FPC program requirements should be based on Reg Guide 1.35, Revision 3, issued July 1990.

Revision 2 of this DIR will address the change in inputs required as a result of several meetings at the CR3 site. FPC's discussions with the NRC concluded that the new FPC Tech Spec Program may not be implemented as soon as expected and that the current Tech Spec requirements are to be be addressed for this surveillance within the acceptance criteria of SP-182, Revision 11.

2. CLASSIFICATION; DESIGN CODE(S) AND STANDARDS:

Nuclear Safety Related Classification
Existing Tech Spec 3.6.1.6 and 4.6.1.6, Amendment 29 & 31.
FSAR 5.2
Reg Guide 1.35, Revision 3, July 1990.

3. PERFORMANCE REQUIREMENTS AND SOURCE:

The Tendon Surveillance Program is controlled by Tech Spec Sections 3.6.1.6 and 4.6.1.6. However, FPC is currently going through a Tech Spec Improvement Program and will possibly be implementing this Program in mid November in the middle of the surveillance. The new Tech Spec (See Attachment 1) will commit the Surveillance Program to Regulatory Guide 1.35, Revision 3 criteria. FPC has discussed this with the NRC, and it was agreed that the new acceptance criteria is acceptable for use for this entire surveillance period. Therefore, the Reg. Guide criteria will be the basis for a revision to the existing Revision 10 of Surveillance Procedure SP-182. ~~Per FPC direction, the requirements of the current existing Tech Spec will not be included in the revision to SP-182 (See Attachment 2).~~ It was determined in mid November that the existing current Tech Spec requirements will have to be addressed in SP-182, Revision 11 until the actual implementation of the new Tech Spec program takes place. This acceptance criteria is to be worked into SP-182 in addition to the Reg. Guide 1.35 acceptance criteria already built into the draft version.

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4. **DESIGN MARGINS OR SAFETY FACTORS:**

Design margins and safety factors are as included in the above Codes and Standards.

5. **DESIGN CONDITIONS AND SOURCE:**

There are no design activities.

6. **OPERATING CONDITIONS AND SOURCE:**

This surveillance will be performed during normal plant operation. Tendons in the area between Buttresses 1 and 3, (0^0 to 120^0) must be avoided due to the safety hazard of the main steam vents in that area. After numerous discussions with the site, it was determined that outside tendons with the following group/buttress numbers are to be considered inaccessible due to the steam venting problem: 13HXX, 42HXX, 51HXX, 53HXX, 62HXX. Inside tendons accessiblity must be individually confirmed through an FPC walkdown/concurrance. Radiological conditions, safety, and interference with safety related systems and components may affect the selection of tendons inside the plant. Adequate consideration must be given to the potential effects on safety related systems from any surveillance activity.

FPC has been informed by G/C that the tendon selection process can be sucessfully completed for this surveillance using the limitations on the tendon population as noted above, however, the next several surveillances cannot be performed during plant operation because of these effects on the random tendon selection process.

In addition, the exempted tendons from the selection process of this surveillance must be reviewed and considered for inclusion in the next surveillance. The exact position for the resolution of many exempted tendons will depend on the final accepted position taken by the NRC on the proposed Tech Spec position taken by FPC. See the Attachment 3 letter, Attachment 1. This position will not affect remaining work for this surveillance but will need to be considered in future work.

7. **AMBIENT CONDITIONS AND SOURCE:**

Ambient temperatures and pressures of the Reactor Building during normal operation of the plant are to be considered. Elevated temperature effects on the tendons may need to be considered.

8. **MATERIAL(S):**

Most tendon materials are replacement of original materials. A summary of tendon related materials can be found in FSAR Section 5.2.2.3.3 and in the CR3 Reactor Building Design Basis Document.

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9. OTHER REQUIREMENTS:

The requirements of Reg Guide 1.35, Revision 3, are essentially the same as the requirements of ASME Section XI, Subsection IWL. In many places, the ASME Code provides a greater level of detail than the requirements of the Reg Guide. The ASME Code document will be utilized as a reference in the interpretation of some Reg. Guide requirements and criteria.

FPC administrative procedures noted in References 16, 17, and 18 are to be followed for the revision of SP-182.

The normal 40 year plant life is to be considered. As yet, no consideration for plant life extension has been requested from FPC. Future retensioning or other tendons work may need to consider any FPC plant life extension plans or considerations.

10. REFERENCES:

1. Design Input 5500-528-1, Revision to SP-182 Procedure for Tendons and Calculations for Force-Time Curves for Surveillance 4, Revisions 0 and 1, Jan. 87 and Sept. 87.
2. Calculation 5500-528-1, Tendon Loss Calculations for Surveillance 4, Revisions 0 and 1 Jan. 87 and Sept. 87.
3. J. Fulton and G. T. DeMoss Calculation 04-4762-099, Tendon Loss Calculations and Appendices for CR3 Tendons, 3/6/87 and 1980 calculations.
4. Vertical Tendon History Sheets
5. Hoop Tendon History Sheets
6. Dome Tendon History Sheets
7. SP-182, Revision 10.
8. SP-182, Revision 7. (Last surveillance proven revision)
9. ASME B & PV Code, Section XI, Subsection IWL
10. Regulatory Guide 1.35, Revision 3, Issued July 1990.
11. Regulatory Guide 1.35.1, Revision 0, Issued July 1990.
12. G/C Engineering Study on the CR3 Tendon Surveillance Program, FCS-13670, March 5, 1993.

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13. G/C Study of ASME Section XI, Subsection IWL for the CR3 tendon Surveillance Program, FCS-13892, June 2, 1993.

14. G/C Letter to FPC, FCS-12439, August 13, 1992, for Task 1 deliverables, Tendon Selection, General Report and recommendations for the 5th Surveillance.

15. Prescon Vendor Drawings - G/C Vendor Code 4680, Drawing Numbers 52-0026-0001A through 52-0026-0043P.

16. FPC Administrative Instructions, AI-402B, Procedure Writing (Except for EP/AP/VP), Revision 8, 10/25/91.

17. FPC Administrative Instructions, AI-400-C, Permanent Procedures Revisions, Revision 10, 11/19/92.

18. FPC Administrative Instructions, AI-701, Conduct of Inservice Inspection, Revision 9, 7/11/91.

19. G/C Memo, 10/27/93, D.L. Keiser to M. Marcellus, Calculation references for minimum required prestress forces.

20 Crystal River 3 Reactor Building Design Basis Document.

21. G/C Engineering Report for the 3rd Surveillance, By T.H. Noble, May 19, 1982.

22. G/C Engineering Report for the 4th Surveillance, By J. Herr, March 10, 1988.

23. G/C Scope Document Letter to FPC, FCS-13766, 4/2/93.

ATTACHMENTS

1. Proposed and submitted FPC Tech Spec showing compliance to ASME Section XI, Subsection IWL, fax received from FPC on 9/24/93.

2. G/C Letter to FPC, 10/8/93, FCS-14114, M. Marcellus to J. Mascoll/B.Crane/B. Gutherman, Summary of G/C Design Input positions.

3. FPC Letter to the NRC, October 25, 1993, Withdrawal of Tech Spec Change 197 with attached revised Tech Spec, Changing from ASME IWL compliance to Reg Guide 1.35, Rev 3 compliance.

Engineering Instruction No. 1

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4. G/C Letter to FPC, 10/12/93, FCS-14119, M. Marcellus to J. Mascoll/B.Crane/B. Gutherman, Revised summary of G/C Design Input positions.

5. G/C Letter to FPC, 10/27/93, FCS-14158, M. Marcellus to J. Mascoll/B.Crane, with G/C comments on the proposed Tech Spec.

ONLY ATTACHMENT 4 WAS INCLUDED IN CALC S95-0082

Calculation S-95-0082
Attachment A
Page A17

DI-6520-152.0 SE
ATTACHMENT 4
Page 1

Gilbert/Commonwealth engineers and consultants
Green Hills Corporate Center, Rt. 10 & Pheasant Rd., Reading, PA 19607

ROY W. ADLER
Project Manager
Nuclear Services

October 12, 1993

FCS-14119
Work Order #04-5520-152
Contract NPM00AD, WA 152

DI
REV 1

NOTE - THIS LETTER SUPERCEDES POSITIONS 1, 2 & 3 IN FCS-14114, 10/8/93, ATTACHMENT THIS D.I.

Mr. R. T. Bowles
Nuclear Project Management Engineer
Florida Power Corporation
P. O. Box 14042/C2I
St. Petersburg, Florida 33733

Attention: J. O. Mascoll, B. Crane, B. Gutherman

Re: Crystal River 3
Tendon Surveillance Program

Ref: FCS-14114 Dated October 7, 1993

Action By: FPC - October 13, 1993
Review and Comments,
Unless N/A

Dear Mr. Bowles:

Key issues and criteria for the tendon surveillance program were reviewed with you in the above referenced letter. Since then, the direction for implementation of our work has significantly changed based upon the NRC rejection of the Tech Spec for the Tendon Surveillance Program. Based on discussions with Bruce Crane, we will now perform all related tendon surveillance tasks based on the following:

1. Revision 11 of SP-182 will now be performed to comply with Reg. Guide 1.35 Revision 3, not ASME Section XI, Subsection IWL. An earlier review of the Reg. Guide versus the CR3 program concluded there were no significant issues or disadvantages to committing to Reg. Guide, Revision 3. However, until our review and revision is complete, G/C is recommending that FPC consider that there are some exceptions likely to be taken against the full compliance to the Reg. Guide by FPC. G/C will notify FPC as any significant exception is identified.

2. The documentation of the above position, acceptance items and specific interpretations of the Reg. Guide acceptance criteria has not been decided at this time. It may be within CP-145. However, an interim place is to include these positions within SP-182. G/C will now include some of the general positions in the SP-182 document, but is uncertain whether all engineering/licensing positions and acceptance criteria can be properly placed in SP-182. SP-182 has basically addressed site inspection activities in the past and has not addressed engineering/licensing issues to any level of detail.

Gilbert/Commonwealth

3. It is assumed that the Tech Spec Improvement Program will be in place and accepted by the NRC by November 22nd. With the surveillance rapidly approaching, a Tech Spec revision prior to that date is impractical. The acceptance criteria for the interim period up to November 22 was discussed. Based on the established CR3 Tendon Surveillance Program as defined by SP-182 and other documents, it is assumed that this entire tendon surveillance can be performed against the new criteria. Therefore, the acceptance criteria within SP-182 which is related to the existing Tech Spec positions will be removed and replaced by the Reg. Guide 135, Revision 3 positions. This will involve new enclosures and calculations within SP-182.

Note that the above direction significantly changes most positions noted in the reference letter. However, items 4, 5, 6 and 7 of that letter are unchanged for G/C to implement the required scope of work.

FPC concurrence with the above positions by October 13 is required for G/C to complete our tasks in support of the surveillance. Any revision to the above will impact our completion of SP-182. Additional rework, enclosures and verification resulting from this change in criteria, as discussed above, has impacted the schedule. Assuming no further change in basic criteria, SP-182 Revision 11 will be electronically transmitted to FPC on October 26 for review and comments. In addition, a copy of the document will be Federal Expressed at the same time.

Should there be questions or discussion on any of the above items, please feel free to contact us at your convenience.

Very truly yours,

M. D. Marcellus

M. D. Marcellus
Structural Task Engineer

RWAdler

R. W. Adler
Project Manager

cc: R. T. Bowles
J. Mascoll
B. Gutherman
B. Crane
FPC Records Management (CL Only)
R. W. Adler (2)
C. N. Rentschler
D. D. Krause

ATTACHMENT B

TENDON HISTORY SHEETS FOR 6TH SURVEILLANCE

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D112 CUT LENGTH 142'-7 1/2

SHOP WASHER ID: PC 121 CR 469 FIELD WASHER ID: PC 122 CR 1243

1. CAI/QA vendor inspection cover letter number-FPC # 10190 DATE 4/1/74
2. Date tendon received on-site 3-18-74 RMR Number 37984
3. Date installed in conduit 5-1-74 Installation NCR's
   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 10-1-74 Buttonheading NCR's
   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0
5. Date stressed 12-9-74 Stressing NCR's
   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 3/4 / 4 3/4	4 3/4 / 5	9 1/2 / 9 3/4
Lift-Off Pressure - Predicted/Actual	6800/6950	6840/7000	N/A
Shim Thickness/80% Ultimate Pressure	7 / 7770	7 3/16 / 7790	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163
6. Date Bulk-filled 3-25-75 Bulk-Filling NCR's
   Time since installation 10 3/4 months Inlet Pressure 50 psi Outlet Temp. 140°
   Date end caps refilled: Shop Field
7. Data compiled by D. Miller Organization Salem
   Date 3/30/77
8. Additional Comments:

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D113 CUT LENGTH 144'-6"

SHOP WASHER ID: PC 411 CR 121 FIELD WASHER ID: PC 121 CR 1075

1. GAI/QA vendor inspection cover letter number-FPC # 10190 DATE 4/1/74
2. Date tendon received on-site 3-18-74 RMR Number 37984
3. Date installed in conduit 5-2-74 Installation NCR's ____
   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 10-1-74 Buttonheading NCR's ____
   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0
5. Date stressed 11-21-74 Stressing NCR's 1717
   Date restressed ____ Restressing NCR's ____

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 7/8"/4 7/8"	4 7/8"/4 3/4"	9 3/4"/9 5/8"
Lift-Off Pressure - Predicted/Actual	6800 psi/7100 psi	6840 psi/6850 psi	N/A
Shim Thickness/80% Ultimate Pressure	7 3/16"/7770	6 5/8"/7790 psi	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 3-25-75 Bulk-Filling NCR's ____
   Time since installation 10 3/4 months Inlet Pressure 50 psi Outlet Temp. 140°
   Date end caps refilled: Shop ____ Field ____
7. Data compiled by D. Walker Organization Salem
   Date 3/30/77
8. Additional Comments: ____

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Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D113 CUT LENGTH ____

SHOP WASHER ID: PC ____ CR ____ FIELD WASHER ID: PC ____ CR ____

1. GAI/QA vendor inspection cover letter number-FPC # ____ DATE ____
2. Date tendon received on-site ____ RMR Number ____
3. Date installed in conduit ____ Installation NCR's ____

   Wires removed ____ Wires replaced ____ Total Ineffective wires ____
4. Date buttonheaded ____ Buttonheading NCR's ____

   Bad wires ____ Accept. Reheads ____ Total Ineffective wires ____
5. Date stressed ____ Stressing NCR's ____

   Date restressed ____ Restressing NCR's ____

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ____ Total effective wires after stressing ____
6. Date Bulk-filled ____ Bulk-Filling NCR's ____

   Time since installation ____ Inlet Pressure ____ Outlet Temp. ____

   Date end caps refilled: Shop ____ Field ____
7. Data compiled by D. Waller Organization Sulem

   Date 4/11/77
8. Additional Comments: Dome Repair -

   Degreasing - Shop End (7/15/76)

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Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

ENDON IDENTIFICATION NUMBER D114 CUT LENGTH 146'- 2 3/8"

HOP WASHER ID: PC 121 CR 814 FIELD WASHER ID: PC 122 CR 1206

. GAI/QA vendor inspection cover letter number-FPC # 10190 DATE 4/1/74

2. Date tendon received on-site 3-18-74 RMR Number 37984

3. Date installed in conduit 5-2-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 10-1-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 11-27-74 Stressing NCR's 1726, 1727

Date restressed 12-11-74 Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 7/8 / 5 1/8	4 7/8 / 4 5/8	9 3/4 / 9 3/4
Lift-Off Pressure - Predicted/Actual	6,800 / 7,000	6840 / 6,900	N/A
Shim Thickness/80% Ultimate Pressure	7 / 7,770	6 9/16 / 7790	N/A

Unseated/Broken Wires 1 Total effective wires after stressing 162

6. Date Bulk-filled 3-25-75 Bulk-Filling NCR's

Time since installation 10 3/4 months Inlet Pressure 45 psi Outlet Temp. 140°

Date end caps refilled: Shop 11-24-76 Field 11-24-76

7. Data compiled by D Walker Organization Salem

Date 3/30/77

8. Additional Comments: One wire not seated on field End.

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Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D114 CUT LENGTH

SHOP WASHER ID: PC CR FIELD WASHER ID: PC CR

1. CAI/QA vendor inspection cover letter number-FPC # DATE

2. Date tendon received on-site RMR Number

3. Date installed in conduit Installation NCR's

Wires removed Wires replaced Total Ineffective wires

4. Date buttonheaded Buttonheading NCR's

Bad wires Accept. Reheads Total Ineffective wires

5. Date stressed Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

Unseated/Broken Wires Total effective wires after stressing

6. Date Bulk-filled Bulk-Filling NCR's

Time since installation Inlet Pressure Outlet Temp.

Date end caps refilled: Shop Field

7. Data compiled by D Walle Organization Salem

Date 4/11/77

8. Additional Comments: Dome Repair –

Degreasing – Shop End (7/10/76) Field End (7/13/76)

~~Determining~~ Lift off Pressure – Shop 5890 Field 6300 (7/11/76)

Regreasing – (11/24/76) 200 PSIG NCR 2581 190° NCR 2582

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D115 CUT LENGTH 147'-7½"

SHOP WASHER ID: PC — CR 675 FIELD WASHER ID: PC 122 CR 1231

1. CAI/QA vendor inspection cover letter number-FPC # 10190 DATE 4/1/74

2. Date tendon received on-site 3-18-74 RMR Number 37984

3. Date installed in conduit 5-2-74 Installation NCR's

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 9-30-74 Buttonheading NCR's

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 11-11-74 Stressing NCR's

   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5"/5"	5"/5"	10"/10"
Lift-Off Pressure - Predicted/Actual	6840/7050 psi	6800/7100 psi	N/A
Shim Thickness/80% Ultimate Pressure	6⅝"/7790	6⅝"/7770	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 3-25-75 Bulk-Filling NCR's

   Time since installation 10¾ month Inlet Pressure 52 psi Outlet Temp. 140°

   Date end caps refilled: Shop Field

7. Data compiled by D. Waller Organization Salem

   Date 3/30/77

8. Additional Comments:

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Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D 115 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. CAI/QA vendor inspection cover letter number-FPC # [illegible] DATE [illegible]
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______

   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______

   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ______ Total effective wires after stressing ______
6. Date Bulk-filled ______ Bulk-Filling NCR's ______

   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D Miller Organization Salem

   Date 4/11/77
8. Additional Comments: Dome Repair -

   Degreasing - Shop End (7/15/76) Cap reinstalled

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D 115 CUT LENGTH ____

SHOP WASHER ID: PC 121 CR ____ FIELD WASHER ID: PC ____ CR ____

1. CAI/QA vendor inspection cover letter number-FPC # ____ DATE ____

2. Date tendon received on-site ____ RMR Number ____

3. Date installed in conduit ____ Installation NCR's ____

   Wires removed ____ Wires replaced ____ Total Ineffective wires ____

4. Date buttonheaded ____ Buttonheading NCR's ____

   Bad wires ____ Accept. Reheads ____ Total Ineffective wires ____

5. Date stressed ____ Stressing NCR's ____

   Date restressed ____ Restressing NCR's ____

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ____ Total effective wires after stressing ____

6. Date Bulk-filled ____ Bulk-Filling NCR's ____

   Time since installation ____ Inlet Pressure ____ Outlet Temp. ____

   Date end caps refilled: Shop ____ Field ____

7. Data compiled by D. J. Griffin Organization FPC

   Date 9-30-77

8. Additional Comments: IN PREPARATION FOR 1ST SURVEILLANCE

907 716

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D116 CUT LENGTH 148'-10 1/8"

SHOP WASHER ID: PC 121 CR 946 FIELD WASHER ID: PC 121 CR 734

1. CAI/QA vendor inspection cover letter number-FPC # 10190 DATE 4/1/74

2. Date tendon received on-site 3-18-74 RMR Number 37984

3. Date installed in conduit 5-6-74 Installation NCR's ______

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 9-30-74 Buttonheading NCR's ______

Bad wires 1 Accept. Reheads 0 Total Ineffective wires 1

5. Date stressed 12-5-74 Stressing NCR's ______

Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5"/4 3/4"	5"/5 1/8"	10"/9 7/8"
Lift-Off Pressure - Predicted/Actual	6760 psi/6950 psi	6800 psi/6750 psi	N/A
Shim Thickness/80% Ultimate Pressure	7"/7720	7 1/4"/7750	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 162

6. Date Bulk-filled 3-25-75 Bulk-Filling NCR's ______

Time since installation 10 1/2 months Inlet Pressure 50 psi Outlet Temp. 140°

Date end caps refilled: Shop ______ Field ______

7. Data compiled by D. Waller Organization Salem

Date 3/30/77

8. Additional Comments: ______

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRE-STRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D130 CUT LENGTH 142'-7½"

SHOP WASHER ID: PC 121 CR 924 FIELD WASHER ID: PC 122 CR 1260

1. CAI/QA vendor inspection cover letter number-FPC # 10202 DATE 4/1/74
2. Date tendon received on-site 3-22-74 RMR Number 38020
3. Date installed in conduit 5-13-74 Installation NCR's
   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 9-20-74 Buttonheading NCR's
   Bad wires 8 Accept. Reheads 8 Total Ineffective wires 0
5. Date stressed 10-31-74 Stressing NCR's
   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4¾"/5"	4¾"/5"	9½"/10"
Lift-Off Pressure - Predicted/Actual	6870/6550	6810/6800	N/A
Shim Thickness/80% Ultimate Pressure	5⅝"/7810	5⅜"/7780	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163
6. Date Bulk-filled 4-4-75 Bulk-Filling NCR's
   Time since installation 10¾ mo. Inlet Pressure 55 psi Outlet Temp. 140°
   Date end caps refilled: Shop Field
7. Data compiled by D. Muller Organization Salem
   Date 3/30/77
8. Additional Comments:

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D131 CUT LENGTH 140'-4 3/8"

SHOP WASHER ID: PC 121 CR 1002 FIELD WASHER ID: PC 121 CR 470

1. GAI/QA vendor inspection cover letter number-FPC # 10202 DATE 4/1/74

2. Date tendon received on-site 3-22-74 RMR Number 38020

3. Date installed in conduit 5-13-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 9-20-74 Buttonheading NCR's 1616

Bad wires 11 Accept. Reheads 9 Total Ineffective wires 2

5. Date stressed 12-5-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 3/4"/4 1/2"	4 3/4"/4 7/8"	9 1/2"/9 3/8"
Lift-Off Pressure - Predicted/Actual	6710/6700	6740/6600	N/A
Shim Thickness/80% Ultimate Pressure	6 1/4"/7660	6 1/4"/7700	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 161

6. Date Bulk-filled 4-4-75 Bulk-Filling NCR's

Time since installation 10 3/4 months Inlet Pressure 31 psi Outlet Temp. 160°

Date end caps refilled: Shop Field

7. Data compiled by D. Waller Organization Salem

Date 3/30/77

8. Additional Comments:

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CORPORATION

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D131 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. GAI/QA vendor inspection cover letter number-FPC # ______ DATE ______

2. Date tendon received on-site ______ RMR Number ______

3. Date installed in conduit ______ Installation NCR's ______

Wires removed ______ Wires replaced ______ Total Ineffective wires ______

4. Date buttonheaded ______ Buttonheading NCR's ______

Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______

5. Date stressed ______ Stressing NCR's ______

Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

Unseated/Broken Wires ______ Total effective wires after stressing ______

6. Date Bulk-filled ______ Bulk-Filling NCR's ______

Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

Date end caps refilled: Shop ______ Field ______

7. Data compiled by D Waller Organization Salem

Date 4/11/77

8. Additional Comments: Dome Repair -

Degreasing - Shop (7/19/76) Field (7/19/76)

Regreasing - (12/1/76) 225 PSIG NCR # 2582, 180° NCR # 2581

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D 132 CUT LENGTH 137'-11"

SHOP WASHER ID: PC 121 CR 938 FIELD WASHER ID: PC 121 CR 955

.. CAI/QA vendor inspection cover letter number-FPC # 10202 DATE 4/1/74

!. Date tendon received on-site 3-22-74 RMR Number 38020

1. Date installed in conduit 5-13-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

.. Date buttonheaded 9-20-74 Buttonheading NCR's

Bad wires 1 Accept. Reheads 0 Total Ineffective wires 1

.. Date stressed 12-3-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4¾/4½	4⅝/4⅞	9⅜/9⅜
Lift-Off Pressure - Predicted/Actual	6760/6,700	6800/6,700	N/A
Shim Thickness/80% Ultimate Pressure	6"/7,720	6⅝"/7,750	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 162

. Date Bulk-filled 1-4-75 Bulk-Filling NCR's

Time since installation 18 months Inlet Pressure 20psi Outlet Temp. 160°

Date end caps refilled: Shop Field

'. Data compiled by D. Waller Organization Salem

Date 3/30/77

1. Additional Comments:

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D211 CUT LENGTH 142'-0 1/2"

SHOP WASHER ID: PC 121 CR 487 FIELD WASHER ID: PC 122 CR 1268

GAI/QA vendor inspection cover letter number-FPC # 10245 DATE 4/10/74

Date tendon received on-site 3-29-74 RMR Number 38246

Date installed in conduit 5-30-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

Date buttonheaded 10-17-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

Date stressed 10-30-74 Stressing NCR's 1681, 1683

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 3/8" / 5 1/4"	5" / 5 1/2"	9 3/8" / 10 3/4"
Lift-Off Pressure - Predicted/Actual	6810 / 7100 psi	6,870 / 7,000 psi	N/A
Shim Thickness/80% Ultimate Pressure	5 1/2" / 7,780	6" / 7810	N/A

Unseated/Broken Wires 1 Total effective wires after stressing 162

Date Bulk-filled 3-26-75 Bulk-Filling NCR's

Time since installation 9 3/4 month Inlet Pressure 50 psi Outlet Temp. 132°

Date end caps refilled: Shop Field

Data compiled by D Waller Organization Salem

Date 3/29/77

Additional Comments: One wire not seated on washer.

Florida Power CORPORATION

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D211 CUT LENGTH ____

SHOP WASHER ID: PC ____ CR ____ FIELD WASHER ID: PC ____ CR ____

1. GAI/QA vendor inspection cover letter number-FPC # ____ DATE ____
2. Date tendon received on-site ____ RMR Number ____
3. Date installed in conduit ____ Installation NCR's ____

   Wires removed ____ Wires replaced ____ Total Ineffective wires ____
4. Date buttonheaded ____ Buttonheading NCR's ____

   Bad wires ____ Accept. Reheads ____ Total Ineffective wires ____
5. Date stressed ____ Stressing NCR's ____

   Date restressed ____ Restressing NCR's ____

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ____ Total effective wires after stressing ____
6. Date Bulk-filled ____ Bulk-Filling NCR's ____

   Time since installation ____ Inlet Pressure ____ Outlet Temp. ____

   Date end caps refilled: Shop ____ Field ____
7. Data compiled by D Waller Organization Sal[illegible]

   Date 4/11/77
8. Additional Comments: Dome Repair –

   Degreasing – Shop (7/15/76)

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D212 CUT LENGTH 144'-3"

SHOP WASHER ID: PC 121 CR 1032 FIELD WASHER ID: PC 122 CR 1214

GAI/QA vendor inspection cover letter number-FPC # 10245 DATE 4/10/74

Date tendon received on-site 3-29-74 RMR Number 38246

Date installed in conduit 6-4-74 Installation NCR's 1410

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

Date buttonheaded 10-17-74 Buttonheading NCR's

Bad wires 1 Accept. Reheads 0 Total Ineffective wires 1

Date stressed 12-3-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 3/8" / 4 5/8"	5 1/8" / 4 7/8"	9 1/2" / 9 1/2"
Lift-Off Pressure - Predicted/Actual	6,770 / 6,600 psi	6,770 / 6,700 psi	N/A
Shim Thickness/80% Ultimate Pressure	6 3/8" / 7,730	6 3/8" / 7,720	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 162

Date Bulk-filled 3-26-75 Bulk-Filling NCR's

Time since installation 9 3/4 months Inlet Pressure 47 psi Outlet Temp. 124°

Date end caps refilled: Shop Field

Data compiled by D Waller Organization Salem

Date 3/29/77

Additional Comments:

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON SURVEILLANCE RECORD

TENDON NO. D212

Inspection Period and Date	Location	LIFT OFF CONDITION: Force (kips)	Avg. Force (kips)	Shim Thickness (in)	Elongation (in)	Total Effective Wires	RETENSIONING: Force (kips)	Avg. Force (kips)	Shim Thickness (in)	Elongation (in)	Total Effective Wires	Reactor Bldg. Temperature °F: Int.	Ext.	Comments
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Original Stressing	S	1588		6 3/8"	4 5/8"		N/A		N/A	N/A				
12/3/74	F	1612	1600	6 3/8"	4 7/8"	162	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
3rd	S	1392		6 3/8"	N/A		N/A		N/A	N/A				1. Lift-off only
10/26/81	F	1285	1338	6 3/8"	N/A	162	N/A	N/A	N/A	N/A	162	82	83	
4TH	S-1	1292		6 5/8	N/A		N/A		N/A	N/A		85° TO	S 67°F	1. 12 GAL OF GREASE NET ADDED
10/26/87	F-3	1260	1276	6 1/2	N/A	162	N/A	N/A	N/A	N/A	N/A	90°F	F 72°F	

Florida Power Corporation

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D213 CUT LENGTH 146'-2 1/4"

SHOP WASHER ID: PC 121 CR 984 FIELD WASHER ID: PC 121 CR 878

1. GAI/QA vendor inspection cover letter number-FPC # 10245 DATE 4/10/74

2. Date tendon received on-site 3-29-74 RMR Number 38246

3. Date installed in conduit 6-10-74 Installation NCR's

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 10-16-74 Buttonheading NCR's

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 11-18-74 Stressing NCR's

   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8" / 4 3/4"	4 3/8" / 4 3/4"	9 1/2" / 9 1/2"
Lift-Off Pressure - Predicted/Actual	6840 / 6,900 psi	6,800 / 6,800 psi	N/A
Shim Thickness/80% Ultimate Pressure	6 5/8" / 7,790	6 3/8 / 7,770	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 3-26-75 Bulk-Filling NCR's

   Time since installation 9 1/2 months Inlet Pressure 51 PSI Outlet Temp. 122°

   Date end caps refilled: Shop Field

7. Data compiled by D. Waller Organization Salem

   Date 3/29/77

8. Additional Comments: Yellow slime

Florida Power
CORPORATION

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D213 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. GAI/QA vendor inspection cover letter number-FPC # ______ DATE ______
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______

   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______

   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ______ Total effective wires after stressing ______
6. Date Bulk-filled ______ Bulk-Filling NCR's ______

   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D Waller Organization Sanborn

   Date 4/11/77
8. Additional Comments: Dome Repair —

   Degreasing - Shop - (7/15/76)

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D 214 CUT LENGTH 147'-11 1/4"

SHOP WASHER ID: PC — CR 765 FIELD WASHER ID: PC *121 CR 964 (YW)

GAI/QA vendor inspection cover letter number-FPC # 10245 DATE 4/10/74

Date tendon received on-site 3-29-74 RMR Number 38246

Date installed in conduit 6-10-74 Installation NCR's

Wires removed 1 Wires replaced 0 Total Ineffective wires 1

Date buttonheaded 10-16-74 Buttonheading NCR's

Bad wires 1 Accept. Reheads 0 Total Ineffective wires 1

Date stressed 12-6-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 60% ult.)-Pred./Act.	5¼", 4¾"	4⅜", 4⅞"	9⅝", 9⅝"
Lift-Off Pressure - Predicted/Actual	6670/6800 psi	6740/6800 psi	N/A
Shim Thickness/80% Ultimate Pressure	7" / 7600	7⅜" / 7680	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 161

Date Bulk-filled 3-26-75 Bulk-Filling NCR's

Time since installation 9½ months Inlet Pressure 48 psi Outlet Temp. 134°

Date end caps refilled: Shop Field

Data compiled by D. Waller Organization Salem

Date 3/29/77

Additional Comments: * Yellow shims used with yellow washer.

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D 214 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. GAI/QA vendor inspection cover letter number-FPC # ______ DATE ______
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______

   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______

   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ______ Total effective wires after stressing ______
6. Date Bulk-filled ______ Bulk-Filling NCR's ______

   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D. Malley Organization Sabey

   Date 4/11/77
8. Additional Comments: Dome Repair -

Degreasing - Shop (7/11/76) Field (7/9/76)

Lift-off Readings - Shop 5600 (7/13/76) Field 6350 (7/10/76)

Regreasing - Field 200 PHG NCR# 2581, 2582, 190°-190° (12/1/76)

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D 214 CUT LENGTH

SHOP WASHER ID: PC 121 CR FIELD WASHER ID: PC CR

1. CAI/QA vendor inspection cover letter number-FPC # DATE
2. Date tendon received on-site RMR Number
3. Date installed in conduit Installation NCR's

   Wires removed Wires replaced Total Ineffective wires
4. Date buttonheaded Buttonheading NCR's

   Bad wires Accept. Reheads Total Ineffective wires
5. Date stressed Stressing NCR's

   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires Total effective wires after stressing
6. Date Bulk-filled Bulk-Filling NCR's

   Time since installation Inlet Pressure Outlet Temp.

   Date end caps refilled: Shop Field
7. Data compiled by D. J. Diffin Organization FPC

   Date 9-30-77
8. Additional Comments: IN PREPARATION FOR 1ST SURVEILLANCE

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Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D-215 CUT LENGTH 149'-3 3/4

SHOP WASHER ID: PC 121 CR 1022 FIELD WASHER ID: PC 121 CR 445

1. GAI/QA vendor inspection cover letter number-FPC # 10245 DATE 4/10/74
2. Date tendon received on-site 3-29-74 RMR Number 38246
3. Date installed in conduit 6-10-74 Installation NCR's
   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 10-16-74 Buttonheading NCR's
   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0
5. Date stressed 11-4-74 Stressing NCR's
   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 7/8" / 4 1/2"	4 7/8" / 5 1/8"	9 3/4 / 9 5/8"
Lift-Off Pressure - Predicted/Actual	6800 / 6900 psi	6870 / 7000 psi	N/A
Shim Thickness/80% Ultimate Pressure	7" / 17800	6 3/4" / 17810	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163
6. Date Bulk-filled 3-26-75 Bulk-Filling NCR's
   Time since installation 9 1/2 months Inlet Pressure 55 psi Outlet Temp. 132°
   Date end caps refilled: Shop Field
7. Data compiled by D. Walker Organization Salem
   Date 3/29/77
8. Additional Comments:

Florida Power
CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D 215 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. CAI/QA vendor inspection cover letter number-FPC # ______ DATE ______
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______

   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______

   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ______ Total effective wires after stressing ______
6. Date Bulk-filled ______ Bulk-Filling NCR's ______

   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D. Walls Organization Salem

   Date 4/11/77
8. Additional Comments: Dome Repair -

   Degreasing - Shop (7/15/76)

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D-215 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. GAI/QA vendor inspection cover letter number-FPC # ______ DATE ______
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______

   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______

   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off ~~Pressure~~ FORCE - Predicted/Actual (KIPS) LOCK-OFF FORCE BELOW	1336.6/1612	1336.6/1675.5	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163
6. Date Bulk-filled ______ Bulk-Filling NCR's ______

   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

   Date end caps refilled: Shop 2-9-78 Field 2-9-78
7. Data compiled by D.F. Hoff [signature] Organization FPC

   Date 5-15-78
8. Additional Comments: INSPECTED FIRST SURVEILLANCE (2-3-78)

   1) NO INDICATION OF RUST-CORROSION

   2) LOCK-OFF FORCE (SHOP - SAME AS LIFT-OFF; FIELD - 1654 K)

   3) NO CRACKING AT ANCHORAGE

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON SURVEILLANCE RECORD

TENDON NO. D215

Inspection Period and Date	Location	LIFT OFF CONDITION Force (kips)	Avg. Force (kips)	Shim Thickness (in)	Elongation (in)	Total Effective Wires	RETENSIONING Force (kips)	Avg. Force (kips)	Shim Thickness (in)	Elongation (in)	Total Effective Wires	Reactor Bldg. Temperature °F Int.	Ext.	Comments
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Original Stressing	S	1663		7"	4½"		N/A		N/A	N/A				
11/4/74	F	1670	1667	6 3/4"	5 1/8"	163	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1st	S	1612		7"	N/A		1612		7"	N/A				
2/3/78	F	1676	1644	6 3/4"	N/A	163	1656	1633	6 3/4"	N/A	163	92	46	
3rd	S	1568		7"	N/A		N/A		7"	N/A				1. Lift-off only
10/27/83	F	1619	1594	6 3/4"	N/A	163	N/A	N/A	6 3/4"	N/A	163	82	85	
5TH	S	1458		7 1/8	N/A		N/A		N/A	N/A				32 GALLONS OF GREASE ADDED OVER REMOVED
11/9/93	F	1579	1518	6 7/8	N/A	163	N/A	N/A	N/A	N/A	N/A	123°	72°	

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D 216 CUT LENGTH 150'-6 3/4

SHOP WASHER ID: PC 121 CR 912 FIELD WASHER ID: PC 122 CR 1239

1. GAI/QA vendor inspection cover letter number-FPC # 10245 DATE 4/10/74

2. Date tendon received on-site 4-1-74 RMR Number 38273

3. Date installed in conduit 6-10-74 Installation NCR's

. Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 10-15-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 12-3-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5¼"/5"	4⅝"/5"	9⅞"/10"
Lift-Off Pressure - Predicted/Actual	6800/6700 psi	6810/6700 psi	N/A
Shim Thickness/80% Ultimate Pressure	7¼"/7770	6¾"/7780	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 3-26-75 Bulk-Filling NCR's

Time since installation 9½ months Inlet Pressure 55 psi Outlet Temp. 132°

Date end caps refilled: Shop Field

7. Data compiled by D. Walk Organization Salem

Date 3/29/77

8. Additional Comments:

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D 303 CUT LENGTH 115'-8 3/4

SHOP WASHER ID: PC 121 CR 447 FIELD WASHER ID: PC 121 CR 836(YW)

CAI/QA vendor inspection cover letter number-FPC # 10357 DATE 4/30/74

Date tendon received on-site 4-10-74 RMR Number 38726

Date installed in conduit 6-20-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

Date buttonheaded 10-11-74 Buttonheading NCR's

Bad wires 1 Accept. Reheads 0 Total Ineffective wires 1

Date stressed 11-14-74 Stressing NCR's 1704

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	3 3/4", 4 1/4"	3 3/4", 3 3/4"	7 1/2", 8"
Lift-Off Pressure - Predicted/Actual	6760, 6700 psi	6770, 7030 psi	N/A
Shim Thickness/80% Ultimate Pressure	6 1/4", 7720	6 3/8", 7730	N/A

Unseated/Broken Wires 1 Total effective wires after stressing 161

Date Bulk-filled 3-27-75 Bulk-Filling NCR's 1880

Time since installation 9 1/4 months Inlet Pressure: 95 psi Outlet Temp. 124°

Date end caps refilled: Shop Field

Data compiled by D. Walker Organization Salem

Date 4/1/77

Additional Comments: Broken wire.

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D 303 CUT LENGTH ____

SHOP WASHER ID: PC ____ CR ____ FIELD WASHER ID: PC ____ CR ____

1. GAI/QA vendor inspection cover letter number-FPC # ____ DATE ____
2. Date tendon received on-site ____ RMR Number ____
3. Date installed in conduit ____ Installation NCR's ____

   Wires removed ____ Wires replaced ____ Total Ineffective wires ____
4. Date buttonheaded ____ Buttonheading NCR's ____

   Bad wires ____ Accept. Reheads ____ Total Ineffective wires ____
5. Date stressed ____ Stressing NCR's ____

   Date restressed ____ Restressing NCR's ____

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ____ Total effective wires after stressing ____
6. Date Bulk-filled ____ Bulk-Filling NCR's ____

   Time since installation ____ Inlet Pressure ____ Outlet Temp. ____

   Date end caps refilled: Shop ____ Field ____
7. Data compiled by D. Waller Organization Salem

   Date 4/11/77
8. Additional Comments: Dome Repair -

   Degreasing - Shop (7/8/76) Field (7/7/76) (7/13/76)

   Regreasing - 200 PSIG NCR #2582 190° NCR #2581

907 716

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D304 CUT LENGTH 120'-4 1/2"

SHOP WASHER ID: PC 121 CR 479 FIELD WASHER ID: PC 121 CR 696

GAI/QA vendor inspection cover letter number-FPC # 10357 DATE 4/30/74

Date tendon received on-site 4-10-74 RMR Number 38726

Date installed in conduit 5-23-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

Date buttonheaded 10-11-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

Date stressed 12-6-74 Stressing NCR's 1764

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	3 7/8" / 4 1/8"	3 7/8" / 4"	7 3/4" / 8 1/8"
Lift-Off Pressure - Predicted/Actual	6840 / 6800 psi	6800 / 6600 psi	N/A
Shim Thickness/80% Ultimate Pressure	5 3/16" / 7790	6 3/4" / 7770	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

Date Bulk-filled 3-27-75 Bulk-Filling NCR's

Time since installation 10 months Inlet Pressure 35 psi Outlet Temp. 120°

Date end caps refilled: Shop Field

Data compiled by D. Waller Organization Salem

Date 4/1/77

Additional Comments:

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D 304 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. GAI/QA vendor inspection cover letter number-FPC # ______ DATE ______
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______
   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______
   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______
   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ______ Total effective wires after stressing ______
6. Date Bulk-filled ______ Bulk-Filling NCR's ______
   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______
   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D Waller Organization Salem
   Date 4/11/77
8. Additional Comments: Dome Repair —
   Degreasing - Field (7/7/76)

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D 305 CUT LENGTH 124'-9 1/4"

SHOP WASHER ID: PC 120 CR 172 FIELD WASHER ID: PC 121 CR 541

GAI/QA vendor inspection cover letter number-FPC # 10357 DATE 4/30/74

Date tendon received on-site 4-10-74 RMR Number 38726

Date installed in conduit 5-22-74 Installation NCR's 1386

Wires removed 1 Wires replaced 0 Total Ineffective wires 1

Date buttonheaded 10-11-74 Buttonheading NCR's

Bad wires 3 Accept. Reheads 1 Total Ineffective wires 2

Date stressed 11-25-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 1/8" / 4 1/8"	4 1/8" / 4 9/16"	8 1/4" / 18 5/16
Lift-Off Pressure - Predicted/Actual	6700 / 6900 psi	6680 / 6650 psi	N/A
Shim Thickness/80% Ultimate Pressure	6" / 7630	5 5/8" / 7620	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 160

Date Bulk-filled 3-27-75 Bulk-Filling NCR's

Time since installation 10 months Inlet Pressure 25 psi Outlet Temp. 126°

Date end caps refilled: Shop Field

Data compiled by D. Waller Organization Salem

Date 4/1/77

Additional Comments:

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D 305 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. GAI/QA vendor inspection cover letter number-FPC # ______ DATE ______
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______

   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______

   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ______ Total effective wires after stressing ______
6. Date Bulk-filled ______ Bulk-Filling NCR's ______

   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D. Walle Organization Salem

   Date 4/11/77
8. Additional Comments: Dome Repair

Degreasing - Shop (7/8/76) Field (7/8/76) (7/19/76)

Regreasing - 200 PSIG NCR# 2582, 164° NCR# 2581

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER D310 CUT LENGTH 140'-11'

SHOP WASHER ID: PC 121 CR 1069 FIELD WASHER ID: PC 121 CR 363

1. GAI/QA vendor inspection cover letter number-FPC # 10357 DATE 4/30/74

2. Date tendon received on-site 4-12-74 RMR Number 38757

3. Date installed in conduit 5-22-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 10-9-74 Buttonheading NCR's

Bad wires 1 Accept. Reheads 0 Total Ineffective wires 1

5. Date stressed 11-27-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 5/8" / 5"	4 5/8" / 4 1/2"	9 1/4" / 9 1/2"
Lift-Off Pressure - Predicted/Actual	6770 / 6800 PSI	6770 / 6800 PSI	N/A
Shim Thickness/80% Ultimate Pressure	6" / 7720	6" / 7730	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 162

6. Date Bulk-filled 3-27-75 Bulk-Filling NCR's

Time since installation 10 months Inlet Pressure 30 PSI Outlet Temp. 138°

Date end caps refilled: Shop Field

7. Data compiled by D. Waller Organization Salem

Date 4/1/77

8. Additional Comments: Lift off not simultaneous

Florida Power Corporation

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D 310 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. GAI/QA vendor inspection cover letter number-FPC # ______ DATE ______
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______

   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______

   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ______ Total effective wires after stressing ______
6. Date Bulk-filled ______ Bulk-Filling NCR's ______

   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D. Walley Organization Salem

   Date 4/11/77
8. Additional Comments: Dome Repair —

   Degreasing — Shop (7/8/76)

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

1. TENDON IDENTIFICATION NUMBER D311 CUT LENGTH 143'-5"

SHOP WASHER ID: PC 121 CR 1040 FIELD WASHER ID: PC 121 CR 636

.. CAI/QA vendor inspection cover letter number-FPC # 10357 DATE 4/30/74

2. Date tendon received on-site 4-12-74 RMR Number 38757

3. Date installed in conduit 5-22-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 10-9-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 11-11-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 3/4 / 4 11/16	4 3/4 / 4 5/8	9 1/2 / 9 5/16
Lift-Off Pressure - Predicted/Actual	6800/7000	6840/7000	N/A
Shim Thickness/80% Ultimate Pressure	6 3/8 / 7770	6 3/8 / 7790	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 3-27-75 Bulk-Filling NCR's

Time since installation 10 months Inlet Pressure 30 PSI Outlet Temp. 132°

Date end caps refilled: Shop Field

7. Data compiled by D. Waller Organization Salem

Date 4/1/77

8. Additional Comments:

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER D 311 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. CAI/QA vendor inspection cover letter number-FPC # ______ DATE ______
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______

   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______

   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off Pressure - Predicted/Actual	/	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

   Unseated/Broken Wires ______ Total effective wires after stressing ______
6. Date Bulk-filled ______ Bulk-Filling NCR's ______

   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D. Walker Organization Salem

   Date 4/11/77
8. Additional Comments: Dome Repair —

Degreasing — Field (7/15/76)

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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Tendon IDENTIFICATION NUMBER D312 CUT LENGTH 145'-5 3/4"

SHOP WASHER ID: PC 121 CR 1052 FIELD WASHER ID: PC 121 CR 655

1. GAI/QA vendor inspection cover letter number-FPC # 10357 DATE 4/30/74

2. Date tendon received on-site 4-12-74 RMR Number 38757

3. Date installed in conduit 5-22-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 10-9-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 12-6-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 3/4 / 4 7/8	4 3/4 / 4 7/8	9 1/2 / 9 3/4
Lift-Off Pressure – Predicted/Actual	6840/6950	6800/6700	N/A
Shim Thickness/80% Ultimate Pressure	6 1/4 17790	6 1/2 17770	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

Date Bulk-filled 3-27-75 Bulk-Filling NCR's

Time since installation 10 months Inlet Pressure 25 PSI Outlet Temp. 136°

Date end caps refilled: Shop Field

Data compiled by D. Waller Organization Salem

Date 4/1/77

Additional Comments:

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 42H17 CUT LENGTH 155'-8"

SHOP WASHER ID: PC 121 CR 674 FIELD WASHER ID: PC 122 CR 1275

1. CAI/QA vendor inspection cover letter number-FPC # 9861 DATE 2/12/74
2. Date tendon received on-site 12-28-73 RMR Number 35496
3. Date installed in conduit 1-22-74 Installation NCR's ______
   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 6-17-74 Buttonheading NCR's ______
   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0
5. Date stressed 2-6-75 Stressing NCR's ______
   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8 / 5 5/8	5 1/8 / 4 5/8	10 1/4 / 10 1/4
Lift-Off Pressure - Predicted/Actual	6870 / 7060	6810 / 6800	N/A
Shim Thickness/80% Ultimate Pressure	7 / 7810	6 / 7780	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163
6. Date Bulk-filled 7-26-74 Bulk-Filling NCR's ______
   Time since installation 6 months Inlet Pressure 9 PSI Outlet Temp. 142°
   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D. Muller Organization Gilbert
   Date 4/4/77
8. Additional Comments: ______

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 42H18 CUT LENGTH 155'-6 3/4

SHOP WASHER ID: PC 121 CR 615 FIELD WASHER ID: PC 121 CR 906

1. GAI/QA vendor inspection cover letter number-FPC # 9921 DATE 2/20/74

2. Date tendon received on-site 12-20-73 RMR Number 35528

3. Date installed in conduit 1-22-74 Installation NCR's ______

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 6-18-74 Buttonheading NCR's ______

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 3-4-75 Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8 / 5	5 1/8 / 5 3/8	10 1/4 / 10 3/8
Lift-Off Pressure - Predicted/Actual	6840 / 7100	6799 / 6750	N/A
Shim Thickness/80% Ultimate Pressure	6 3/8 / 7810	6 3/8 / 7750	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 7-26-74 Bulk-Filling NCR's ______

   Time since installation 6 months Inlet Pressure 13 PSI Outlet Temp. 148°

   Date end caps refilled: Shop ______ Field ______

7. Data compiled by D. Vadden Organization Salem

   Date 4/4/77

8. Additional Comments: ______

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Florida Power
CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 42H19 CUT LENGTH 155'-7 1/2

SHOP WASHER ID: PC 121 CR 555 FIELD WASHER ID: PC 121 CR 1013

1. GAI/QA vendor inspection cover letter number-FPC # 9921 DATE 2/20/74
2. Date tendon received on-site 12-28-73 RMR Number 35528
3. Date installed in conduit 1-22-74 Installation NCR's ______

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 6-18-74 Buttonheading NCR's ______

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0
5. Date stressed 2-6-75 Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8 , 5 1/4	5 1/8 , 5	10 1/4 , 10 1/4
Lift-Off Pressure - Predicted/Actual	6870 , 6900	6810 , 6850	N/A
Shim Thickness/80% Ultimate Pressure	7 9/16 , 7810	6 5/8 , 7780	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163
6. Date Bulk-filled 7-26-74 Bulk-Filling NCR's ______

   Time since installation 6 months Inlet Pressure 8 PSI Outlet Temp. 154°

   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D Waller Organization Salem

   Date 4/4/77
8. Additional Comments: ______

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 42H31 CUT LENGTH 155'-7 1/4"

SHOP WASHER ID: PC 121 CR 368 FIELD WASHER ID: PC 122 CR 1233

1. GAI/QA vendor inspection cover letter number-FPC # 9285 DATE 11/5/73
2. Date tendon received on-site 10-4-73 RMR Number 33356
3. Date installed in conduit 1-29-74 Installation NCR's ______

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 6-25-74 Buttonheading NCR's ______

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0
5. Date stressed 2-13-75 Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8 / 5 1/4	5 1/8 / 4 7/8	10 1/4 / 10 1/8
Lift-Off Pressure - Predicted/Actual	6870 / 7000	6810 / 6800	N/A
Shim Thickness/80% Ultimate Pressure	6 9/16 / 7810	5 3/8 / 7780	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163
6. Date Bulk-filled 7-31-74 Bulk-Filling NCR's ______

   Time since installation 6 months Inlet Pressure 22 PSI. Outlet Temp. 128°

   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D. Walker Organization Salem

   Date 4/4/77
8. Additional Comments: ______

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 42H32 CUT LENGTH 155'-6

SHOP WASHER ID: PC 121 CR 564 FIELD WASHER ID: PC 120 CR 123

1. GAI/QA vendor inspection cover letter number-FPC # 9920 DATE 2/20/74
2. Date tendon received on-site 1-9-74 RMR Number 35888
3. Date installed in conduit 1-17-74 Installation NCR's
   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 6-27-74 Buttonheading NCR's
   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0
5. Date stressed 2-28-75 Stressing NCR's
   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8 / 5 1/4	5 1/8 / 5 1/8	10 1/4 / 10 3/8
Lift-Off Pressure - Predicted/Actual	6810 / 6750	6790 / 6800	N/A
Shim Thickness/80% Ultimate Pressure	6 3/8 / 7810	6 3/8 / 7750	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 8-9-74 Bulk-Filling NCR's
   Time since installation 7 months Inlet Pressure 15 PSI Outlet Temp. 157°
   Date end caps refilled: Shop Field
7. Data compiled by D. Walker Organization Salem
   Date 4/4/77
8. Additional Comments:

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 42H33 CUT LENGTH 155'-8

SHOP WASHER ID: PC 121 CR 546 FIELD WASHER ID: PC 121 CR 934

1. GAI/QA vendor inspection cover letter number-FPC # 9920 DATE 2/20/74
2. Date tendon received on-site 1-9-74 RMR Number 35888
3. Date installed in conduit 1-18-74 Installation NCR's

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0
4. Date buttonheaded 6-27-74 Buttonheading NCR's

   Bad wires 0 Accept. Reheads 0 Total Ineffective Wires 0
5. Date stressed 2-14-75 Stressing NCR's

   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/4 / 5 3/8	5 1/8 / 5 1/4	10 1/4 / 10 5/8
Lift-Off Pressure - Predicted/Actual	6870 / 7000	6810 / 6900	N/A
Shim Thickness/80% Ultimate Pressure	7 3/8 / 7810	7 3/8 / 7780	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163
6. Date Bulk-filled 8-9-74 Bulk-Filling NCR's

   Time since installation 7 months Inlet Pressure N/A Outlet Temp. 160°

   Date end caps refilled: Shop Field
7. Data compiled by D Walker Organization [illegible]

   Date 4/4/77
8. Additional Comments:

Florida Power Corporation

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 42 H 43 CUT LENGTH 155'-6 3/4

SHOP WASHER ID: PC 121 CR 524 FIELD WASHER ID: PC 121 CR 978

1. GAI/QA vendor inspection cover letter number-FPC # 9920 DATE 2/20/74

2. Date tendon received on-site 1-14-74 RMR Number 36031

3. Date installed in conduit 1-21-74 Installation NCR's ______

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 7-8-74 Buttonheading NCR's ______

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 2-19-75 Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8 / 5 1/2	5 1/8 / 5 1/8	10 1/4 / 10 5/8
Lift-Off Pressure - Predicted/Actual	6870 / 6750	6810 / 6700	N/A
Shim Thickness/80% Ultimate Pressure	7 3/16 / 7810	6 1/4 / 7780	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 7-31-74 Bulk-Filling NCR's ______

   Time since installation 6 months Inlet Pressure 10 PSI Outlet Temp. 136°

   Date end caps refilled: Shop ______ Field ______

7. Data compiled by R Waller Organization Salem

   Date 4/4/77

8. Additional Comments: ______

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 42 H 44 CUT LENGTH 155'-6"

SHOP WASHER ID: PC 122 CR 1230 FIELD WASHER ID: PC 122 CR 1230

1. GAI/QA vendor inspection cover letter number-FPC # 9920 DATE 2/20/74

2. Date tendon received on-site 1-14-74 RMR Number 36031

3. Date installed in conduit 1-21-74 Installation NCR's

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 7-10-74 Buttonheading NCR's

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 2-26-75 Stressing NCR's

   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8, 5 1/8	5 1/8, 5	10 1/4, 10 1/8
Lift-Off Pressure - Predicted/Actual	6790, 6600	6840, 6750	N/A
Shim Thickness/80% Ultimate Pressure	6 1/4, 7750	7, 7790	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 7-31-74 Bulk-Filling NCR's

   Time since installation 6 months Inlet Pressure 14 PSI Outlet Temp. 140°

   Date end caps refilled: Shop Field -

7. Data compiled by D. Walla Organization Salem

   Date 4/4/77

8. Additional Comments:

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

TENDON IDENTIFICATION NUMBER 4-2H45 CUT LENGTH 155'-7

SHOP WASHER ID: PC 121 CR 566 FIELD WASHER ID: PC 122 CR 1194

1. GAI/QA vendor inspection cover letter number-FPC # 9957 DATE 2/25/74

2. Date tendon received on-site 1-16-74 RMR Number 36035

3. Date installed in conduit 1-21-74 Installation NCR's ______

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 7-10-74 Buttonheading NCR's ______

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 2-20-75 Stressing NCR's ______

Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8, 5 7/16	5 1/8, 5	10 1/4, 10 7/16
Lift-Off Pressure - Predicted/Actual	6870, 7000	6810, 6900	N/A
Shim Thickness/80% Ultimate Pressure	7 1/4, 7810	6 3/8, 7780	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 7-31-74 Bulk-Filling NCR's ______

Time since installation 6 months Inlet Pressure 12 PSI Outlet Temp. 140°

Date end caps refilled: Shop ______ Field ______

7. Data compiled by D. Walker Organization Salem

Date 4/4/77

8. Additional Comments: ______

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER 46H20 CUT LENGTH 155'-11 1/4

SHOP WASHER ID: PC 120 CR 78 FIELD WASHER ID: PC 122 CR 1138

1. GAI/QA vendor inspection cover letter number-FPC # 9245 DATE 10/31/73

2. Date tendon received on-site 7-17-73 RMR Number 32681

3. Date installed in conduit 4-15-74 Installation NCR's ______

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 7-19-74 Buttonheading NCR's ______

   Bad wires 13 Accept. Reheads 12 Total Ineffective wires 1

5. Date stressed 3-5-75 Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 , 5 1/4	5 1/4 , 5 1/8	10 1/4 , 10 3/8
Lift-Off Pressure - Predicted/Actual	6640 , 6930	6600 , 6600	N/A
Shim Thickness/80% Ultimate Pressure	7 3/8 , 7700	6 5/8 , 7610	N/A

   Unseated/Broken Wires 2 Total effective wires after stressing 160

6. Date Bulk-filled 11-4-74 Bulk-Filling NCR's ______

   Time since installation 6 1/2 month Inlet Pressure 50 psi Outlet Temp. 130°

   Date end caps refilled: Shop 4-14-75 Field 4-14-75

7. Data compiled by D. Miller Organization Salem

   Date 4/4/77

8. Additional Comments:

Florida Power CORPORATION

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER 46H21 CUT LENGTH 154'-4

SHOP WASHER ID: PC 120 CR 167 FIELD WASHER ID: PC 122 CR 1141

1. GAI/QA vendor inspection cover letter number-FPC # N/A DATE

2. Date tendon received on-site 10-15-73 RMR Number 33610

3. Date installed in conduit 4-23-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 7-19-74 Buttonheading NCR's

Bad wires 1 Accept. Reheads 0 Total Ineffective wires 1

5. Date stressed 2-7-75 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	5 1/8 / 5 1/8	5 1/8 / 5 1/4	10 1/4 / 10 3/8
Lift-Off Pressure - Predicted/Actual	6720 / 6700	6730 / 6950	N/A
Shim Thickness/80% Ultimate Pressure	5 5/8 / 7700	5 9/16 / 7640	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 162

6. Date Bulk-filled 11-4-74 Bulk-Filling NCR's

Time since installation 6 1/2 months Inlet Pressure 50 psi Outlet Temp. 130°

Date end caps refilled: Shop 4-14-75 Field 4-14-75

7. Data compiled by D. Waller Organization Salem

Date 4/4/77

8. Additional Comments:

Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON HISTORY

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TENDON IDENTIFICATION NUMBER 46 H21 CUT LENGTH ______

SHOP WASHER ID: PC ______ CR ______ FIELD WASHER ID: PC ______ CR ______

1. GAI/QA vendor inspection cover letter number-FPC # ______ DATE ______
2. Date tendon received on-site ______ RMR Number ______
3. Date installed in conduit ______ Installation NCR's ______

   Wires removed ______ Wires replaced ______ Total Ineffective wires ______
4. Date buttonheaded ______ Buttonheading NCR's ______

   Bad wires ______ Accept. Reheads ______ Total Ineffective wires ______
5. Date stressed ______ Stressing NCR's ______

   Date restressed ______ Restressing NCR's ______

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	/	/	/
Lift-Off ~~Pressure~~ FORCE - Predicted/Actual (KIPS)	1425.6 / 1457.5	1425.6 / 1546	N/A
Shim Thickness/80% Ultimate Pressure LOCK-OFF FORCE	5 3/4" /	/	N/A

   Unseated/Broken Wires 1- BAD PREV. 0- AT SURV. Total effective wires after stressing 162
6. Date Bulk-filled ______ Bulk-Filling NCR's ______

   Time since installation ______ Inlet Pressure ______ Outlet Temp. ______

   Date end caps refilled: Shop ______ Field ______
7. Data compiled by D. F. Griffin Organization FPC

   Date 5-16-78
8. Additional Comments: INSPECTED FIRST SURVEILLANCE (1-10-78)

1) NO INDICATION OF RUST - CORROSION
2) LOCK-OFF FORCE (SHOP - SAME AS LIFT-OFF; FIELD - 1524 K)
3) NO INDICATION OF CRACKING AT ANCHORAGES
4) SHOP END SHIM - RECORDS SHOW (5 5/8") - ACTUAL (5 3/4")

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CRYSTAL RIVER UNIT NO. 3
REACTOR BUILDING PRESTRESSING SYSTEM
TENDON SURVEILLANCE RECORD

TENDON NO. 46H21

Inspection Period and Date	Location	LIFT OFF CONDITION: Force (kips)	Avg. Force (kips)	Shim Thickness (in)	Elongation (in)	Total Effective Wires	RETENSIONING: Force (kips)	Avg. Force (kips)	Shim Thickness (in)	Elongation (in)	Total Effective Wires	Reactor Bldg. Temperature °F Int.	Ext.	Comments
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Original Stressing	S-6	1624		5 5/8	5 1/8		N/A		N/A	N/A				
2-7-75	F-4	1682	1653	5 9/16	5 1/4	162	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1st	S-6	1458		5 3/4	N/A		1458		5 3/4	N/A				
1-10-78	F-4	1546	1502	5 9/16	N/A	163	1516	1536	5 9/16	N/A	~~163~~ 162	106	41	
5TH	S-6	1423		5 7/8	N/A		N/A		N/A	N/A				15 GALLONS OF GREASE ADDED OVER REMOVED.
12/7/93	E-4	1427	1425	5 11/16	N/A	162	N/A	N/A	N/A	N/A	N/A	130°	68°	

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ATTACHMENT 1
Sheet 1 of 1
QA or Vital Records Change Form

FORM RDC-NGGC-0001-1-15

Original Document Number/Description: Work Order No. 681043-01

Original Record Number (RMS (Record Nbr), STAIRS (Din Nbr), SEEK (RAN Nbr):

Record No. 3792595

Original Document Date: 12/7/07

Reason For Correction or Supplement:

Receipt of Final Report From Testing Vendor (PSC) and Site approval. Final Report for the 8th Tendon Surveillance is to be attached / Part of the Work order (W.O.# 681043-01) Records.

Approved By: [signature] / 2/25/08

Signature Originating Organization — Date

NOTE: When transmitting the Correction or Supplement add "Supplement" to the document title field.

QA RECORD

Evaluation and Acceptance of PSC Tendon Surveillance Results (30th Year)

The surveillance was conducted by Precision Surveillance Corporation (PSC) between October and November 2007 with CR-3 site overview utilizing SP-182 as the controlling site procedure. The actual procedures used for testing activities were contained in the PSC In-Service Inspection Manual for Progress Energy Crystal River Unit 3 (N1002) Revision 0. This 30th year surveillance met all the requirements of ASME Section XI, subsection IWL as modified by 10CFR50.55(a). The results of this surveillance have shown that the CR-3 containment structure has not experienced abnormal degradation and is projected to meet its minimum design criteria until the end of its current forty-year life.

Code Compliance.

IWL-2400: Schedule
CR-3 performed the Structural Integrity Test in November of 1976. The code required the 30th year surveillance is to be performed in November of 2006 +/- 1 year. Since the 30th surveillance was performed between October and November 2007 this requirement was met.

IWL-2510: Examination of Concrete
The concrete was visually examined (VT-3) during the 30th surveillance period. For areas that required further evaluation, a detailed visual exam (VT-1) was performed. The data was reviewed by the Responsible Professional Engineer (RPE) and found to be acceptable.

IWL-2520: Examination of Unbonded Post-Tensioning Systems
The random selection for CR-3 resulted in three Dome, three Vertical and 5 Horizontal tendons being selected. These tendons were D129, D212, D238, 12V01, 45V20, 61V17, 46H21, 42H46, 51H34, 62H30 and 13H36. It was later determined that 12V01 (identified as a control tendon) was retensioned during the prior surveillance. Per IWL-2521 (b), 61V08 was selected as a substitute control tendon. Although not identified as an exempted tendon the IWL-2524 and IWL-2525 examinations were performed on the original selected tendon (12V01).

IWL-2522: Tendon Force Measurements
Tendon force measurements were performed on the selected sample and adjacent tendons as required. All vertical and dome tendons tested this inspection period were found to have forces greater than 95% of the corresponding predicted force. Of the hoop tendons, 42H46 and 51H34 were observed with forces above 95% of their predicted force. Tendons 62H30, 46H21 and 13H36 were found to have forces below 95% but above 90% of their corresponding predicted forces. While monitoring the forces of tendons adjacent to the respective surveillance tendons, PSC NCR's FN1002-001, 002, 003, 006, 007, 008, 009, 011 and 012 were generated to document the conditions and were dispositioned by CR03ENG in AR's 251318 and 252558. After the completion of testing the adjacent tendons, all tendons with an as-found force below 95% were restored to an as-left force –0%, +6% of their corresponding predicted force in accordance with PSC Procedure SQ9.0. The acceptance criteria of IWL-3221.1 were met for all the tendons with the exception of tendon 62H30, 13H36, and 46H21. The analysis of the as-found lift-off forces contained in the PSC final report, demonstrates that the as-found condition is acceptable for these tendons. Part of the analysis is a

discussion on the calculation of the predicted base value for each tendon. Historically CR-3 has found numerous tendons below the 95% of predicted base value, but demonstrated the acceptability of the containment with the as-found condition.

IWL-2523: Tendon Wire and Strand Sample Examination and Testing
Tendons D238, 61V17 and 51H34 were detensioned and a wire removed for testing. The acceptance criteria of IWI-3221.2 were met for all wire samples.

IWL-2524: Examination of Tendon Anchorage Areas
A VT-1 visual examination was performed for all tendons when the end cap was removed. The detailed inspections did not reveal any cracks in the concrete adjacent to the bearing plates nor in any of the anchorage components. There were several instances of missing or broken wires observed. These instances were compared against the acceptance criteria contained in IWL-3321.3 and SP-182 and found to be acceptable. Therefore no further analysis was required for these conditions.

IWL-2525: Examination of Corrosion Protection Medium and Free Water
There were no instances of free water in the corrosion protection medium. The acceptance criteria of IWL-3221.4 were met for all samples taken.

IWL-2526: Removal and Replacement of Corrosion Protection Medium
The amount of grease removed and replaced was recorded for each tendon.

10CFR50.55(a)(b)(viii) Examination of Concrete Containments

(a) During the visual exam, all grease caps were examined for leakage and deformation. No grease leakage or deformation was observed. Minor weepage continues to be observed on the intermediate building buttresses. See (d) (3) below for further discussion.
(b) The evaluation of the trend data does not indicate an adverse trend.
(c) The elongation of any tendon during restressing did not vary from previously recorded results by more than 10% and therefore was acceptable.
(d) The following items shall be included in the RFO 15 NIS-1 report:
    (1) The presence of water in the grease sample. There was no water recorded for this surveillance.
    (2) The absolute difference between the amount of grease removed and the amount replaced did not exceed 10% of the net duct volume in any of the tendons.
    (3) Detection of grease leakage (if found). During the tendon accessibility walkdown PSC noted that small grease/oil leaks were occurring on multiple tendon caps, which were located inside existing structures that adjoin the containment building (adjacent to main steam and feedwater penetrations). The substance displacing from the tendon cap is actually the oil portion from the original P2 grease that has separated. This is a common occurrence that we has been noted throughout many plants which perform tendon surveillances. This condition does not correspond to the system's degradation. A small amount of oil can cause a large aesthetically unpleasing condition. On buttresses without any coating, the oil is absorbed into the concrete, leaving very little signs of leakage. However, in the existing condition, the coated surface does not allow for the absorption to occur.

Therefore, the oil continues to displace down the buttress face. PSC recommends this condition be monitored and cleaned on a periodic. Gasket replacement can be performed on the tendon cap, however the oil will continue to leak from the cap based on PSC's experience. The labor and material required for the gasket replacement is not cost effective and PSC does not recommend performing such task.

Based on the evaluation of the In-Service Inspection results of the 30th Year Containment IWL Tendon Surveillance performed at CR-3 have been determined to meet the code requirements and that the containment structure has experience no abnormal degradation of the post-tensioning system. The containment post-tensioning system is performing in accordance with the design requirements and is expected to continue to do so for the remaining life of the unit.

Prepared By: ______________________

Rick Portmann (IWE/IWL Program Owner)

Reviewed By: ______________________

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Loyd Larramore (ANII)

PSC	DOCUMENT NUMBER: CR-N1002-504 REVISION: 0 PAGE: i DOCUMENT TITLE: FINAL REPORT FOR THE 30TH YEAR CONTAINMENT IWL INSPECTION PROJECT TITLE: 30TH YEAR TENDON SURVEILLANCE AT CRYSTAL RIVER DATE: 01/24/08	Progress Energy

DOCUMENT COVER SHEET

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Title: FINAL REPORT FOR THE 30TH YEAR CONTAINMENT IWL INSPECTION

No.	Description	Prepared By	Date	Reviewed By	Date
0	Submittal Issue	*C.E. COX*	*01/24/08*	*P.C. SMITH*	*01/24/08*
		PSC SIGN OFF			

REVISIONS

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ABSTRACT

The purpose of this report is to present the results of the 2007 30th Year Containment IWL Inspection of the Progress Energy Florida Crystal River Unit 3 Containment Structure post tensioning system. The results of this investigation are discussed in detail in the body of this report and are summarized as follows:

1. The sheathing filler (grease) samples were tested and found to have acceptable levels of water-soluble ions, (Chlorides, Nitrates, and Sulfides). All tendon ends had a moisture content within acceptable limits. All neutralization numbers were above the IWL requirement of 0.0 mg KOH/g value and acceptable. No visible breakdown of the grease was noted either by color or consistency for all grease samples tested.
2. No tendon end exhibited water during removal of the grease cap, detensioning or around the tendon anchorage.
3. Acceptable corrosion levels were found on all tendon ends and no cracks were found on any anchorage components. Cracks in the concrete surrounding the bearing plates were all within allowable tolerance of < 0.010"
4. Additional missing or protruding buttonheads were found on two of the inspected surveillance tendons. The conditions have been reported via NCR's FN1002-004 & FN1002-010 (12V01) and FN1002-005 (61V17) to CR03ENG for disposition.
5. The IWL baseline concrete examination for Unit 3 was required to be completed by September 10, 2001. The subsequent required examination of the containment concrete was performed during this 30th Year period. However, all of the examinations associated with this IWL requirement have been performed by the Utility and the results are reviewed and reported by CR03ENG.
6. The hydraulic jacks used for liftoffs, detensioning and retensioning tendons were calibrated and found to be within an acceptable variation of +/- 1.5%.
7. All surveillance tendons monitored for forces this inspection period were found to have forces greater than 95% of the corresponding predicted force OR, if found below 95%, had their adjacent tendons inspected until one tendon, on both sides of the original scope tendon, met the lift-off force criteria. All tendons, both original and adjacent found below 95% were restored to an As left force of –0%, +6% above predicted force.
8. The detensioned tendons were retensioned with acceptable elongations and acceptable force levels. All test wires removed from detensioned tendons were found to have acceptable corrosion levels and acceptable yield and tensile tests.
9. All tendons were resealed and regreased to acceptable levels in accordance with SQ12.1 of the PSC Surveillance Procedure, which is included in Appendix F.
10. A comparison of "As-found" force levels to the original force levels was made in an effort to detect any evidence of system degradation. The amount of force loss since the original installation is comparable to the losses of other plants of this age and does not show any evidence of system degradation.

Based on the data gathered during the 2007 30th Year Containment IWL Inspection and reported herein, the conclusion is reached that no abnormal degradation of the Post Tensioning System has occurred at the Progress Energy Florida Crystal River Unit 3 Containment Structure.

APPENDICES	NO. OF PAGES
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APPENDIX B: LABORATORY ANALYSIS OF SHEATHING FILLER	12
APPENDIX C: NON-CONFORMANCE REPORTS	14
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1.0 INTRODUCTION

This report details the 30th Year Containment IWL Inspection of the Progress Energy Florida Crystal River Unit 3 containment structure. The Containment Structure surveillance program is a systematic means of assessing the quality and structural performance of the post tensioning system and exterior concrete surface.

The tendon surveillance program consists of a periodic inspection of the condition of a selected group of tendons. This program provides confidence in the condition and functional capability of the system, and an opportunity for timely corrective measures if adverse conditions are detected. Physical tendon surveillance consists of: sheathing filler inspection and testing, anchorage inspection, force monitoring, inspection and tensile testing of removed wire samples (for detensioned tendons), retensioning of detensioned tendons and replacement of sheathing filler after completion of all inspections.

Crystal River Unit 3 is currently committed to meet the requirements of the American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section XI, 1992 Edition with 1992 Addenda, Sub-Section IWL "Requirements for Class CC Concrete Components of Light-Water Cooled Plants". This program is also subject to the limitations and modifications of 10 CFR 50.55a(b)(2), 10 CFR 50.55a(g)(4), and 10 CFR 50.55a(g)(6).

The 30th Year tendon surveillance at the Crystal River Unit 3 began on October 8, 2007 and ended on December 6, 2007. This surveillance period consisted of a Physical Inspection on Unit 3. The Crystal River Reactor Building Structural Integrity Tendon Surveillance Program (SP-182), PSC Surveillance Procedures, the Code of Federal Regulations 10 CFR 50.55a and ASME Section XI, Sub-Section IWL, define the specific requirements for selection of the inspection tendons as well as specific requirements and acceptance criteria for the performance of the inspection. A copy of the PSC Surveillance Procedures is included in Appendix F of this Surveillance Report. The tendon selection for the Surveillance is listed in the following Tables 1 and 2.

Upper Support Frames are assembled and then lifted to the top of the Containment Dome to support the crews and equipment performing inspection activities.

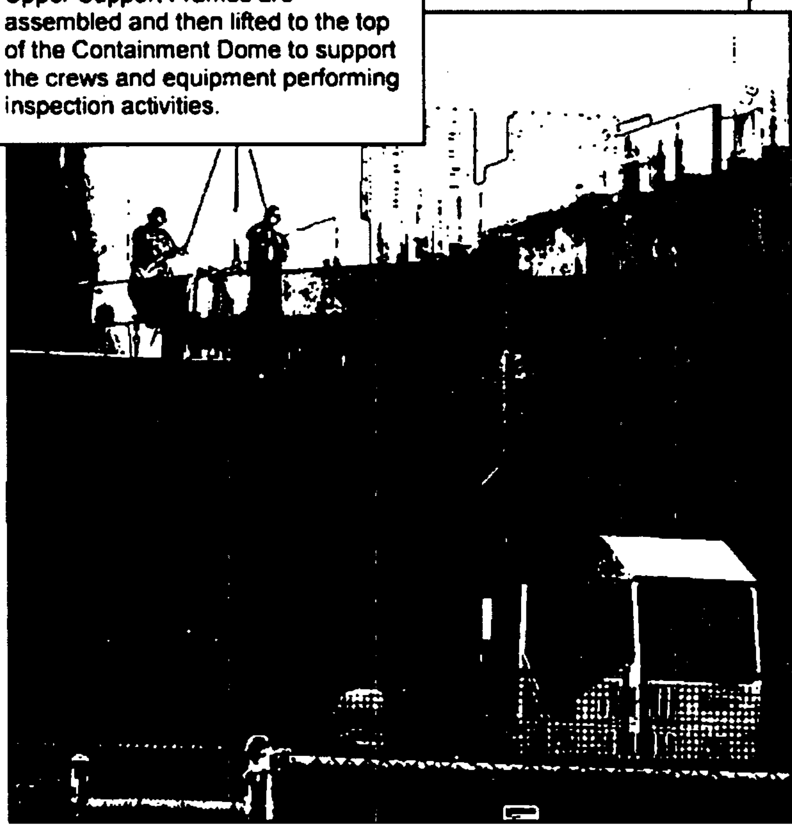
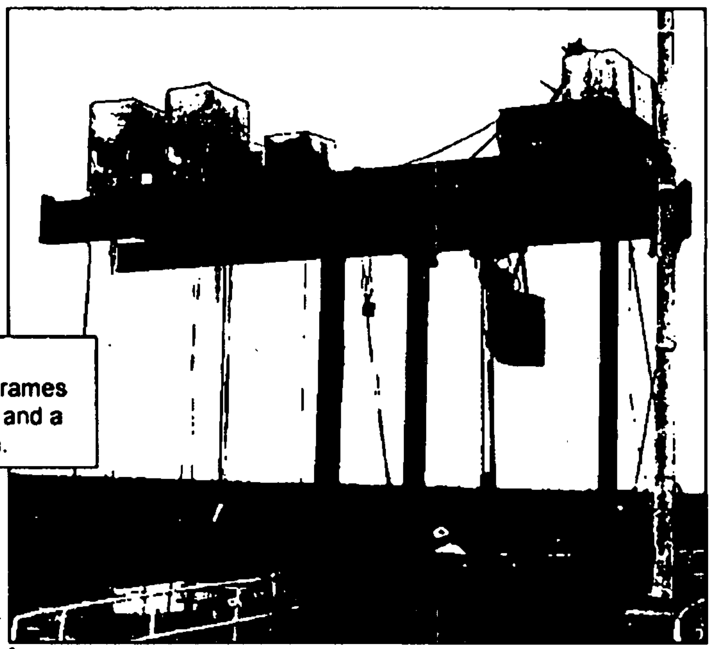


TABLE 1: 30TH YEAR SURVEILLANCE SCOPE OF WORK

TENDON	END	VISUAL					PHYSICAL					COMMENTS
		SQ6.0	SQ6.1	SQ7.0	SQ8.0	SQ8.3	SQ9.0	SQ10.2	SQ10.3	SQ11.0	SQ12.1	
12V01	D & G	●	●	●	●	●	●				●	STEAM ZONE @ DOME
45V20	D & G	●	●	●	●	●	●				●	ORIGINAL SCOPE
61V17	D & G	●	●	●	●	●	●	●	●	●	●	DETENSION
61V08	D & G	●	●	●	●	●	●				●	COMMON (REF. FCR-FN1002-001)
13H36	BT. 1 & 3	●	●	●	●	●	●				●	
42H46	BT. 2 & 4	●	●	●	●	●	●				●	STEAM ZONE @ BT2
46H21	BT. 4 & 6	●	●	●	●	●	●				●	COMMON
51H34	BT. 5 & 1	●	●	●	●	●	●	●	●	●	●	DETENSION, STEAM ZONE @BT1
62H30	BT. 6 & 2	●	●	●	●	●	●				●	STEAM ZONE @BT 2
46H07	BT. 4 & 6											ALTERNATE
D129	BT. 3 & 5	●	●	●	●	●	●				●	STEAM ZONE @BT3
D212	BT. 1 & 3	●	●	●	●	●	●				●	COMMON
D238	BT. 4 & 6	●	●	●	●	●	●	●	●	●	●	DETENSION
D337	BT. 1 & 5											ALTERNATE

LEGEND

SQ 6.0 – GREASE CAP REMOVAL
SQ 6.1 – INSPECTION FOR WATER
SQ 7.0 – AQUIRE GREASE SAMPLES
SQ 8.0 – ANCHORAGE INSPECTION
SQ 8.3 – CONCRETE INSPECTION
SQ 9.0 – MONITOR TENDON FORCE
SQ 10.2 – TENDON WIRE INSPECTION
SQ 10.3 – TESTING TENDON WIRES
SQ 11.0 – RETENSION TENDONS
SQ 12.1 – GREASE REPLACEMENT



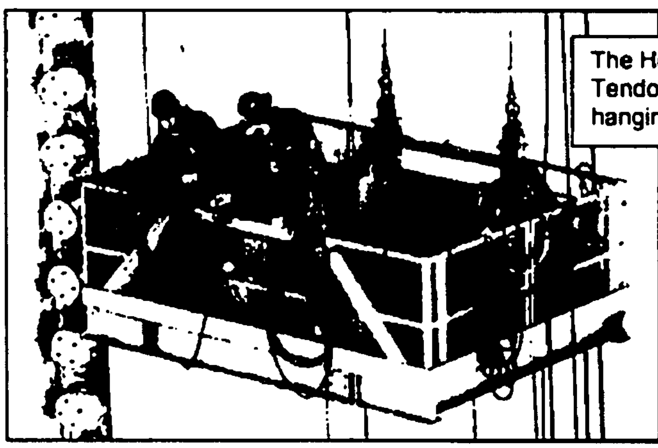
Once Installed on the Containment Dome, the Frames support the work platform and a hoist for the hydraulic ram.

TABLE 2. 30TH YEAR ADDITIONAL SCOPE OF WORK: ADJACENT TENDONS												
		VISUAL					PHYSICAL					
TENDON	END	SQ 6.0	SQ 6.1	SQ 7.0	SQ 8.0	SQ 8.3	SQ 9.0	SQ 10.2	SQ 10.3	SQ 11.0	SQ 12.1	COMMENTS
13H33	BT. 1 & 3	●	●		●		●				●	DUE TO LOW LIFT OFF ON 13H36
13H34	BT. 1 & 3	●	●		●		●			●	●	DUE TO LOW LIFT OFF ON 13H36
13H35	BT. 1 & 3	●	●		●		●			●	●	DUE TO LOW LIFT OFF ON 13H36
13H37	BT. 1 & 3	●	●		●		●			●	●	DUE TO LOW LIFT OFF ON 13H36
13H38	BT. 1 & 3	●	●		●		●				●	DUE TO LOW LIFT OFF ON 13H36
46H19	BT. 4 & 6	●	●		●		●				●	DUE TO LOW LIFT OFF ON 46H21
46H20	BT. 4 & 6	●	●		●		●			●	●	DUE TO LOW LIFT OFF ON 46H21
46H22	BT. 4 & 6	●	●		●		●			●	●	DUE TO LOW LIFT OFF ON 46H21
46H23	BT. 4 & 6	●	●		●		●			●	●	DUE TO LOW LIFT OFF ON 46H21
46H24	BT. 4 & 6	●	●		●		●			●	●	DUE TO LOW LIFT OFF ON 46H21
62H29	BT. 6 & 2	●	●		●		●				●	DUE TO LOW LIFT OFF ON 62H30
62H31	BT. 6 & 2	●	●		●		●			●	●	DUE TO LOW LIFT OFF ON 62H30
62H32	BT. 6 & 2	●	●		●		●			●	●	DUE TO LOW LIFT OFF ON 62H30
62H33	BT. 6 & 2	●	●		●		●			●	●	DUE TO LOW LIFT OFF ON 62H30
62H34	BT. 6 & 2	●	●		●		●				●	DUE TO LOW LIFT OFF ON 62H30

NOTE:
Physical inspection of 62H31 & 62H32 were only performed on the Buttress 2 end. Access restrictions limited the Buttress 6 to visual inspections only

LEGEND

SQ 6.0 – GREASE CAP REMOVAL
SQ 6.1 – INSPECTION FOR WATER
SQ 7.0 – AQUIRE GREASE SAMPLES
SQ 8.0 – ANCHORAGE INSPECTION
SQ 8.3 – CONCRETE INSPECTION
SQ 9.0 – MONITOR TENDON FORCE
SQ 10.2 – TENDON WIRE INSPECTION
SQ 10.3 – TESTING TENDON WIRES
SQ 11.0 – RETENSION TENDONS
SQ 12.1 – GREASE REPLACEMENT



The Hoop and Dome Tendons are accessed from hanging work platforms.

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2.0 SURVEILLANCE PROCEDURES

Appendix F of this Surveillance Report contains the detailed procedures for conducting the tendon surveillance. The surveillance consists of the following steps:

2.1 Visual examination of sheathing filler grease.

2.2 Analytical testing of sheathing filler grease samples.

2.3 Inspection of the anchorage assembly of each of the surveillance tendon ends for deleterious conditions such as corrosion, cracks, broken or missing wires or buttonheads.

2.4 Inspection of concrete surrounding the bearing plate.

2.5 Measurement of the liftoff force for each physical surveillance tendon.

2.6 Removal of one wire from surveillance tendons, which are detensioned for examination and testing.

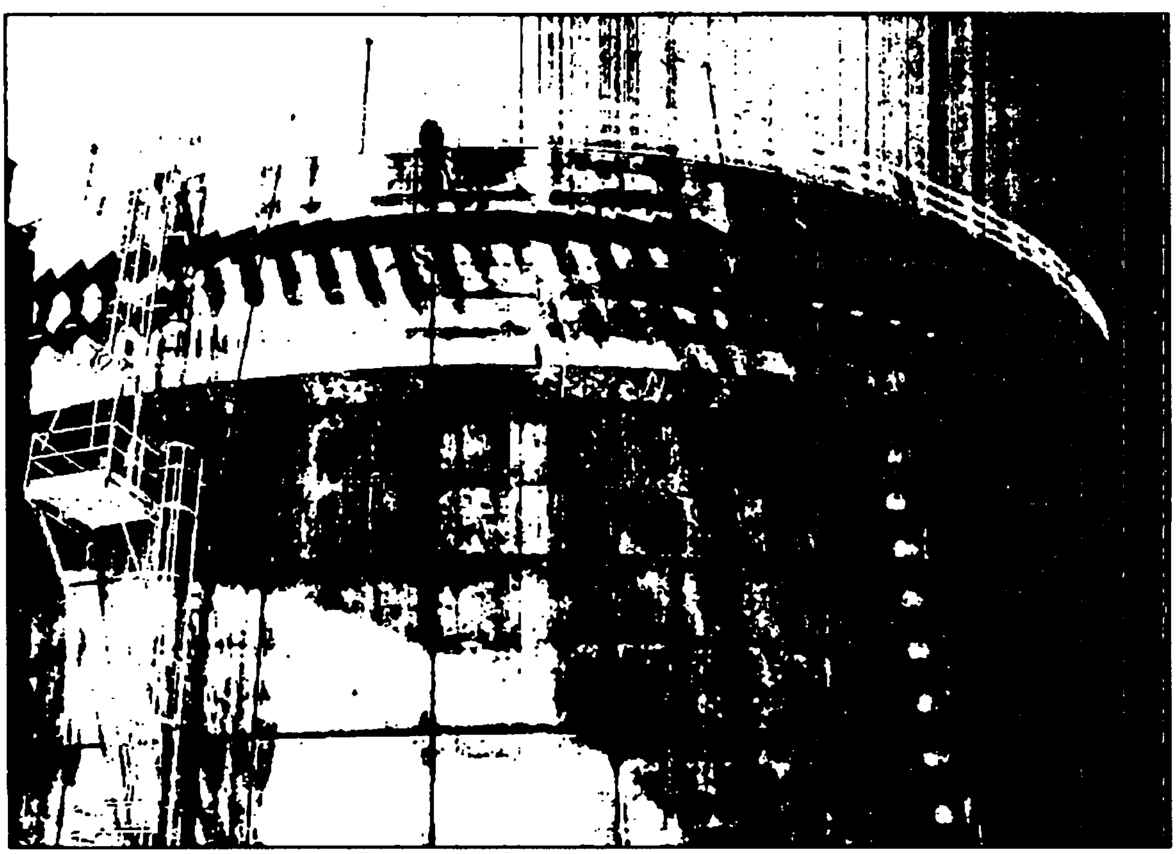
2.7 Retensioning of detensioned tendons and measuring the corresponding tendon elongation.

2.8 Visual inspection for corrosion, pitting, or any significant physical change of the removed wires.

2.9 Testing of wires removed from tendons for yield strength, ultimate strength, and percentage elongation at failure.

2.10 Resealing tendon caps and replacement of lost sheathing filler into the tendon duct and cap.

2.11 Evaluation of test and inspection results to assess the general condition of the post tensioning system.



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3.0 SHEATHING FILLER ANALYSIS

3.1 A sample of sheathing filler (grease) was removed from each end of the surveillance tendons. Chemical tests were performed on each sample by Suburban Laboratories, Inc. The results are presented in Appendix B and are summarized in Tables 3 thru 5. In Tables 3 thru 5, "N/A" indicates that samples were not required for testing.

3.2 The maximum acceptable limits are: 10 percent by weight for water content and 10 parts per million for water-soluble chlorides, nitrates and sulfides. All samples that were tested met the acceptance criteria as stated above.

3.3 The sample testing report also includes the neutralization number of each grease sample. This test is generally performed by grease manufacturers on new batches of the product and is a method of determining the overbase additives in the grease. Degradation of the sheathing filler will yield a change in the acidity of the filler material as well as an increase in the ion content. The required neutralization number for the mixture of grease at Crystal River Unit 3 is greater than 0.0 mg KOH/g. This requirement was achieved by all samples tested.

3.4 No detrimental condition was noted on any grease samples, and no visible breakdown of the grease by either color or consistency was noted on any of the tendons tested.

TABLE 3: VERTICALS-LABORATORY ANALYSIS OF SHEATHING FILLER

TENDON	END	ION CONCENTRATION (PPM)			WATER CONTENT (%wt)	NEUTRAL No. (mg KOH/g)
		CHLORIDE	SULFIDE	NITRATE		
12V01	TOP	<0.50	<0.50	<0.50	0.19	71.5
	BOT	0.50	<0.50	<0.50	0.31	51.9
45V20	TOP	<0.50	<0.50	<0.50	0.19	72.3
	BOT	0.50	<0.50	<0.50	0.34	60.2
61V08	TOP	0.50	<0.50	<0.50	0.16	68.4
	BOT	0.50	<0.50	<0.50	<0.10	48.0
61V17	TOP	0.50	<0.50	<0.50	<0.10	61.5
	BOT	0.50	<0.50	<0.50	<0.10	43.4

ACCEPTANCE LIMITS

TEST	LIMITS
WATER SOLUBLE CHLORIDE	LESS THAN 10.0PPM
WATER SOLUBLE NITRATES	LESS THAN 10.0PPM
WATER SOLUBLE SULFIDES	LESS THAN 10.0PPM
WATER CONTENT	LESS THAN 10% DRY WEIGHT
NEUTRALIZATION NO.	GREATER THAN 0.0 mg KOH/

After the grease cap is removed, samples of grease are taken for all tendons requiring a visual or physical inspection.

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TABLE 4: HOOPS-LABORATORY ANALYSIS OF SHEATHING FILLER						
TENDON	END	ION CONCENTRATION (PPM)			WATER CONTENT (%wt)	NEUTRAL No. (mg KOH/g)
		CHLORIDE	SULFIDE	NITRATE		
13H36	BT 1	0.50	<0.50	<0.50	0 33	45.4
	BT 3	1.0	<0.50	<0.50	0.10	46.3
42H46	BT 2	0.50	<0.50	<0.50	<0 10	40.4
	BT 4	0.50	<0.50	<0.50	<0.10	43.1
46H21	BT 4	0.50	<0.50	<0.50	<0.10	55.7
	BT 6	0.50	<0.50	<0.50	<0.10	62.4
51H34	BT 1	<0.50	<0.50	<0.50	0.12	47.7
	BT 5	0.50	<0.50	<0.50	<0.10	40.3
62H30	BT 2	0.50	<0.50	<0.50	<0.10	34.0
	BT 6	0.50	<0.50	<0.50	<0.10	48.2

ACCEPTANCE LIMITS

TEST	LIMITS
WATER SOLUBLE CHLORIDE	LESS THAN 10.0PPM
WATER SOLUBLE NITRATES	LESS THAN 10.0PPM
WATER SOLUBLE SULFIDES	LESS THAN 10.0PPM
WATER CONTENT	LESS THAN 10% DRY WEIGHT
NEUTRALIZATION NO.	GREATER THAN 0.0 mg KOH/

TABLE 5: DOMES-LABORATORY ANALYSIS OF SHEATHING FILLER						
TENDON	END	ION CONCENTRATION (PPM)			% WATER CONTENT (%wt)	NEUTRAL No. (mg KOH/g)
		CHLORIDE	SULFIDE	NITRATE		
D129	BT 3	0.50	<0.50	<0.50	0.91	50.2
	BT 5	0.50	<0.50	<0.50	0.48	42.9
D212	BT 1	0.50	<0.50	<0.50	0.17	54.3
	BT 3	0.50	<0.50	<0.50	0.16	44.0
D238	BT 4	0.50	<0.50	<0.50	0.17	45.2
	BT 6	0.50	<0.50	<0.50	<0.10	43.3

ACCEPTANCE LIMITS

TEST	LIMITS
WATER SOLUBLE CHLORIDE	LESS THAN 10.0PPM
WATER SOLUBLE NITRATES	LESS THAN 10.0PPM
WATER SOLUBLE SULFIDES	LESS THAN 10 0PPM
WATER CONTENT	LESS THAN 10% DRY WEIGHT
NEUTRALIZATION NO.	GREATER THAN 0.0 mg KOH/

4.0 ANCHORAGE COMPONENTS

In the following discussion, all procedures referred to are included in Appendix F of this report and all data sheets are included in Appendix A.

4.1 SQ6.0 – GREASE CAP REMOVAL

4.1.1 Inspection of the anchorage components began by removing the grease cap (PSC Procedure SQ 6.0). Complete grease coating (100%) was found on all tendon ends inspected. The percentage of grease coverage was recorded on Data Sheet SQ 6.0 with the results tabulated in Tables 6 thru 11.

TABLE 6: VERTICALS - SQ6.0 - GREASE CAP REMOVAL

TENDON	END	GREASE COATING (%)				
		GREASE CAP	BUTTON HEADS	ANCHOR HEAD	SHIMS	BEARING PLATE
12V01	TOP	100	100	100	100	100
	BOT	100	100	100	100	100
45V20	TOP	100	100	100	100	100
	BOT	100	100	100	100	100
61V08	TOP	100	100	100	100	100
	BOT	100	100	100	100	100
61V17	TOP	100	100	100	100	100
	BOT	100	100	100	100	100

Before the Grease Cap is removed, a plastic bag is taped to the concrete in order to catch any grease that might fall during removal.

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TABLE 7: HOOPS - SQ6.0 – GREASE CAP REMOVAL

TENDON	END	GREASE COATING (%)				
		GREASE CAP	BUTTON HEADS	ANCHOR HEAD	SHIMS	BEARING PLATE
13H36	BT 1	100	100	100	100	100
	BT 3	100	100	100	100	100
42H46	BT 2	100	100	100	100	100
	BT 4	100	100	100	100	100
46H21	BT 4	100	100	100	100	100
	BT 6	100	100	100	100	100
51H34	BT 1	100	100	100	100	100
	BT 5	100	100	100	100	100
62H30	BT 2	100	100	100	100	100
	BT 6	100	100	100	100	100

TABLE 8: DOMES - SQ6.0 – GREASE CAP REMOVAL

TENDON	END	GREASE COATING (%)				
		GREASE CAP	BUTTON HEADS	ANCHOR HEAD	SHIMS	BEARING PLATE
D129	BT 3	100	100	100	100	100
	BT 5	100	100	100	100	100
D212	BT 1	100	100	100	100	100
	BT 3	100	100	100	100	100
D238	BT 4	100	100	100	100	100
	BT 6	100	100	100	100	100

Grease Cans are removed using an impact wrench. While workers take care to support the weight of the can filled with grease.

TABLE 9: 13H36 ADJACENT HOOPS - SQ6.0 - GREASE CAP REMOVAL

TENDON	END	GREASE COATING (%)				
		GREASE CAP	BUTTON HEADS	ANCHOR HEAD	SHIMS	BEARING PLATE
13H33	BT1	100	100	100	100	100
	BT3	100	100	100	100	100
13H34	BT1	100	100	100	100	100
	BT3	100	100	100	100	100
13H35	BT1	100	100	100	100	100
	BT3	100	100	100	100	100
13H37	BT1	100	100	100	100	100
	BT3	100	100	100	100	100
13H38	BT1	100	100	100	100	100
	BT3	100	100	100	100	100

TABLE 10: 46H21 ADJACENT HOOPS - SQ6.0 - GREASE CAP REMOVAL

TENDON	END	GREASE COATING (%)				
		GREASE CAP	BUTTON HEADS	ANCHOR HEAD	SHIMS	BEARING PLATE
46H19	BT4	100	100	100	100	100
	BT6	100	100	100	100	100
46H20	BT4	100	100	100	100	100
	BT6	100	100	100	100	100
46H22	BT4	100	100	100	100	100
	BT6	100	100	100	100	100
46H23	BT4	100	100	100	100	100
	BT6	100	100	100	100	100
46H24	BT4	100	100	100	100	100
	BT6	100	100	100	100	100

TABLE 11: 62H30 ADJACENT HOOPS - SQ6.0 – GREASE CAP REMOVAL						
TENDON	END	GREASE COATING (%)				
		GREASE CAP	BUTTON HEADS	ANCHOR HEAD	SHIMS	BEARING PLATE
62H29	BT2	100	100	100	100	100
	BT6	100	100	100	100	100
62H31	BT2	100	100	100	100	100
	BT6	100	100	100	100	100
62H32	BT2	100	100	100	100	100
	BT6	100	100	100	100	100
62H33	BT2	100	100	100	100	100
	BT6	100	100	100	100	100
62H34	BT2	100	100	100	100	100
	BT6	100	100	100	100	100

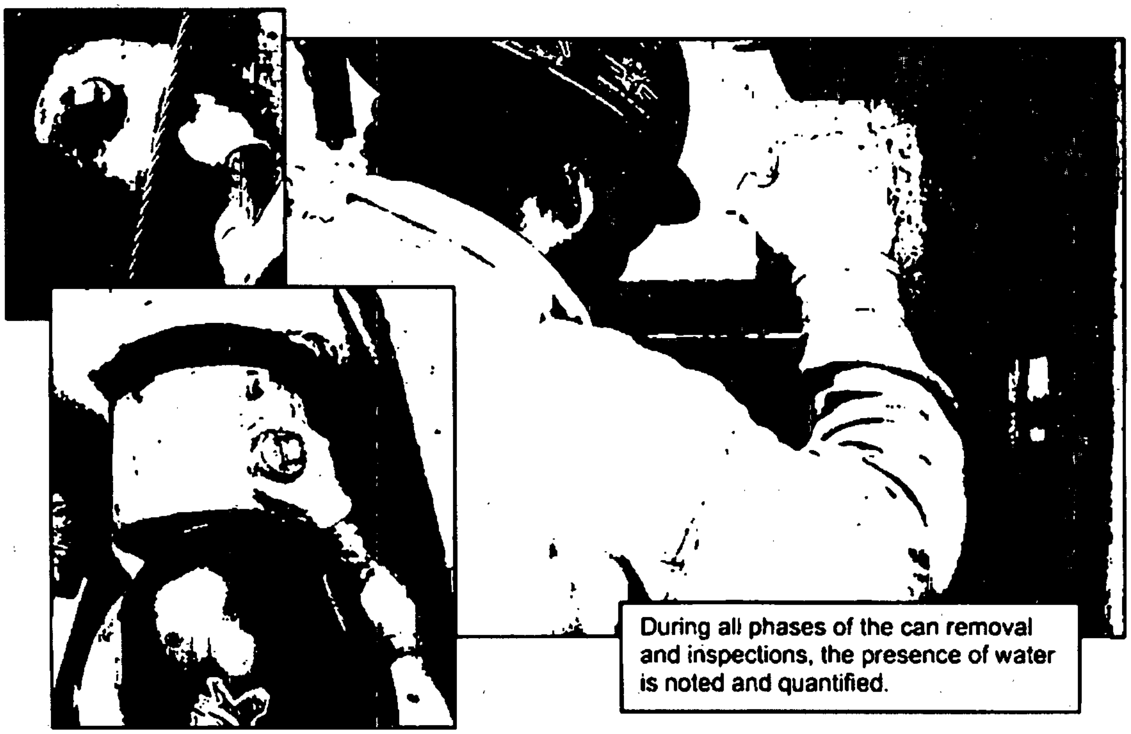
4.2 SQ6.1 – INSPECT FOR WATER

4.2.1 Water Inspections were recorded on Data Sheet SQ 6.1 and are summarized in Tables 12 and 13. No water was found in any tendon inspected or around the tendon anchorage either during removal of the grease cap or detensioning.

TABLE 12: ORIGINAL SCOPE - SQ6.1 – INSPECT FOR WATER						
SURVEILLANCE TENDONS				SURVEILLANCE TENDONS		
TENDON	END	WATER QUANTITY (oz.)		TENDON	END	WATER QUANTITY (oz.)
12V01	TOP	0		46H21	BT 4	0
	BOT	0			BT 6	0
45V20	TOP	0		51H34	BT 1	0
	BOT	0			BT 5	0
61V08	TOP	0		62H30	BT 2	0
	BOT	0			BT 6	0
61V17	TOP	0		D129	BT 3	0
	BOT	0			BT 5	0
13H36	BT 1	0		D212	BT 1	0
	BT 3	0			BT 3	0
42H46	BT 2	0		D238	BT 4	0
	BT 4	0			BT 6	0

TABLE 13: ADDITIONAL SCOPE - SQ6.1 - INSPECT FOR WATER

ADJACENT TENDONS				ADJACENT TENDONS		
TENDON	END	WATER QUANTITY (oz.)		TENDON	END	WATER QUANTITY (oz.)
13H33	BT 1	0		46H23	BT 4	0
	BT 3	0			BT 6	0
13H34	BT 1	0		46H24	BT 4	0
	BT 3	0			BT 6	0
13H35	BT 1	0		62H29	BT 2	0
	BT 3	0			BT 6	0
13H37	BT 1	0		62H31	BT 2	0
	BT 3	0			BT 6	0
13H38	BT 1	0		62H32	BT 2	0
	BT 3	0			BT 6	0
46H19	BT 4	0		62H33	BT 2	0
	BT 6	0			BT 6	0
46H20	BT 4	0		62H34	BT 2	0
	BT 6	0			BT 6	0
46H22	BT 4	0				
	BT 6	0				



During all phases of the can removal and inspections, the presence of water is noted and quantified.

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4.3 SQ8.0 – ANCHORAGE CORROSION CONDITON

4.3.1 The anchorage components (anchorhead, buttonheads, shims and bearing plate) were inspected for corrosion level and cracks per PSC Procedure SQ 8.0. The results were recorded on Data Sheet SQ 8.0 and are summarized in Tables 14 thru 19. In Tables 14 thru 19, "N/A" indicates the Anchor I.D. was not detected.

4.3.2 The corrosion level for all of the inspected anchorage assemblies and wire was either:

1 - Bright metal; no visible oxidation.

Or

2 – Metal reddish brown color, no pitting.

4.3.3 No evidence of cracking was observed on any of the anchorage components.

TABLE 14: VERTICALS – SQ8.0 – ANCHORAGE CORROSION CONDITION

TENDON	END	ANCHOR I.D.	BUTTON HEADS	CORROSION LEVEL, CRACKS		
				ANCHOR HEAD	SHIMS	BEARING PLATE
12V01	TOP	CR650	1	1, NONE	2, NONE	2, NONE
	BOT	N/A	1	1, NONE	2, NONE	2, NONE
45V20	TOP	CR850	2	2, NONE	2, NONE	2, NONE
	BOT	CR260	1	2, NONE	2, NONE	2, NONE
61V08	TOP	CR933	1	1, NONE	2, NONE	2, NONE
	BOT	CR300	1	1, NONE	2, NONE	2, NONE
61V17	TOP	CR943	1	1, NONE	2, NONE	2, NONE
	BOT	CR256	1	2, NONE	2, NONE	2, NONE

1, NONE

INDICATES CORROSION LEVEL → 1 ← INDICATES # OF CRACKS

1 – Bright metal, No visible oxidation.
2 - Metal reddish brown color, no pitting.
3 - Metal having patches of red oxide

TABLE 15: HOOPS – SQ8.0 – ANCHORAGE CORROSION CONDITION

TENDON	END	ANCHOR I.D.	BUTTON HEADS	CORROSION LEVEL, CRACKS		
				ANCHOR HEAD	SHIMS	BEARING PLATE
13H36	BT 1	CR618	1	2, NONE	2, NONE	2, NONE
	BT 3	CR1167	1	2, NONE	2, NONE	2, NONE
42H46	BT 2	CR1170	1	1, NONE	2, NONE	2, NONE
	BT 4	CR529	1	1, NONE	2, NONE	2, NONE
46H21	BT 4	CR1141	1	1, NONE	2, NONE	2, NONE
	BT 6	CR167	1	1, NONE	2, NONE	2, NONE
51H34	BT 1	CR459	1	1, NONE	2, NONE	2, NONE
	BT 5	CR943	1	1, NONE	2, NONE	2, NONE
62H30	BT 2	CR96	1	1, NONE	2, NONE	2, NONE
	BT 6	CR609	1	1, NONE	2, NONE	2, NONE

INDICATES CORROSION LEVEL → 1, NONE ← INDICATES # OF CRACKS

1 - Bright metal, No visible oxidation.
2 - Metal reddish brown color, no pitting.
3 - Metal having patches of red oxide.

TABLE 16: DOMES – SQ8.0 – ANCHORAGE CORROSION CONDITION

TENDON	END	ANCHOR I.D.	BUTTON HEADS	CORROSION LEVEL, CRACKS		
				ANCHOR HEAD	SHIMS	BEARING PLATE
D129	BT 3	CR996	1	1, NONE	2, NONE	2, NONE
	BT 5	CR866	2	2, NONE	2, NONE	2, NONE
D212	BT 1	CR1032	1	2, NONE	2, NONE	2, NONE
	BT 3	CR1214	1	1, NONE	2, NONE	2, NONE
D238	BT 4	CR657	1	1, NONE	2, NONE	2, NONE
	BT 6	CR1029	1	1, NONE	2, NONE	2, NONE

INDICATES CORROSION LEVEL → 1, NONE ← INDICATES # OF CRACKS

1 - Bright Metal, No visible oxidation.
2 - Metal reddish brown color, no pitting.
3 - Metal having patches of red oxide.

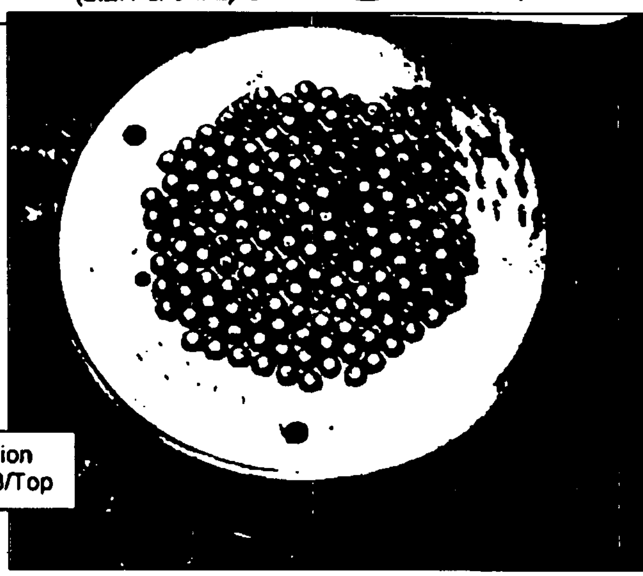
TABLE 17: 13H36 ADJACENT HOOPS – SQ8.0 – ANCHORAGE CORROSION CONDITION						
TENDON	END	ANCHOR I.D.	BUTTON HEADS	CORROSION LEVEL, CRACKS		
				ANCHOR HEAD	SHIMS	BEARING PLATE
13H33	BT 1	CR518	1	1, NONE	2, NONE	2, NONE
	BT 3	CR1200	1	2, NONE	2, NONE	2, NONE
13H34	BT 1	CR514	1	1, NONE	2, NONE	2, NONE
	BT 3	CR1159	1	1, NONE	2, NONE	2, NONE
13H35	BT 1	CR510	1	1, NONE	2, NONE	2, NONE
	BT 3	CR1158	1	2, NONE	2, NONE	2, NONE
13H37	BT 1	CR509	1	1, NONE	2, NONE	2, NONE
	BT 3	CR1272	1	1, NONE	2, NONE	2, NONE
13H38	BT1	CR614	1	1, NONE	2, NONE	2, NONE
	BT 3	CR710	1	2, NONE	2, NONE	2, NONE

INDICATES CORROSION LEVEL → 1, NONE ← INDICATES # OF CRACKS

1 - Bright Metal, No visible oxidation
2 - Metal reddish brown color, no pitting.
3 - Metal having patches of red oxide.

8.2 & 8.3 - CORROSION & CRACK INSPECTION

(8.2.1.1) Buttonheads	Level: 1 (1)	(8.2.1 & 8.2.2) Cracks	☐ Yes (2)	☒ No	☐ N/A
(8.2.2.1) Anchorhead	Level: 1 (1)	(8.2.1 & 8.2.2) Cracks	☐ Yes (2)	☒ No	☐ N/A
(8.2.2.1) Shims	Level: 2 (1)	(8.2.1 & 8.2.2) Cracks	☐ Yes (2)	☒ No	☐ N/A
(8.2.2.1) Bearing Plate	Level: 2 (1)	(8.2.1 & 8.2.2) Cracks	☐ Yes (2)	☒ No	☐ N/A



Corrosion Inspection
for Tendon 61V08/Top

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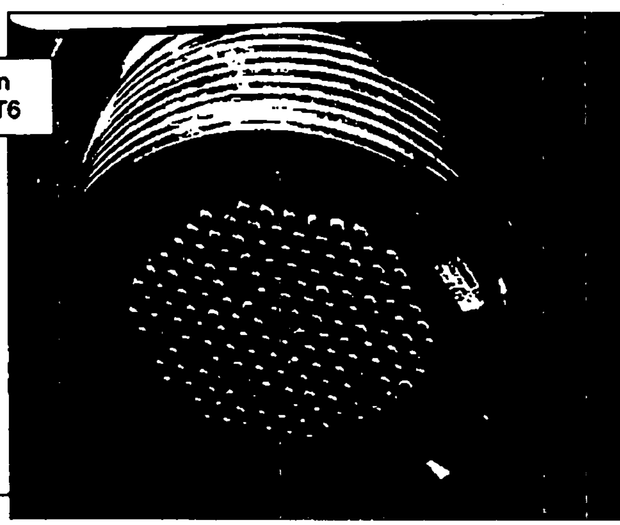
TABLE 18: 46H21 ADJACENT HOOPS – SQ8.0 – ANCHORAGE CORROSION CONDITION

TENDON	END	ANCHOR I.D.	BUTTON HEADS	CORROSION LEVEL, CRACKS		
				ANCHOR HEAD	SHIMS	BEARING PLATE
46H19	BT 4	CR1218	1	2, NONE	2, NONE	2, NONE
	BT 6	CR380	1	2, NONE	2, NONE	2, NONE
46H20	BT4	CR1138	2	2, NONE	2, NONE	2, NONE
	BT 6	CR78	1	1, NONE	2, NONE	2, NONE
46H22	BT 4	CR1140	1	2, NONE	2, NONE	2, NONE
	BT 6	CR41	1	2, NONE	2, NONE	2, NONE
46H23	BT4	CR903	1	2, NONE	2, NONE	2, NONE
	BT 6	CR40	1	2, NONE	2, NONE	2, NONE
46H24	BT 4	CR1157	1	2, NONE	2, NONE	2, NONE
	BT 6	CR14	1	2, NONE	2, NONE	2, NONE

INDICATES CORROSION LEVEL → 1, NONE ← INDICATES # OF CRACKS

1 - Bright Metal, No visible oxidation.
2 - Metal reddish brown color, no pitting.
3 - Metal having patches of red oxide.

Corrosion Inspection for Tendon D238/BT6



8.2 & 8.3 - CORROSION & CRACK INSPECTION

(8.2.1.1) Buttonheads	Level: 1 (1)	(8.2.1 & 8.2.2) Cracks	☐ Yes (2) ☒ No ☐ N/A
(8.2.2.1) Anchorhead	Level: 1 (1)	(8.2.1 & 8.2.2) Cracks	☐ Yes (2) ☒ No ☐ N/A
(8.2.2.1) Shims	Level: 2 (1)	(8.2.1 & 8.2.2) Cracks	☐ Yes (2) ☒ No ☐ N/A
(8.2.2.1) Bearing Plate	Level: 2 (1)	(8.2.1 & 8.2.2) Cracks	☐ Yes (2) ☒ No ☐ N/A

(1) – Corrosion Levels of 3, 4, 5 or 6 required an NCR.
(2) – Compose a sketch of the cracks on Sketch Sheet 8.0 and indiate an NCR.

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TABLE 19: 62H30 ADJACENT HOOPS – SQ8.0 – ANCHORAGE CORROSION CONDITION

TENDON	END	ANCHOR I.D.	BUTTON HEADS	CORROSION LEVEL, CRACKS		
				ANCHOR HEAD	SHIMS	BEARING PLATE
62H29	BT2	CR393	1	1, NONE	2, NONE	2, NONE
	BT 6	CR1113	1	1, NONE	2, NONE	2, NONE
62H31	BT 2	CR164	1	1, NONE	2, NONE	2, NONE
	BT 6	CR958	1	1, NONE	2, NONE	2, NONE
62H32	BT 2	CR75	1	1, NONE	2, NONE	2, NONE
	BT 6	CR960	1	1, NONE	2, NONE	2, NONE
62H33	BT 2	CR77	1	1, NONE	2, NONE	2, NONE
	BT 6	CR538	1	1, NONE	2, NONE	2, NONE
62H34	BT 2	CR25	1	1, NONE	2, NONE	2, NONE
	BT 6	CR900	1	1, NONE	2, NONE	2, NONE

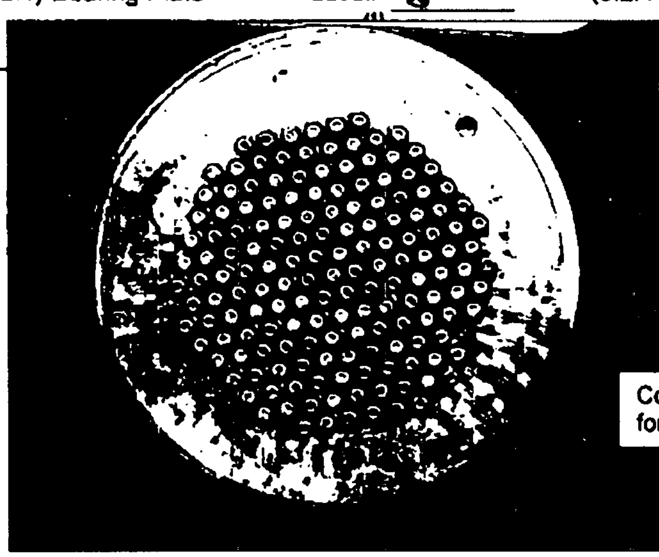
INDICATES CORROSION LEVEL → 1, NONE ← INDICATES # OF CRACKS

1 - Bright Metal, No visible oxidation.
2 - Metal reddish brown color, no pitting.
3 - Metal having patches of red oxide.

8.2 & 8.3 - CORROSION & CRACK INSPECTION

(8.2.1.1) Buttonheads	Level: 1 (1)	(8.2.1 & 8.2.2) Cracks	☐ Yes (2)	☒ No	☐ N/A
(8.2.2.1) Anchorhead	Level: 2 (1)	(8.2.1 & 8.2.2) Cracks	☐ Yes (2)	☒ No	☐ N/A
(8.2.2.1) Shims	Level: 2 (1)	(8.2.1 & 8.2.2) Cracks	☐ Yes (2)	☒ No	☐ N/A
(8.2.2.1) Bearing Plate	Level: 2 (1)	(8.2.1 & 8.2.2) Cracks	☐ Yes (2)	☒ No	☐ N/A

(1) ... or 6 required an NCR.
... tch Sheet 8.0 and initiate an NCR



Corrosion Inspection for Tendon D212/BT1

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4.4 SQ8.0 – BUTTONHEAD COUNT

4.4.1 The inspection for protruding and missing buttonheads was performed and documented per PSC procedure SQ 8.0. The buttonheads were inspected for their physical condition. This inspection is performed to acquire information on the function of the tendon, since the original installation or previous surveillance. A missing and/or protruding buttonhead decreases the amount of effective wires in the tendon. All conditions for buttonheads and wires, whether missing or defective, have been documented. The results of these inspections are recorded on Data Sheet SQ 8.0, and are summarized in Tables 20 thru 25. In Tables 20 thru 25, "N/A" indicates no inspection was performed.

4.4.2 No additional protruding/missing buttonheads were detected on any of the inspected tendon ends except tendons 12V01 both ends and 61V17 shop (top) end. 12V01 shop was found with 1 wire protruding that was not previously reported, NCR FN1002-010 was written to document this finding. The field end of 12V01 was identified as having 3 missing buttonheads not previously reported and was documented on NCR FN1002-004. 61V17 had one (1) additional missing buttonhead that was recorded on NCR FN1002-005. The stated conditions have been submitted to CR03ENG for disposition.

4.4.3 All of the other tendon ends with missing or protruding wires have been previously documented and accepted, either at original installation or during a previous inspection.

4.4.4 In addition to the nominal 163 stressed wires, the anchorheads have another hole in which a test wire was originally installed on some tendons. The cases in which the surveillance test wire was found to be missing or not installed has been documented for all tendons, however a missing test wire has no bearing on the ability of a tendon to carry force. The documentation of this condition is purely for informational purposes.

TABLE 20: VERTICALS – SQ8.0 – BUTTONHEAD COUNT

TENDON	END	ORIGINAL		AS FOUND		AS LEFT			EFFECTIVE WIRES AS FOUND	EFFECTIVE WIRES AS LEFT
		PROTRUDE	BROKEN / MISSING	PROTRUDE	BROKEN / MISSING	PROTRUDE	BROKEN / MISSING	REMOVED FOR TESTING		
12V01	TOP	1	0	2	0	2	0	0	161	161
	BOT	0	2	0	5	0	5	0	158	158
45V20	TOP	0	0	0	0	0	0	0	163	163
	BOT	0	0	0	0	0	0	0	163	163
61V08	TOP	0	0	0	0	0	0	0	163	163
	BOT	0	0	0	0	0	0	0	163	163
61V17	TOP	0	1	0	2	0	2	1	161	160
	BOT	0	0	0	0	0	0	1	163	162

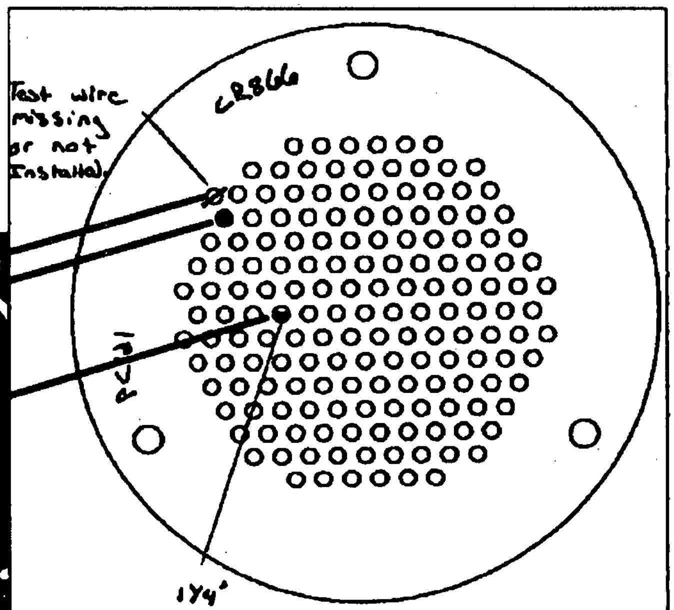
TABLE 21: HOOPS – SQ8'0 – BUTTONHEAD COUNT

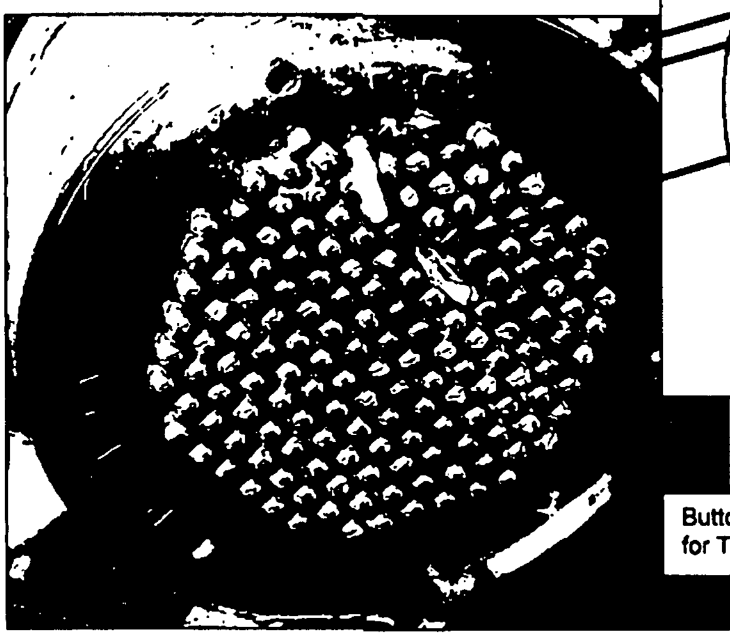
TENDON	END	ORIGINAL		AS FOUND		AS LEFT			EFFECTIVE WIRES AS FOUND	EFFECTIVE WIRES AS LEFT
		PROTRUDE	BROKEN / MISSING	PROTRUDE	BROKEN / MISSING	PROTRUDE	BROKEN / MISSING	REMOVED FOR TESTING		
13H36	BT 1	0	0	0	0	0	0	0	163	163
	BT 3	0	0	0	0	0	0	0	163	163
42H46	BT 2	0	0	0	0	0	0	0	163	163
	BT 4	0	0	0	0	0	0	0	163	163
46H21	BT 4	0	0	0	0	0	0	0	163	163
	BT 6	0	0	0	0	0	0	0	163	163
51H34	BT 1	0	0	0	0	0	0	1	163	162
	BT 5	0	0	0	0	0	0	1	163	162
62H30	BT 2	0	0	0	0	0	0	0	163	163
	BT 6	0	0	0	0	0	0	0	163	163

TABLE 22: DOMES – SQ8'0 – BUTTONHEAD COUNT

TENDON	END	ORIGINAL		AS FOUND		AS LEFT			EFFECTIVE WIRES AS FOUND	EFFECTIVE WIRES AS LEFT
		PROTRUDE	BROKEN / MISSING	PROTRUDE	BROKEN / MISSING	PROTRUDE	BROKEN / MISSING	REMOVED FOR TESTING		
D129	BT 3	0	1	0	1	0	1	0	162	162
	BT 5	1	1	1	1	1	1	0	161	161
D212	BT 1	0	1	0	1	0	1	0	162	162
	BT 3	0	1	0	1	0	1	0	162	162
D238	BT 4	0	0	0	0	0	0	1	163	162
	BT 6	0	0	0	0	0	0	1	163	162

TABLE 23: 13H36 ADJACENTS – SQ8.0 – BUTTONHEAD COUNT										
TENDON	END	ORIGINAL		AS FOUND		AS LEFT			EFFECTIVE WIRES AS FOUND	EFFECTIVE WIRES AS LEFT
		PROTRUDE	BROKEN / MISSING	PROTRUDE	BROKEN / MISSING	PROTRUDE	BROKEN / MISSING	REMOVED FOR TESTING		
13H33	BT 1	0	0	0	0	0	0	0	163	163
	BT 3	0	0	0	0	0	0	0	163	163
13H34	BT 1	0	0	0	0	0	0	0	163	163
	BT 3	0	0	0	0	0	0	0	163	163
13H35	BT 1	0	0	0	0	0	0	0	163	163
	BT 3	0	1	0	1	0	1	0	162	162
13H37	BT 1	0	0	0	0	0	0	0	163	163
	BT 3	0	0	0	0	0	0	0	163	163
13H38	BT 1	0	0	0	0	0	0	0	163	163
	BT 3	0	0	0	0	0	0	0	163	163

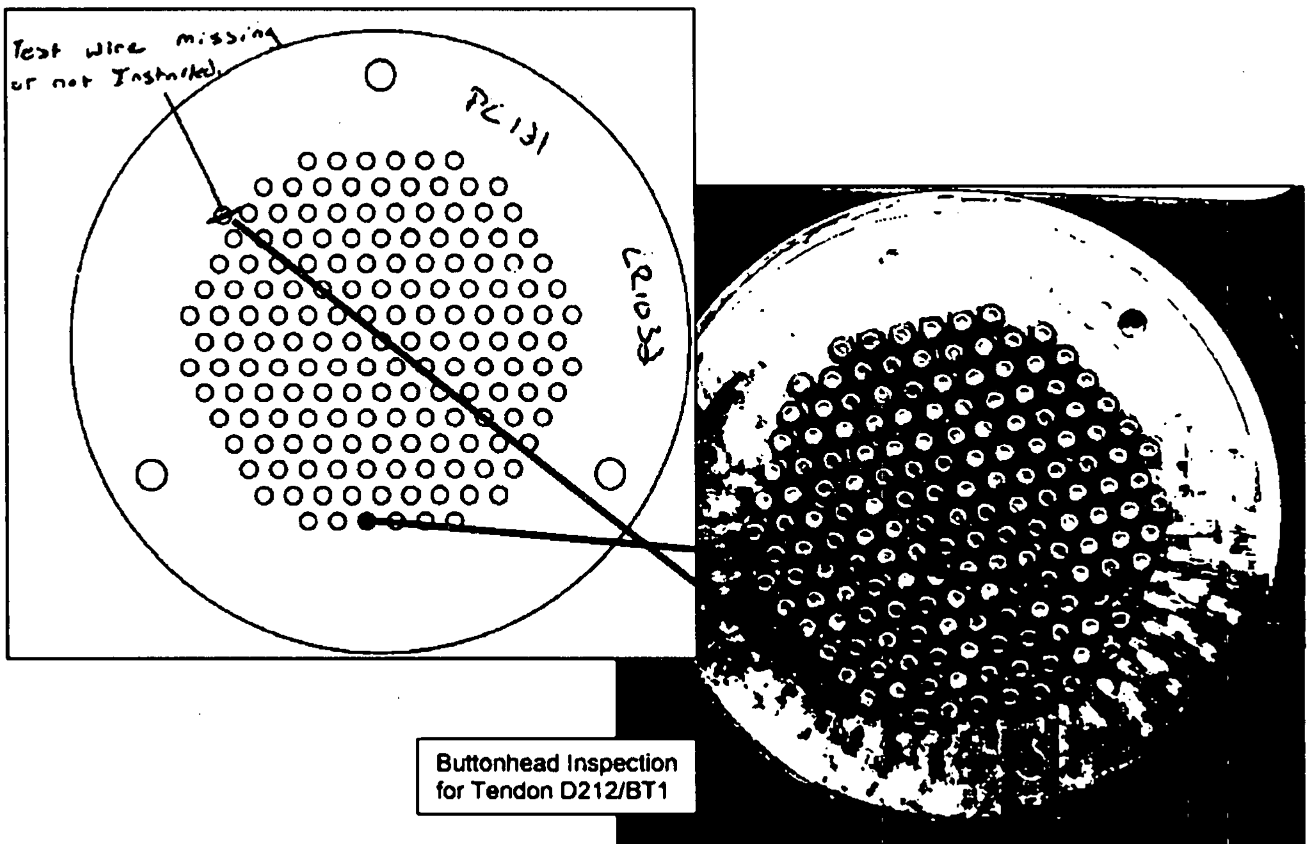




Buttonhead Inspection for Tendon D129/BT5

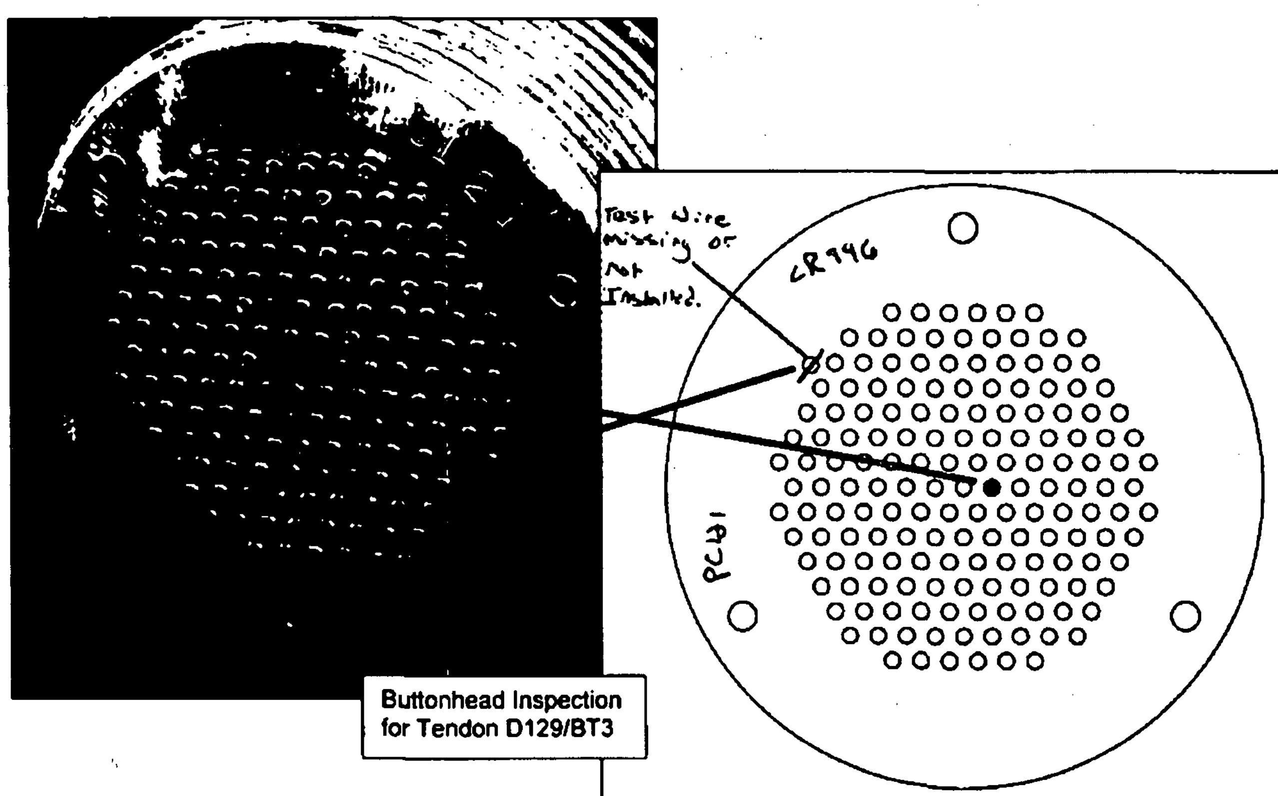
TABLE 24: 46H21 ADJACENTS - SQ8.0 - BUTTONHEAD COUNT

TENDON	END	ORIGINAL		AS FOUND		AS LEFT			EFFECTIVE WIRES AS FOUND	EFFECTIVE WIRES AS LEFT
		PROTRUDE	BROKEN / MISSING	PROTRUDE	BROKEN / MISSING	PROTRUDE	BROKEN / MISSING	REMOVED FOR TESTING		
46H19	BT 4	0	0	0	0	0	0	0	163	163
	BT 6	0	0	0	0	0	0	0	163	163
46H20	BT 4	3	0	3	0	3	0	0	160	160
	BT 6	0	0	0	0	0	0	0	163	163
46H22	BT 4	0	0	0	0	0	0	0	163	163
	BT 6	0	0	0	0	0	0	0	163	163
46H23	BT 4	0	2	0	2	0	2	0	161	161
	BT 6	0	0	0	0	0	0	0	163	163
46H24	BT 4	0	0	0	0	0	0	0	163	163
	BT 6	0	0	0	0	0	0	0	163	163



Buttonhead Inspection for Tendon D212/BT1

TABLE 25: 62H30 ADJACENTS – SQ8.0 – BUTTONHEAD COUNT										
TENDON	END	ORIGINAL		AS FOUND		AS LEFT			EFFECTIVE WIRES AS FOUND	EFFECTIVE WIRES AS LEFT
		PROTRUDE	BROKEN / MISSING	PROTRUDE	BROKEN / MISSING	PROTRUDE	BROKEN / MISSING	REMOVED FOR TESTING		
62H29	BT 2	0	0	0	0	0	0	0	163	163
	BT 6	0	0	0	0	0	0	0	163	163
62H31	BT 2	0	0	0	0	0	0	0	163	163
	BT 6	0	0	0	0	0	0	0	163	163
62H32	BT 2	0	0	0	0	0	0	0	163	163
	BT 6	0	0	0	0	0	0	0	163	163
62H33	BT 2	0	0	0	0	0	0	0	163	163
	BT 6	1	0	1	0	1	0	0	162	162
62H34	BT 2	0	0	0	0	0	0	0	163	163
	BT 6	0	1	0	1	0	1	0	162	162



Buttonhead Inspection for Tendon D129/BT3

5.0 SQ8.3 – CONCRETE INSPECTION

5.1 A VT-1C Detailed inspection in accordance with PSC Procedure SQ8.3 was performed on the 24" around the bearing plate. This detailed inspection is performed in order to detect any cracks in the concrete greater than 0.010" in width. The results were recorded on Data Sheet SQ 8.3 and summarized in Table 26.

5.2 None of the inspected tendon ends exhibited concrete cracks exceeding 0.010" around any bearing plate inspected.

TABLE 26: VERTICALS – SQ8.3 – CONCRETE INSPECTION

TENDON	END	BEARING PLATE I.D.	CRACKS WITH WIDTHS > 0.010"		
			QUANTITY	MAXIMUM LENGTH (IN)	MAXIMUM WIDTH (IN)
12V01	TOP	NONE FOUND	0	0	0
	BOT	NONE FOUND	0	0	0
45V20	TOP	NONE FOUND	0	0	0
	BOT	PC58	0	0	0
61V08	TOP	NONE FOUND	0	0	0
	BOT	NONE FOUND	0	0	0
61V17	TOP	NONE FOUND	0	0	0
	BOT	NONE FOUND	0	0	0
13H36	BT 1	NONE FOUND	0	0	0
	BT 3	NONE FOUND	0	0	0
42H46	BT 2	NONE FOUND	0	0	0
	BT 4	NONE FOUND	0	0	0
46H21	BT 4	NONE FOUND	0	0	0
	BT 6	NONE FOUND	0	0	0
51H34	BT 1	NONE FOUND	0	0	0
	BT 5	NONE FOUND	0	0	0
62H30	BT 2	NONE FOUND	0	0	0
	BT 6	NONE FOUND	0	0	0
D129	BT 3	NONE FOUND	0	0	0
	BT 5	NONE FOUND	0	0	0
D212	BT 1	NONE FOUND	0	0	0
	BT 3	NONE FOUND	0	0	0
D238	BT 4	NONE FOUND	0	0	0
	BT 6	NONE FOUND	0	0	0

6.0 TENDON ACCESSIBILITY

6.1 The PSC field personnel performed a general examination for tendon accessibility during this surveillance period. This examination was performed in order to assist CR03ENG in the planning of future surveillances. The results are summarized in Tables 27 thru 38.

6.2 During this examination it was noted that small grease/oil leaks were occurring on multiple tendon caps, which were located inside existing structures that adjoin the containment building. The substance displacing from the tendon cap is actually the oil portion from the original P2 grease that has separated. This is a common occurrence that has been noted throughout many plants during tendon surveillances. This condition does not correspond to the system's degradation. A small amount of oil can cause a large aesthetically unpleasing condition. On buttresses without any coating, the oil is absorbed into the concrete, leaving very little signs of leakage. However, in the existing condition, the coated surface does not allow for the absorption to occur. Therefore, the oil continues to displace down the buttress face. PSC recommends this condition be monitored and cleaned on a periodic basis. Gasket replacement can be performed on the tendon cap, however the oil will continue to leak from the cap based on our experience. The labor and material required for the gasket replacement is not cost effective and PSC does not recommend performing such task.

TABLE 27: 12V & 23V SERIES – TENDON ACCESSIBILITY MATRIX

TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.	TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.
12V 01	T & B			23V 01	T & B		
12V 02	T & B			23V 02	T & B		
12V 03	T & B			23V 03	T & B		
12V 04	T & B			23V 04	T & B		
12V 05	T & B			23V 05	T & B		
12V 06	T & B			23V 06	T & B		
12V 07	T & B			23V 07	T & B		
12V 08	T & B			23V 08	T & B		
12V 09	T & B			23V 09	T & B		
12V 10	T & B			23V 10	T & B		
12V 11	T & B			23V 11	T & B		
12V 12	T & B			23V 12	T & B		
12V 13	T & B			23V 13	T & B		
12V 14	T & B			23V 14	T & B		
12V 15	T & B			23V 15	T & B		
12V 16	T & B			23V 16	T & B		
12V 17	T & B			23V 17	T & B		
12V 18	T & B			23V 18	T & B		
12V 19	T & B			23V 19	T & B		
12V 20	T & B			23V 20	T & B		
12V 21	T & B			23V 21	T & B		
12V 22	T & B			23V 22	T & B		
12V 23	T & B			23V 23	T & B		
12V 24	T & B			23V 24	T & B		

T = TOP CAN B = BOTTOM END

TABLE 28: 34V & 45V SERIES – TENDON ACCESSIBILITY MATRIX

TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.	TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.
34V 01	T & B			45V 01	T & B		
34V 02	T & B			45V 02	T & B		
34V 03	T & B			45V 03	T & B		
34V 04	T & B			45V 04	T & B		
34V 05	T & B			45V 05	T & B		
34V 06	T & B			45V 06	T & B		
34V 07	T & B			45V 07	T & B		
34V 08	T & B			45V 08	T & B		
34V 09	T & B			45V 09	T & B		
34V 10	T & B			45V 10	T & B		
34V 11	T & B			45V 11	T & B		
34V 12	T & B			45V 12	T & B		
34V 13	T & B			45V 13	T & B		
34V 14	T & B			45V 14	T & B		
34V 15	T & B			45V 15	T & B		
34V 16	T & B			45V 16	T & B		
34V 17	T & B			45V 17	T & B		
34V 18	T & B			45V 18	T & B		
34V 19	T & B			45V 19	T & B		
34V 20	T & B			45V 20	T & B		
34V 21	T & B			45V 21	T & B		
34V 22	T & B			45V 22	T & B		
34V 23	T & B			45V 23	T & B		
34V 24	T & B			45V 24	T & B		

T = TOP CAN B = BOTTOM END

TABLE 29: 56V & 61V SERIES – TENDON ACCESSIBILITY MATRIX

TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.	TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.
56V 01	T & B			61V 01	T & B		
56V 02	T & B			61V 02	T & B		
56V 03	T & B			61V 03	T & B		
56V 04	T & B			61V 04	T & B		
56V 05	T & B			61V 05	T & B		
56V 06	T & B			61V 06	T & B		
56V 07	T & B			61V 07	T & B		
56V 08	T & B			61V 08	T & B		
56V 09	T & B			61V 09	T & B		
56V 10	T & B			61V 10	T & B		
56V 11	T & B			61V 11	T & B		
56V 12	T & B			61V 12	T & B		
56V 13	T & B			61V 13	T & B		
56V 14	T & B			61V 14	T & B		
56V 15	T & B			61V 15	T & B		
56V 16	T & B			61V 16	T & B		
56V 17	T & B			61V 17	T & B		
56V 18	T & B			61V 18	T & B		
56V 19	T & B			61V 19	T & B		
56V 20	T & B			61V 20	T & B		
56V 21	T & B			61V 21	T & B		
56V 22	T & B			61V 22	T & B		
56V 23	T & B			61V 23	T & B		
56V 24	T & B			61V 24	T & B		

T = TOP CAN　　B = BOTTOM END

TABLE 30: 13H SERIES – TENDON ACCESSIBILITY MATRIX

TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.	TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.
13H 01	B3	B1		13H 25	B1 & B3		
13H 02	B1 & B3			13H 26	B1 & B3		
13H 03	B1 & B3			13H 27	B1 & B3		
13H 04	B1 & B3			13H 28	B1 & B3		
13H 05	B1	B3		13H 29	B1 & B3		
13H 06	B1	B3		13H 30	B1 & B3		
13H 07			B1 & B3	13H 31	B1 & B3		
13H 08			B1 & B3	13H 32	B1 & B3		
13H 09	B3	B1		13H 33	B1 & B3		
13H 10	B3		B1	13H 34	B1 & B3		
13H 11	B3	B1		13H 35	B1 & B3		
13H 12	B3	B1		13H 36	B1 & B3		
13H 13	B3	B1		13H 37	B1 & B3		
13H 14	B3	B1		13H 38	B1 & B3		
13H 15	B3	B1		13H 39	B1 & B3		
13H 16	B3		B1	13H 40	B1 & B3		
13H 17		B3	B1	13H 41	B1 & B3		
13H 18	B1	B3		13H 42	B1 & B3		
13H 19	B1	B3		13H 43	B1 & B3		
13H 20	B1 & B3			13H 44	B1 & B3		
13H 21	B1 & B3			13H 45	B1 & B3		
13H 22	B1 & B3			13H 46	B1 & B3		
13H 23	B1 & B3			13H 47	B1 & B3		
13H 24	B1 & B3						

B1 = BUTTRESS 1 END B3 = BUTTRESS 3 END

TABLE 31: 35H SERIES – TENDON ACCESSIBILITY MATRIX

TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.	TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.
35H 01	B3 & B5			35H 25	B3 & B5		
35H 02	B3 & B5			35H 26	B3 & B5		
35H 03	B3 & B5			35H 27	B3 & B5		
35H 04	B3 & B5			35H 28	B3 & B5		
35H 05		B3 & B5		35H 29	B3 & B5		
35H 06		B3	B5	35H 30	B3 & B5		
35H 07			B3 & B5	35H 31	B3 & B5		
35H 08	B5		B3	35H 32	B3 & B5		
35H 09	B3 & B5			35H 33	B3 & B5		
35H 10	B3 & B5			35H 34	B3 & B5		
35H 11	B3 & B5			35H 35	B3 & B5		
35H 12	B3	B5		35H 36	B3 & B5		
35H 13	B3		B5	35H 37	B3 & B5		
35H 14	B3		B5	35H 38	B3 & B5		
35H 15	B3 & B5			35H 39	B3 & B5		
35H 16	B3 & B5			35H 40	B3 & B5		
35H 17	B3 & B5			35H 41	B3 & B5		
35H 18	B3 & B5			35H 42	B3 & B5		
35H 19	B3	B5		35H 43	B3 & B5		
35H 20	B3	B5		35H 44	B3 & B5		
35H 21	B3		B5	35H 45	B3 & B5		
35H 22	B3		B5	35H 46	B3 & B5		
35H 23	B3 & B5			35H 47	B3 & B5		
35H 24	B3 & B5						

B3 = BUTTRESS 3 END B5 = BUTTRESS 5 END

TABLE 32: 51H SERIES – TENDON ACCESSIBILITY MATRIX

TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.	TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.
51H 01		B1	B5	51H 25*	B1 & B5		
51H 02	B1		B5	51H 26	B1 & B5		
51H03	B1		B5	51H 27*	B1 & B5		
51H 04	B1		B5	51H 28	B1 & B5		
51H 05	B1		B5	51H 29	B1 & B5		
51H 06	B1		B5	51H 30	B1 & B5		
51H 07		B1	B5	51H 31	B1 & B5		
51H 08			B1 & B5	51H 32	B1 & B5		
51H 09		B1		51H 33	B1 & B5		
51H 10	B5	B1		51H 34	B1 & B5		
51H 11	B1 & B5			51H 35	B1 & B5		
51H 12	B1	B5		51H 36	B1 & B5		
51H 13	B1	B5		51H 37	B1 & B5		
51H 14	B1		B5	51H 38	B1 & B5		
51H 15		B1	B5	51H 39	B1 & B5		
51H 16	B1 & B5			51H 40	B1 & B5		
51H 17	B1 & B5			51H 41	B1 & B5		
51H 18	B1 & B5			51H 42	B1 & B5		
51H 19	B1 & B5			51H 43	B1 & B5		
51H 20	B1	B5		51H 44	B1 & B5		
51H 21	B1	B5		51H 45	B1 & B5		
51H 22	B1		B5	51H 46	B1 & B5		
51H 23	B1 & B5			51H 47	B1 & B5		
51H 24	B1 & B5						

B1 = BUTTRESS 1 END B5 = BUTTRESS 5 END

TABLE 33: 42H SERIES – TENDON ACCESSIBILITY MATRIX

TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.	TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.
42H 01	B2 & B4			42H 25	B2 & B4		
42H 02	B2 & B4			42H 26	B2 & B4		
42H 03	B4	B2		42H 27	B2 & B4		
42H 04	B4	B2		42H 28	B2 & B4		
42H 05	B2	B4		42H 29	B2 & B4		
42H 06		B2 & B4		42H 30	B2 & B4		
42H 07		B2	B4	42H 31	B2 & B4		
42H 08	B4	B2		42H 32	B2 & B4		
42H 09	B4	B2		42H 33	B2 & B4		
42H 10	B4	B2		42H 34*	B2 & B4		
42H 11		B2 & B4		42H 35	B2 & B4		
42H 12	B4	B2		42H 36	B2 & B4		
42H 13	B4	B2		42H 37	B2 & B4		
42H 14	B4	B2		42H 38	B2 & B4		
42H 15	B4	B2		42H 39	B2 & B4		
42H 16	B4		B2	42H 40	B2 & B4		
42H 17	B2 & B4			42H 41	B2 & B4		
42H 18	B2 & B4			42H 42	B2 & B4		
42H 19	B2 & B4			42H 43	B2 & B4		
42H 20	B2 & B4			42H 44	B2 & B4		
42H 21	B2 & B4			42H 45	B2 & B4		
42H 22	B2 & B4			42H 46	B2 & B4		
42H 23	B2 & B4			42H 47	B2 & B4		
42H 24	B2 & B4				B2 & B4		

B2 = BUTTRESS 2 END B4 = BUTTRESS 4 END

TABLE 34: 46H SERIES – TENDON ACCESSIBILITY MATRIX

TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.	TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.
46H 01		B4	B6	46H 25	B4 & B6		
46H 02	B4 & B6			46H 26	B4 & B6		
46H 03	B4 & B6			46H 27	B4 & B6		
46H 04	B4 & B6			46H 28	B4 & B6		
46H 05	B4 & B6			46H 29	B4 & B6		
46H 06		B4 & B6		46H 30	B4 & B6		
46H 07		B6	B4	46H 31	B4 & B6		
46H 08			B4 & B6	46H 32	B4 & B6		
46H 09	B4 & B6			46H 33	B4 & B6		
46H 10	B4 & B6			46H 34	B4 & B6		
46H 11	B4 & B6			46H 35	B4 & B6		
46H 12	B4		B6	46H 36	B4 & B6		
46H 13	B4 & B6			46H 37	B4 & B6		
46H 14	B4 & B6			46H 38	B4 & B6		
46H 15	B4	B6		46H 39	B4 & B6		
46H 16	B4		B6	46H 40	B4 & B6		
46H 17	B4		B6	46H 41	B4 & B6		
46H 18	B4 & B6			46H 42	B4 & B6		
46H 19	B4 & B6			46H 43	B4 & B6		
46H 20	B4 & B6			46H 44	B4 & B6		
46H 21	B4 & B6			46H 45	B4 & B6		
46H 22	B4 & B6			46H 46	B4 & B6		
46H 23	B4 & B6			46H 47	B4 & B6		
46H 24	B4 & B6						

B4 = BUTTRESS 4 END B6 = BUTTRESS 6 END

TABLE 35: 62H SERIES – TENDON ACCESSIBILITY MATRIX

TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.	TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.
62H 01	B2 & B6			62H 25	B2 & B6		
62H 02	B2 & B6			62H 26	B2 & B6		
62H 03	B2 & B6			62H 27	B2 & B6		
62H 04	B6	B2		62H 28	B2 & B6		
62H 05		B2 & B6		62H 29	B2 & B6		
62H 06		B2 & B6		62H 30	B2 & B6		
62H 07	B6		B2	62H 31	B2	B6	
62H 08		B6	B2	62H 32	B2	B6	
62H 09	B2	B6		62H 33	B2 & B6		
62H 10	B2	B6		62H 34	B2 & B6		
62H 11	B2	B6		62H 35	B2 & B6		
62H 12		B2 & B6		62H 36	B2 & B6		
62H 13	B2		B6	62H 37	B2 & B6		
62H 14	B2		B6	62H 38	B2 & B6		
62H 15		B2	B6	62H 39	B2 & B6		
62H 16	B6		B2	62H 40	B2 & B6		
62H 17	B6		B2	62H 41	B2 & B6		
62H 18	B2 & B6			62H 42	B2 & B6		
62H 19	B2	B6		62H 43	B2 & B6		
62H 20	B2		B6	62H 44	B2 & B6		
62H 21	B2 & B6			62H 45	B2 & B6		
62H 22	B2 & B6			62H 46	B2 & B6		
62H 23	B2 & B6			62H 47	B2 & B6		
62H 24	B2 & B6						

B2 = BUTTRESS 2 END B6 = BUTTRESS 6 END

TABLE 36: D100 SERIES TENDON ACCESSIBILITY MATRIX

TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.	TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.
D 101	B2/3 & B5/6			D 125	B2/3 & B5/6		
D 102	B2/3 & B5/6			D 126	B2/3 & B5/6		
D 103	B2/3 & B5/6			D 127	B2/3 & B5/6		
D 104	B2/3 & B5/6			D 128	B2/3 & B5/6		
D 105	B2/3 & B5/6			D 129	B2/3 & B5/6		
D 106	B2/3 & B5/6			D 130	B2/3 & B5/6		
D 107	B2/3	B5/6		D 131	B2/3 & B5/6		
D 108	B2/3 & B5/6			D 132	B2/3	B5/6	
D 109	B2/3 & B5/6			D 133	B2/3	B5/6	
D 110	B2/3 & B5/6			D 134	B2/3		B5/6
D 111	B2/3 & B5/6			D 135	B2/3		B5/6
D 112	B2/3 & B5/6			D 136	B2/3		B5/6
D 113	B2/3 & B5/6			D 137	B2/3		B5/6
D 114	B2/3 & B5/6			D 138	B2/3	B5/6	
D 115	B2/3 & B5/6			D 139	B2/3 & B5/6		
D 116	B2/3 & B5/6			D 140	B2/3 & B5/6		
D 117	B2/3 & B5/6			D 141	B2/3 & B5/6		
D 118	B2/3 & B5/6						
D 119	B2/3 & B5/6						
D 120	B2/3 & B5/6						
D 121	B2/3 & B5/6						
D 122	B2/3 & B5/6						
D 123	B2/3 & B5/6						
D 124	B2/3 & B5/6						

B2/3 = BUTTRESS 2-3 END B5/6 = BUTTRESS 5-6 END

TABLE 37: D200 SERIES – TENDON ACCESSIBILITY MATRIX

TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.	TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.
D 201	B1/6 & B3/4			D 225	B1/6 & B3/4		
D 202	B1/6 & B3/4			D 226	B1/6 & B3/4		
D 203	B1/6 & B3/4			D 227	B1/6 & B3/4		
D 204	B1/6 & B3/4			D 228	B1/6 & B3/4		
D 205	B1/6 & B3/4			D 229	B1/6 & B3/4		
D 206	B1/6 & B3/4			D 230	B1/6 & B3/4		
D 207	B1/6 & B3/4			D 231	B1/6 & B3/4		
D 208	B1/6 & B3/4			D 232	B1/6 & B3/4		
D 209	B1/6 & B3/4			D 233	B1/6 & B3/4		
D 210	B1/6 & B3/4			D 234	B1/6 & B3/4		
D 211	B1/6 & B3/4			D 235	B1/6 & B3/4		
D 212	B1/6 & B3/4			D 236	B3/4	B1/6	
D 213	B1/6 & B3/4			D 237	B1/6 & B3/4		
D 214	B1/6 & B3/4			D 238	B1/6 & B3/4		
D 215	B1/6 & B3/4			D 239	B1/6 & B3/4		
D 216	B1/6 & B3/4			D 240	B1/6 & B3/4		
D 217	B1/6 & B3/4			D 241	B1/6 & B3/4		
D 218	B1/6 & B3/4						
D 219	B1/6 & B3/4						
D 220	B3/4	B1/6					
D 221	B1/6 & B3/4						
D 222	B1/6 & B3/4						
D 223	B1/6 & B3/4						
D 224	B1/6 & B3/4						

B1/6 = BUTTRESS 1-6 END B3/4 = BUTTRESS 3-4 END

TABLE 38 - D300 SERIES - TENDON ACCESSIBILITY MATRIX

TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.	TENDON	ACCESSIBLE FOR COMPLETE INSPECTION	ACCESSIBLE FOR VISUAL INSPECTION ONLY	COMPLETELY INACCESS.
D 301	B1/2 & B4/5			D 325	B1/2 & B4/5		
D 302	B1/2 & B4/5			D 326	B1/2 & B4/5		
D 303	B1/2 & B4/5			D 327	B1/2 & B4/5		
D 304	B1/2 & B4/5			D 328	B1/2 & B4/5		
D 305	B1/2 & B4/5			D 329	B1/2 & B4/5		
D 306	B1/2 & B4/5			D 330	B1/2 & B4/5		
D 307	B1/2 & B4/5			D 331	B1/2 & B4/5		
D 308	B1/2 & B4/5			D 332	B1/2 & B4/5		
D 309	B1/2 & B4/5			D 333	B1/2	B4/5	
D 310	B1/2 & B4/5			D 334	B1/2		B4/5
D 311	B1/2 & B4/5			D 335	B1/2		B4/5
D 312	B1/2 & B4/5			D 336	B1/2		B4/5
D 313	B1/2 & B4/5			D 337	B1/2		B4/5
D 314	B1/2 & B4/5			D 338	B1/2	B4/5	
D 315	B1/2 & B4/5			D 339	B1/2 & B4/5		
D 316	B1/2 & B4/5			D 340	B1/2 & B4/5		
D 317	B1/2 & B4/5			D 341	B1/2 & B4/5		
D 318	B1/2 & B4/5						
D 319	B1/2 & B4/5						
D 320	B1/2 & B4/5						
D 321	B1/2 & B4/5						
D 322	B1/2 & B4/5						
D 323	B1/2 & B4/5						
D 324	B1/2 & B4/5						

B1/2 = BUTTRESS 1-2 END B4/5 = BUTTRESS 4-5 END

7.0 HYDRAULIC JACK CALIBRATIONS

7.1 Precision Surveillance Corporation has developed a program for calibrating hydraulic jacks utilizing regression analysis (PSC Procedure QA 12.8.G-W). This is a process where a straight line is mathematically best fit to a set of data points (in this case, force versus gauge pressure). This results in a linear equation which relates the ram area (slope) and constant (y-intercept) for each jack calibration, allowing the conversion of pressure to force and vice versa. Completed calibrations for all of the hydraulic jacks used are contained in Appendix G and are summarized in Table 39.

7.2 A before and after comparison of the stressing jacks' ram areas revealed that none of the hydraulic jacks' calibrations varied by more than 1.46%, indicating that they were in a properly calibrated status. Acceptable variation is 1.5%

7.3 The wire-testing ram, I.D.#7702, was also found within the acceptable variation.

7.4 Note that the force exerted by a jack can be calculated as follows:

Force = Area x Pressure + Constant

(F) (in^2) (KSI) (K)

TABLE 39: HYDRAULIC JACK CALIBRATIONS

JACK I.D.	BEFORE SURVEILLANCE				AFTER SURVEILLANCE				MAX PRESSURE	% VARIATION
	DATE	AREA (in^2)	CONSTANT (KIPS)	FORCE F_i (KIPS)	DATE	AREA (in^2)	CONSTANT (KIPS)	FORCE F_i (KIPS)		
8780	9/24/07	335.282	-5.022	1906.09	12/11/07	336.220	-4.344	1912.11	5700	-0.316
8784	9/24/07	337.287	-5.080	1917.48	12/12/07	335.547	-13.489	1899.13	5700	+0.96
9501	9/25/07	372.057	+3.814	1938.51	12/13/07	366.254	+5.666	1910.19	5200	+1.46
7702	05/08/07	1.590	+0.146	13.661	11/30/07	1.579	+0.303	13.725	8500	-0.464

8.0 TENDON LIFTOFFS

8.1 MONITOR TENDON FORCES

8.1.1 A liftoff is defined as the force required to lift the anchor head off the shim stack and is representative of the force held by that tendon. A liftoff is performed on each physical surveillance tendon to monitor the force exerted by the tendon onto the structure. PSC Procedure SQ 9.0 in Appendix F details the steps taken to perform a liftoff. The results were documented on Data Sheet SQ 9.0 and are summarized in Tables 40 thru 45.

8.1.1.1 It should be noted that performing a liftoff has only a localized effect on a tendon; therefore, it is acceptable to use the same jack for both ends of a tendon by executing the liftoff on separate occasions.

8.1.2 All of the vertical and dome tendon liftoffs were found to be above the minimum design and above 95% Predicted Force as required by IWL-3221.1. Three of the five horizontal surveillance tendons were found to be below 95% Predicted Force but above 90% Predicted Force. The liftoff requirement stated in IWL is:

Tendon forces are acceptable if:

(a) The average of all measured tendon forces, including those measured in IWL-3221.1(b)(2), for each type of tendon is equal to or greater than the minimum required prestress specified at the anchorage for that type of tendon;

(b) The measured force in each individual tendon is not less than 95% of the predicted force unless the following conditions are satisfied:

(1) the measured force in not more than one tendon is between 90% and 95% of the predicted force;

(2) The measured forces in two tendons located adjacent to the tendon in IWL-3221.1(b)(1) are not less than 95% of the predicted forces; and

(3) The measured forces in all the remaining sample tendons are not less than 95% of the predicted force.

8.1.3 Based upon the unacceptable horizontal tendon liftoffs, adjacent tendons were monitored for force until an acceptable liftoff reading was obtained on both sides of the selected tendon. 13H36 required testing of 5 adjacent tendons, 46H21 and 62H30 also required testing of five adjacent tendons. Of these tendons, six were above 95%, five were between 95% and 90% and four fell just below 90%. All tendons below 95% were restored to Predicted Force – 0%, + 6% and locked off. The restoration of these tendons is summarized in Table 46.

8.1.4 The average of the As-Found normalized liftoff values was above the minimum requirement, despite the low liftoffs, and deemed acceptable per PSC Procedure SQ9.0 Section 10.4.

8.1.4.1 The average normalized tendon force in Unit 3 for each group and their respective minimum design are:

Vertical Tendon:	Group Average = 1535.2 Kips	Minimum Design = 1149 Kips
Hoop Tendon:	Group Average = 1347.4 Kips	Minimum Design = 1252 Kips
Dome Tendon:	Group Average = 1367.3 Kips	Minimum Design = 1215 Kips

8.1.4.1.1 As depicted above, all group averages are above the required group minimum and are therefore acceptable. The actual values for each tendon and its corresponding group are summarized in Table 47.

8.1.5 Upon completion of the liftoff, a visual verification is performed to identify any changes in the condition of the tendon end. No additional or broken wires were noted during or after liftoffs.

TABLE 40: VERTICALS – SQ9.0 – MONITORING TENDON FORCE

TENDON	END	SHIM STACK HEIGHT (in)	EFFECTIVE WIRES	JACK I.D.	LIFT-OFF (kips)	AALV (kips)	B.V.P.F. (KIPS)	95% B.V.P.F. (KIPS)	90% B.V.P.F. (KIPS)	ADJACENTS REQUIRED	# OF ADJACENTS MONITORED	AS-FOUND ACCEPTANCE
12V01	TOP	14.75	161	8784	1559.95	1559.95	1525	1449	1372	NO	0	YES
	BOT	4.00	158	N/A	N/A							
45V20	TOP	12.50	163	8780	1456.80	1456.80	1507	1432	1357	NO	0	YES
	BOT	4.00	163	N/A	N/A							
61V08	TOP	13.00	163	8784	1505.98	1505.98	1491	1416	1342	NO	0	YES
	BOT	4.00	163	N/A	N/A							
61V17	TOP	12.00	161	8784	1580.18	1580.18	1498	1423	1348	NO	0	YES
	BOT	4.00	163	N/A	N/A							

TABLE 41: HOOPS – SQ9.0 – MONITORING TENDON FORCE

TENDON	END	SHIM STACK HEIGHT (in)	EFFECTIVE WIRES	JACK I.D.	LIFT-OFF (kips)	AALV (kips)	B.V.P.F. (KIPS)	95% B.V.P.F. (KIPS)	90% B.V.P.F. (KIPS)	ADJACENTS REQUIRED	# OF ADJACENTS MONITORED	AS-FOUND ACCEPTANCE
13H36	BT 1	6.50	163	8784	1344.08	1385.23	1484	1410	1336	YES	5	NO
	BT 3	7.25	163	8780	1426.63							
42H46	BT 2	5.75	163	8784	1546.46	1558.63	1456	1383	1310	NO	0	YES
	BT 4	6.00	163	8780	1570.80							
46H21	BT 4	5.75	163	8780	1319.34	1330.02	1441	1369	1297	YES	5	NO
	BT 6	6.00	163	8784	1340.71							
51H34	BT 1	8.00	163	8784	1532.96	1464.70	1487	1413	1339	NO	0	YES
	BT 5	7.00	163	8780	1396.45							
62H30	BT 2	6.75	163	8784	1249.64	1290.84	1413	1342	1272	YES	5	NO
	BT 6	6.75	163	9501	1332.05							

TABLE 42: DOMES – SQ9.0 – MONITORING TENDON FORCE

TENDON	END	SHIM STACK HEIGHT (In)	EFFECTIVE WIRES	JACK I.D.	LIFT-OFF (Kips)	AALV (Kips)	B.V.P.F. (KIPS)	95% B.V.P.F. (KIPS)	90% B.V.P.F. (KIPS)	ADJACENTS REQUIRED	# OF ADJACENTS MONITORED	AS-FOUND ACCEPTANCE
D129	BT 3	6.25	162	8780	1289.16	1289.64	1287	1223	1159	NO	0	YES
	BT 5	6.00	161	8784	1290.12							
D212	BT 1	6.38	162	8784	1259.76	1277.81	1305	1240	1175	NO	0	YES
	BT 3	6.50	162	8780	1295.87							
D238	BT 4	7.00	163	8780	1527.21	1511.53	1348	1281	1213	NO	0	YES
	BT 6	6.00	163	8784	1495.86							

TABLE 43: 13H36 ADJACENTS – SQ9.0 – MONITORING TENDON FORCE

TENDON	END	SHIM STACK HEIGHT (In)	EFFECTIVE WIRES	JACK I.D.	LIFT-OFF (Kips)	AALV (Kips)	B.V.P.F. (KIPS)	95% B.V.P.F. (KIPS)	90% B.V.P.F. (KIPS)	ADJACENTS REQUIRED	AS-FOUND ACCEPTANCE
13H33	BT 1	7.00	163	8784	1310.35	1306.46	1368	1298	1229	NO	YES
	BT 3	6.75	163	8780	1302.57						
13H34	BT 1	7.00	163	8784	1350.83	1368.61	1475	1402	1328	YES	NO
	BT 3	7.00	163	8780	1386.39						
13H35	BT 1	6.56	163	8784	1249.64	1244.25	1373	1304	1235	YES	NO
	BT 3	6.38	162	8780	1238.87						
13H37	BT 1	6.88	163	8784	1367.69	1289.87	1368	1299	1231	YES	NO
	BT3	5.75	163	8780	1212.05						
13H38	BT 1	6.50	163	8784	1411.54	1395.05	1444	1372	1300	NO	YES
	BT 3	7.00	163	8780	1378.57						

TABLE 44: 46H21 ADJACENTS – SQ9.0 – MONITORING TENDON FORCE

TENDON	END	SHIM STACK HEIGHT (in)	EFFECTIVE WIRES	JACK I.D.	LIFT-OFF (Kips)	AALV (Kips)	B.V.P.F. (KIPS)	95% B.V.P.F. (KIPS)	90% B.V.P.F. (KIPS)	ADJACENTS REQUIRED	AS-FOUND ACCEPTANCE
46H19	BT 4	7.00	163	8780	1352.87	1358.61	1402	1332	1262	NO	YES
	BT 6	7.50	163	8784	1364.35						
46H20	BT 4	6 75	160	8780	1269.04	1298.13	1467	1394	1321	YES	NO
	BT 6	7.25	163	8784	1327.22						
46H22	BT 4	5.75	163	8780	1315.98	1311.48	1486	1412	1337	YES	NO
	BT 6	6.38	163	8784	1306.98						
46H23	BT 4	6.00	161	8780	1336.10	1329 97	1425	1354	1283	YES	NO
	BT 6	5.75	163	8784	1323.85						
46H24	BT 4	6.75	163	8780	1419.92	1425.85	1472	1398	1325	NO	YES
	BT 6	7.50	163	8784	1431.78						

TABLE 45: 62H30 ADJACENTS – SQ9.0 – MONITORING TENDON FORCE

TENDON	END	SHIM STACK HEIGHT (in)	EFFECTIVE WIRES	JACK I.D.	LIFT-OFF (Kips)	AALV (Kips)	B.V.P.F. (KIPS)	95% B.V.P.F. (KIPS)	90% B.V.P.F. (KIPS)	ADJACENTS REQUIRED	AS-FOUND ACCEPTANCE
62H29	BT 2	6.50	163	8780	1366.28	1369.63	1421	1350	1279	NO	YES
	BT 6	6.38	163	9501	1372.98						
62H31	BT 2	6.25	163	8780	1269.04	1269.04	1475	1401	1328	YES	NO
	BT 6 *	6.00	163	N/A	N/A						
62H32	BT 2	7.00	163	8780	1332.75	1332.75	1455	1382	1310	YES	NO
	BT 6 *	6 50	163	N/A	N/A						
62H33	BT 2	6.19	163	8780	1242.22	1313.39	1461	1388	1315	YES	NO
	BT 6	6.50	162	8784	1384.56						
62H34	BT 2	7.00	163	8780	1393.10	1378.71	1432	1360	1289	NO	YES
	BT 6	6.75	162	8784	1364.32						

* TENDON NOT ACCESSABLE AT BUTTRESS 6.

TABLE 46 ADJACENTS – TENDON FORCE RESTORATION

TENDON	END	AS-FOUND LIFTOFF			RESTORATION			B.V.P.F. (KIPS)	% VARIATION ABOVE B.V.P.F	ACCPETABLE ?
		JACK	LIFT-OFF (Kips)	AALV (Kips)	JACK	LIFT-OFF (Kips)	AALV (Kips)			
13H34	BT 1	8784	1350.83	1368.61	8784	1479.00	1508.13	1475	+2.2%	YES
	BT 3	8780	1386.39		8780	1537.27				
13H35	BT 1	8784	1249.64	1244.25	8784	1411.54	1417.40	1373	+3.2%	YES
	BT 3	8780	1238.87		8780	1423.27				
13H36	BT 1	8784	1344.08	1385.23	8784	1546.46	1555.27	1484	+4.8%	YES
	BT 3	8780	1426.63		8780	1564.09				
13H37	BT 1	8784	1367.69	1289.87	8784	1394.68	1415.68	1368	+3.5%	YES
	BT 3	8780	1212.05		8780	1436.69				
46H20	BT 4	8780	1269.04	1298.13	8780	1486.98	1494.79	1467	+1.9%	YES
	BT 6	8784	1327.22		8784	1502.61				
46H21	BT 4	8780	1319.34	1330.02	8780	1503.74	1501.49	1441	+4.2%	YES
	BT 6	8784	1340.71		8784	1499.24				
46H22	BT 4	8780	1315.98	1311.48	8780	1567.45	1538.40	1486	+3.5%	YES
	BT 6	8784	1306.98		8784	1509.35				
46H23	BT 4	8780	1336.10	1329.97	8780	1486.98	1481.30	1425	+4.0%	YES
	BT 6	8784	1323.85		8784	1475.62				
62H30	BT 2	8784	1249.64	1290.84	8780	1443.39	1467.71	1413	+3.9%	YES
	BT 6	9501	1332.05		9501	1492.04				
62H31	BT 2	8780	1269.04	1269.04	8780	1486.98	1486.98	1475	+0.8%	YES
	BT 6 *	N/A	N/A		N/A	N/A				
62H32	BT 2	8780	1332.75	1332.75	8780	1497.04	1497.04	1455	+2.9%	YES
	BT 6 *	N/A	N/A		N/A	N/A				
62H33	BT 2	8780	1242.22	1313.39	8780	1486.98	1494.79	1461	+2.3%	YES
		8784	1384.56		8784	1502.61				

* TENDON NOT ACCESSABLE AT BUTTRESS 6 – RESTORATION ONE END ONLY.

TABLE 47: AVERAGE AS-FOUND NORMALIZED TENDON FORCE

TENDON	AALV (KIPS)	NORMALIZING FACTOR	NORMALIZED AALV (KIPS)	NORMALIZED GROUP AVE.	MINIMUM REQUIRED NORMALIZED FORCE	ACCEPT.
12V01	1559.95	-9	1550.95	1535.23	1149	YES
45V20	1456.80	7	1463.80			
61V08	1505.98	23	1528.98			
61V17	1580.18	17	1597.18			
13H33	1306.46	62	1368.46	1347.36	1252	YES
13H34	1368.61	-47	1321.61			
13H35	1244.25	56	1300.25			
13H36	1385.23	-56	1329.23			
13H37	1289.87	61	1350.87			
13H38	1395.05	-17	1378.05			
42H46	1558.63	-28	1530.63			
46H19	1358.61	25	1383.61			
46H20	1298.13	-39	1259.13			
46H21	1330.02	-12	1318.02			
46H22	1311.48	-57	1254.48			
46H23	1329.97	4	1333.97			
46H24	1425.85	-44	1381.85			
51H34	1464.70	-59	1405.70			
62H29	1369.63	7	1376.63			
62H30	1290.84	14	1304.84			
62H33	1313.39	-32	1281.39			
62H34	1378.71	-5	1373.71			
D129	1289.64	34	1323.64	1367.33	1215	YES
D212	1277.81	15	1292.81			
D238	1511.53	-26	1485.53			