6.6 Inadequate Original Tensioning of Tendons

Description:

Initial tensioning of tendons could lead to excessive stresses in the containment structure. This is of particular importance as the CR3 containment dome did delaminate upon tendon original tensioning in 1976 (FM 6.6 Exhibit 4) as well as another Florida containment dome that delaminated at Turkey Point upon original tendon tensioning (FM 6.6 Exhibit 5).

Excessive original tensioning can damage the concrete by generating localized micro-cracks and/or enhanced creep rates.

Also, unbalanced or incorrectly sequenced post-tensioning can lead to high local stresses, micro-cracks and/or delamination.

Data to be collected and Analyzed:

1. Review initial tendon force requirements (FM 6.6 Exhibit 1);
2. Review initial tendon tensioning data (FM 6.6 Exhibit 2);
3. Review first surveillance lift-off measurements (FM 6.6 Exhibit 3);
4. Review original tensioning sequence (FM 6.6 Exhibit 7);

Discussion:

The issue of excessive pre-stress by design is included in FM 1.3 as it is a design feature (this is the hoop pre-stress equal to 1.6 times the accident pressure). The current failure mode deals with the field tensioning in excess of the pre-stress design.

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Draft 1

P/72

The initial tendon tensioning was sufficient to cause delamination early in the life of the containments in the case of the CR3 dome and the Turkey Point dome (FM 6.6 Exhibit 4 and FM 6.6 Exhibit 5). In both cases, issues of radial tensile stresses, tension-compression interactions, and limitations in the concrete tensile strength were indicated as root cause for the events.

Samples of the original tendon tensioning sheets are shown in FM 6.6 Exhibit 2. The tensioning sheets contain the hydraulic pressure on the jacks while the tendon force is the number typically referred to. The relationship between the two numbers is linear and well-known. Each jack is calibrated and the linear relationship is slightly different for each one (FM 6.6 Exhibit 8). For the original tensioning jacks used by VSL, the approximate relationship is that 6,800 psi of hydraulic pressure at the jack is equivalent to a tendon force of 1,635 kips.

Tendon 12V20 shows a lift-off force of 1785 kips at the first tendon surveillance even though the original stressing record does not indicate any special problem with this tendon (FM 6.6 Exhibit 9). Tendon 12V20 does not go around any penetration. The excessive force was recorded again at the second surveillance (1740 kips) before being re-locked off at 1630 kips during the third surveillance. Tendons 45V3 and 56V1 lift-off measurements were also above the 1,635 kips.

Besides the overstressing, the sequence of tensioning is important, both in terms of elastic shortening losses for the various tendons, and in terms of asymmetrical loading of the concrete. The examination of the original detensioning sequence indicates that the CR3 containment was evenly loaded upon tensioning.

The key results here are that there was no indication at the time of the CR3 dome delamination, or since in regular surveillance activities, that the wall had delaminated, and that the CTL condition assessment analysis, using Impulse Response technology, showed there are no delamination in five of the six CR3 containment panels (FM 6.6 Exhibit 6, see Summary page 4 of 96).

This indicates that original tendon tensioning by itself did not create the delamination.

Verified Supporting Evidence:

a. First surveillance lift-off measurements did detect 3 over-tensioned vertical tendons (FM 6.6 Exhibit 3);

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Verified Refuting Evidence:

b. Maximum tendon force is 1,635 kips (FM 6.6 Exhibit 1, page 5 of 5). This is as designed and not expected to create excessive tensile radial stresses (see also FM 1.3);

c. Original tensioning sheets did not report any over-tensioned tendons;

d. First surveillance lift-off measurements did not detect any over-tensioned hoop tendons (FM 6.6 Exhibit 3);

e. There was no indication at the time of the CR3 dome delamination, or since in regular surveillance activities, that the wall had delaminated as well;

f. The CTL condition assessment analysis, using Impulse Response technology, showed there are no delamination in five of the six CR3 containment panels (FM 6.6 Exhibit 6, see Summary page 4 of 96). This tends to indicate that original tendon tensioning by itself did not create the delamination.

Conclusion:

We have not found evidence that the original tendon tensioning was done so incorrectly as to have been a contributor to the delamination, either alone or in combination with other factors.

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Draft 1

Progress Energy

NUCLEAR OPERATIONS ENGINEERING
CRYSTAL RIVER UNIT 3

DESIGN BASIS DOCUMENT
FOR THE

CONTAINMENT

SYSTEM CODE: N/A
TAB: 1/1

ISSUE DATE: 11/8/85

	Revision 3	Revision 4	Revision 5	Revision 6	
Date	03-09-01	09-18-01	04-26-07	09-24-08	
Design Engineer	R. P. Schmiedel	R. P. Schmiedel	P. Winters	Emin Ertatto	
Verification Engineer	C. S. Sterner	L. S. McGowan	C. Pugh	P.J. Winter	
Supervisor	G. E. Englert	K. R. Wilson	L. Santonastaso	L Santonastaso	

REVISION LOG

Revision/Date	Description
0 / 11-8-85	Initial Issue
1 / 07-25-94	Complete re-issue and incorporation of Temporary Change #296 as shown by revision bars.
2 / 11-18-99	Incorporated Temporary change #539 and #954. Text from T.C. # 539 was not incorporated due to being superseded by T.C. # 954.
3 / 01-02-00	Incorporated Temporary change #1180 as shown by revision bars.
4 / 09-18-01	Incorporated Temporary change #1115 as shown by revision bars.
5 / 04-26-07	Incorporated Engineering Change 66751R0 as indicated by the change bars on pages 14 and 25.
6 / 09-29-08	Incorporated Engineering Change 71342 as indicated by the change bars on page 12.

DESIGN BASES INDEX
FOR
CONTAINMENT

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DEFINITION 1

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- Design Conditions 8

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DEFINITION

The Containment Structure is classified as a Class I structure because:

1. Its failure might cause or increase the severity of a loss-of-coolant accident (LOCA).
2. Its failure might result in an uncontrolled release of radioactivity.
3. It is vital to safe shutdown and isolation of the reactor.

In addition, the Containment Structure provides shielding from the fission products which could be airborne in the building under accident conditions.

The containment is composed of those elements listed in the Table of Contents for this Design Basis Document.

The Reactor Building is a concrete structure with a cylindrical wall, a flat foundation mat, and a shallow dome roof. The foundation slab is reinforced with conventional mild-steel reinforcing. The cylindrical wall is prestressed with a post-tensioning system in the vertical and horizontal (hoop) directions. The dome roof is prestressed utilizing a three-way post-tensioning system. The inside surface of the reactor building is lined with a carbon steel liner to ensure a high degree of leak tightness during operating and accident conditions. Nominal liner plate thickness is 3/8 inch for the cylinder and dome and 1/4 inch for the base.

The foundation mat is bearing on competent bearing material and is 12-1/2 feet thick with a 2 feet thick concrete slab above the bottom liner plate. The cylindrical portion has an inside diameter of 130 feet, wall thickness of 3 feet 6 inches, and a height of 157 feet from the top of the foundation mat to the spring line. The shallow dome roof has a large radius of 110 feet, a transition radius of 20 feet 6 inches, and a thickness of 3 feet.

PRESTRESS FORCE

	VERTICAL	HOOP	DOME		SOURCE		
					Vert	Hoop	Dome
Pattern	144 tendons	94 hoops 3 tendons per hoop	3 sets of 35 tendons	2 sets of 6 tendons	3	8	6, 10
Radius	807.375'	812.375'	720.375'	720.375'	3	7	6
Spacing	35.23"	13"	30"	30"	3	5	4
Prestress Level Specified	457 K/ft	829 K/ft**	820 K/ft	--	1	1	1
Immediate (80% GUTS)*	1868 K/ tendon	1868 K/ tendon	1868 K/ tendon	--	9	9	9
Lockoff	1635 K/ tendon	1635 K/ tendon	1635 K/ tendon	646 K/ tendon	9	9	9, 10
Min. Req'd at 40 years	1149 K/ tendon	1252 K/ tendon	1215 K/ tendon	--	2	2	2, 10

** 415K/ft for lower 10 feet of wall

* GUTS = Guaranteed Ultimate Tensile Strength = 2335K/tendon
(A = 9.723 in2, fu = 240 ksi)

Sources:

1. SP-5583
2. Memo: J.F. Fulton to J.C. Herr, "CR3 Tendon Surveillance - FSAR Technical Specification 4.6.1.6 - Required Minimum Average Tendon Force for the Repaired Dome", 2/15/80, plus attached calculations for W.O. 04-4762-099.
3. G/C, Inc. Structural Calculation FC 1.01.7/2
4. G/C, Inc. Structural Calculation FC 1.01.7/50
5. Prescon Shop Drawings
6. G/C, Inc. Structural Calculation FC 1.01.17/0
7. G/C, Inc. Structural Calculation FC 1.01.8/30
8. G/C, Inc. Structural Calculation FC 1.01.8/4
9. ACI 318-63, Sec. 2606.
10. G/C, Inc. Report, "Reactor Building Dome Delamination, Final Report," December 10, 1976.

Reason:

The prestress forces provided in the vertical, dome, and hoop directions are sufficient to eliminate tensile stresses in the shell due to membrane forces resulting from design loads. Prestress losses due to such factors as shrinkage, concrete creep, steel relaxation, elastic shortening of the concrete, and friction were considered in the determination of prestress levels.

FLORIDA POWER CORPORATION

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

IDENTIFICATION NUMBER 13 H 3 CUT LENGTH 155'-10 3/4

~~SHOP WA~~SHER ID: PC 120 CR 343 FIELD WASHER ID: PC 122 CR 1245

1. GAI/QA vendor inspection cover letter number-FPC # 7849 DATE 2/8/74

2. Date tendon received on-site 12-3-73 RMR Number 35087

3. Date installed in conduit 4-1-74 Installation NCR's

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 9-18-74 Buttonheading NCR's

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 1-24-75 Stressing NCR's

   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 1/4 , 5 1/4	6 1/8 , 5 3/4	10 3/8 , 11
Lift-Off Pressure - Predicted/Actual	6760 , 6750	6710 , 6650	N/A
Shim Thickness/80% Ultimate Pressure	6" , 7750	6 3/8 , 7660	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 9-27-74 Bulk-Filling NCR's

   Time since installation 6 months Inlet Pressure 42 psi Outlet Temp. 130°

   Date end caps refilled: Shop Field

7. Data compiled by [illegible] Organization [illegible]

   Date 4/4/77

8. Additional Comments:

Florida Power Corporation

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

1. IDENTIFICATION NUMBER 1344 CUT LENGTH 155'-8 3/4"

SHOP WASHER ID: PC 121 CR 661 FIELD WASHER ID: PC 121 CR 893

1. GAI/QA vendor inspection cover letter number-FPC # 9849 DATE 2/8/74

2. Date tendon received on-site 12-3-73 RMR Number 35087

3. Date installed in conduit 4-1-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 9-17-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 3-21-75 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 1/2	10 1/4 , 10 1/2
Lift-Off Pressure - Predicted/Actual	6800 / 6750	6840 , 6900	N/A
Shim Thickness/80% Ultimate Pressure	6 9/16 / 7770	6 3/8 , 7790	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 9-27-74 Bulk-Filling NCR's

Time since installation 6 months Inlet Pressure 18 PSI Outlet Temp. 140°

Date end caps refilled: Shop Field

7. Data compiled by [illegible] Organization [illegible]

Date 4/4/77

8. Additional Comments:

Florida Power Corporation

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

IDENTIFICATION NUMBER 13M5 CUT LENGTH 155'-10"

~~SHOP~~ WASHER ID: PC 121 CR 640 FIELD WASHER ID: PC 122 CR 1277

1. GAI/QA vendor inspection cover letter number-FPC # 7849 DATE 2/8/74

2. Date tendon received on-site 12-3-73 RMR Number 35087

3. Date installed in conduit 3-29-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 9-17-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 1-23-75 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	4 3/4, 5 5/8	5 3/8, 5 1/8	10 1/8, 10 3/4
Cut-Off Pressure - Predicted/Actual	6760, 6800	6710, 6700	N/A
Shim Thickness/80% Ultimate Pressure	6 3/8, 7750	6, 7660	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 9-27-74 Bulk-Filling NCR's

Time since installation 6 months Inlet Pressure 10 psi Outlet Temp. 140°

Date end caps refilled: Shop Field

7. Data compiled by Bradley Organization Salem

Date 4/4/77

8. Additional Comments:

FM 6.6 Exhibit 2

Florida Power CORPORATION

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

TENDON IDENTIFICATION NUMBER 42H30 CUT LENGTH 155-6 1/4

SHOP WASHER ID: PC 121 CR 569 FIELD WASHER ID: PC 122 CR 1143

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 6-25-74 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 / 4 7/8	5 1/8 / 5 3/4	10 1/4 / 10 5/8
Lift-Off Pressure - Predicted/Actual	6870 / 6950	6790 / 6750	N/A
Shim Thickness/80% Ultimate Pressure	6 3/8 / 7810	6 / 7750	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. 141°

   Date end caps refilled: Shop Field

7. Data compiled by D. Waller Organization Salem

   Date 4/4/77

8. Additional Comments:

FM 6.6 Exhibit 2

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 P.S.I. Outlet Temp. 128°

   Date end caps refilled: Shop Field

7. Data compiled by D. Walker Organization Salem

   Date 4/4/77

8. Additional Comments:

FM 6.6 Exhibit 2

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	6870 / 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:

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

TENDON IDENTIFICATION NUMBER 12V2 CUT LENGTH 188'-6 1/2

SHOP WASHER ID: PC 121 CR 557 FIELD WASHER ID: PC 120 CR 232

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 36036

3. Date installed in conduit 7-3-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 8-27-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 10-14-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	12 1/8 / 12 1/2	N/A / N/A	12 1/4 12 1/2
Lift-Off Pressure - Predicted/Actual	6800 / 7050 PSI	" / "	N/A
Shim Thickness/80% Ultimate Pressure	13" / 7770	4 / "	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 10-23-74 Bulk-Filling NCR's

Time since installation 3 1/4 months Inlet Pressure 112 PSI Outlet Temp. 126°

Date end caps refilled: Shop Field

7. Data compiled by D. Vinlan 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 12 V 3 CUT LENGTH 188'-6 1/2

SHOP WASHER ID: PC 121 CR 587 FIELD WASHER ID: PC 120 CR 176

1. GAI/QA vendor inspection cover letter number-FPC # 9951 DATE 2/25/74

2. Date tendon received on-site 1-16-74 RMR Number 36036

3. Date installed in conduit 7-3-74 Installation NCR's

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 7-24-74 Buttonheading NCR's

   Bad wires 7 Accept. Reheads 4 Total Ineffective wires 3

5. Date stressed 9-27-74 Stressing NCR's

   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	12 1/8 / 12 5/8	N/A / N/A	12 1/8 / 12 5/8
Lift-Off Pressure - Predicted/Actual	6800 / 7000 PSI	" / "	N/A
Shim Thickness/80% Ultimate Pressure	13 3/8 / 7770	4" / "	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 10-23-74 Bulk-Filling NCR's

   Time since installation 3 3/4 months Inlet Pressure 110 PSI Outlet Temp. 122°

   Date end caps refilled: Shop Field

7. Data compiled by D. Walker Organization Salem

   Date 4/1/77

8. Additional Comments:

907 716

Florida Power Corporation

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

TENDON IDENTIFICATION NUMBER 12 V 4 CUT LENGTH 188'-7

SHOP WASHER ID: PC 121 CR 579 FIELD WASHER ID: PC 120 CR 267

1. GAI/QA vendor inspection cover letter number-FPC # 9957 DATE 2/25/74

2. Date tendon received on-site 1-18-74 RMR Number 36073

3. Date installed in conduit 7-3-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 8-27-74 Buttonheading NCR's

Bad wires 5 Accept. Reheads 4 Total Ineffective wires 1

5. Date stressed 10-14-74 Stressing NCR's

Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	12 1/8 / 12 7/8	N/A / N/A	12 1/8 / 12 7/8
ft-Off Pressure - Predicted/Actual	6760 / 6850 PSI	" / "	N/A
Shim Thickness/80% Ultimate Pressure	14 3/16" / 7720	4" / "	N/A

Unseated/Broken Wires Total effective wires after stressing 162

6. Date Bulk-filled 1-30-75 Bulk-Filling NCR's

Time since installation 6 months Inlet Pressure 140 LBS Outlet Temp. 122°

Date end caps refilled: Shop Field

7. Data compiled by D. Walker Organization Salem

Date 4/1/77

8. Additional Comments:

FM 6.6 Exhibit 2

Florida Power CORPORATION

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

TENDON IDENTIFICATION NUMBER D 106 CUT LENGTH 125'-5 1/4"

SHOP WASHER ID: PC 121 CR 923 FIELD WASHER ID: PC 121 CR 945

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

2. Date tendon received on-site 3-13-74 RMR Number 37569

3. Date installed in conduit 6-7-74 Installation NCR's

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 10-2-74 Buttonheading NCR's

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

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

   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 60% ult.)-Pred./Act.	4 1/4 / 4	4 1/4 / 4 3/4	8 1/2 / 8 3/4
Lift-Off Pressure - Predicted/Actual	6,800 / 6,700	6,840 / 6,840	N/A
Shim Thickness/80% Ultimate Pressure	5 3/8 / 7,770	5 3/8 / 7,790	N/A

   Unseated/Broken Wires 1 Total effective wires after stressing 162

6. Date Bulk-filled 4-7-75 Bulk-Filling NCR's

   Time since installation 10 months Inlet Pressure 25 psi Outlet Temp. 125°

   Date end caps refilled: Shop Field

7. Data compiled by D. Walla Organization Salem

   Date 3/30/77

8. Additional Comments:

FM 6.6 Exhibit 2

Florida Power CORPORATION

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

TENDON IDENTIFICATION NUMBER D 107 CUT LENGTH 128'-11 1/8

SHOP WASHER ID: PC 121 CR 852 FIELD WASHER ID: PC 121 CR 975

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

2. Date tendon received on-site 3-13-74 RMR Number 37569

3. Date installed in conduit 6-7-74 Installation NCR's

Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 10-2-74 Buttonheading NCR's

Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 11-12-74 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 1/4	4 3/8 / 4 5/8	8 3/4 / 8 7/8
Lift-Off Pressure - Predicted/Actual	6,810 / 6,900	6,810 / 6,950	N/A
Shim Thickness/80% Ultimate Pressure	6 3/16 / 17,780	6 3/8 / 17,780	N/A

Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 4-7-75 Bulk-Filling NCR's 163

Time since installation 10 months Inlet Pressure 25 psi Outlet Temp. 130°

Date end caps refilled: Shop Field

7. Data compiled by D. Waller Organization Salem

Date 3/30/77

8. Additional Comments:

DATA SHEET 6

PRESTRESS FORCE CONFIRMATION TEST

DOME TENDONS

INSPECTION PERIOD #1

TENDON				LIFT-OFF CONDITION						LOCK-OFF			REACTOR BLDG TEMP °F		DATE INSP.	INSP. BY
I.D.	LOCATION	PREVIOUS FORCE (kips)	EXPECTED LIFT-OFF FORCE (kips)	GAGE PRESS. (Ksi)	FORCE (kips)	FORCE AVG. OF 2 ENDS (kips)	WIRE FORCE	SHIM THICKNESS (in.) PREVIOUS	SHIM THICKNESS (in.) ORIGINAL	GAGE PRESS. (Ksi)	FORCE (kips)	FINAL SHIM THICKNESS (in.)	INT.	EXT.		INITIALS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. D-171	[illegible]	[illegible]	1334.6	[illegible]	1612	1570	9,335	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	92°	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]		7.3	1516			[illegible]	[illegible]	7.2	[illegible]	[illegible]				
2. D-215	[illegible]	[illegible]	1334.6	7.6	1612	1594	10,086	7	7	[illegible]	[illegible]	[illegible]	92°	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]		7.7	1635			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
3. D-221	[illegible]	[illegible]	1334.6	7.6	1634	1511	9,270	[illegible]	[illegible]	7.6	[illegible]	[illegible]	115°	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]		6.5	1365			7	7	[illegible]	[illegible]	7				
4. D-228	[illegible]	[illegible]	1334.6	7.2	1556	1524	9,350	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100°	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]		7.6	1650			7	7	7.6	[illegible]	7				
5. D-234	[illegible]	[illegible]	1334.6	7.3	1565	1513	9,331	7	7	7.2	[illegible]	7	113°	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]		6.9	1475			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
6. D-241	[illegible]	[illegible]	1334.6	7.45	1633	1562	9,523	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110°	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]		7.1	1522			[illegible]	[illegible]	7.1	[illegible]	[illegible]				

NOTE A:
FORCE CALCULATION: (1) Force @ Lift-off = Jack Pressure x Jack Piston Area
OR: (2) Determine force from calibration curve

NOTE B:
Reactor Building internal temperature will be read using CI-274-TE or CI-275-TE (temperature read at Johnson Panel 11-B)

NOTE C:
Wire Force (Column 8) is defined as follows:

$$W.F. = \frac{\text{Column 7}}{163 - \text{Column 4 of Data Sheet 1}}$$

NOTE D:
Expected lift-off force (column 4) is defined as follows: No. of effective wires at installation (or previous inspection) X Ave. predicted wire force shown on Fig. 1 at time of inspection.

LEGEND

LOCATION: 1 to 6 Number of buttress nearest to end of tendon.
SHIM THICKNESS: Clear distance between bearing plate and stressing washer.
PREVIOUS: At time of installation or previous surveillance.
ORIGINAL: At time of starting current surveillance.

Contractor Review by: _____ Date: _____

F.P.C. Approval by: _____ Date: _____

DATA SHEET 7

PRESTRESS FORCE CONFIRMATION TEST

VERTICAL TENDONS

INSPECTION PERIOD #1

RAM #

TENDON I.D. 1	LOCATION 2	PREVIOUS FORCE (kips) 3	EXPECTED LIFT-OFF FORCE (kips) 4		LIFT-OFF CONDITION: GAGE PRESS. (Ksi) 5	FORCE (kips) 6	FORCE AVG. OF 2 ENDS (kips) 7	WIRE FORCE 8	SHIM THICKNESS (in.) PREVIOUS 9	SHIM THICKNESS (in.) ORIGINAL 10	LOCK-OFF: GAGE PRESS. (Ksi) 11	FORCE (kips) 12	FINAL SHIM THICKNESS (in.) 13	REACTOR BLDG TEMP °F INT. 14	REACTOR BLDG TEMP °F EXT. 15	DATE INSP. 16	INSP. BY INITIALS 17
1. 12V20	T	1615	1499.6	5	8.2	1785	1785	10,951	T 9" B 4"	15" 4"	8.2	1785	15" 4"	111°	65°	12/12/77	[illegible]
2. 23V15	T	1615	1490.4	5	7.3	1589.5	1589.5	9,751	T 13" B 4"	13" 4"	7.3	1589.5	13" 4"	102°	62°	12/12/77	[illegible]
3. 34V6	T	1615	1499.6	3	7.5	1590	1590	9,755	T 14" B 4"	14 3/8" 4"	7.7	1634	14 3/8" 4"	102°	41°	12/8/77	[illegible]
4. 45V3	T	1639	1499.6	3	7.9	1678	1678	10,294	T 14" B 4"	14" 4"	7.9	1678	14" 4"	103°	63°	12/1/77	[illegible]
5. 56V1	T	1690 1780 *	1499.6	5	7.9	1718.5	1718.5	10,543	T 14" B 4"	14" 4"	7.7	1675.5	14" 4"	107°	66°	12/7/77	[illegible]

*NOTE:

TWO ACTUAL LIFT-OFF PRESSURES WERE REPORTED IN TENDON HISTORY FOR 56V1

NOTE A:
FORCE CALCULATION: (1) Force @ Lift-off = Jack Pressure x Jack Piston Area
OR: (2) Determine force from calibration curve

NOTE B:
Reactor Building internal temperature will be read using CI-274-TE or CI-275-TE (temperature read at Johnson Panel 11-B)

NOTE C:
Wire Force (Column 8) is defined as follows:

$$W.F. = \frac{\text{Column 7}}{163 - \text{Column 4 of Data Sheet 2}}$$

NOTE D:
Expected lift-off force (column 4) is defined as follows: No. of effective wires at installation (or previous inspection) X Ave. predicated wire force shown on Fig. 2 at time of inspection.

LEGEND
LOCATION: T or B - top or bottom (vertical tendon).
SHIM THICKNESS: Clear distance between bearing plate and stressing washer.
PREVIOUS: At time of installation or previous surveillance.
ORIGINAL: At time of starting current surveillance.

Contractor Review by: _____ Date: _____

F.P.C. Approval by: _____ Date: _____

DATA SHEET 1A

PRESTRESS FORCE CONFIRMATION TEST

VERTICAL TENDONS

INSPECTION PERIOD #1

RAH #

	TENDON					LIFT-OFF CONDITION							LOCK-OFF			REACTOR BLDG TEMP °F		DATE INSP.	INSP. BY
	I.D.	LOCATION	PREVIOUS FORCE (kips)	EXPECTED LIFT-OFF FORCE (kips)		CAGE PRESS. (Ksi)	FORCE (kips)	FORCE AVG. OF 2 ENDS (kips)	WIRE FORCE	SHIM THICKNESS (in.) PREVIOUS	SHIM THICKNESS (in.) ORIGINAL	CAGE PRESS. (Ksi)	FORCE (kips)	FINAL SHIM THICKNESS (in.)	INT.	EXT.		INITIALS
	1	2	3	4		5	6	7	8	9	10	11	12	13	14	15	16	17
1.	12V19	T	1640	1499.6	5	7.3	1587.5	1589.5	9737	T 13 3/8"	13 3/4"	LIFT-OFF		ONLY	—	—	—	—
2.	12V21	T	1651	1472	5	7.5	1632.5	1632.5	10203	T 13"	13"	LIFT-OFF		ONLY	—	—	—	—
3.	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—
4.	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—
5.	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—

NOTE A:
FORCE CALCULATION: (1) Force @ Lift-off = Jack Pressure x Jack Piston Area
OR: (2) Determine force from calibration curve

NOTE B:
Reactor Building internal temperature will be read using CI-274-TE or CI-275-TE (temperature read at Johnson Panel 11-8)

NOTE C:
Wire Force (Column 8) is defined as follows:

$$W.F. = \frac{\text{Column 7}}{163 - \text{Column 4 of Data Sheet 2}}$$

NOTE D:
Expected lift-off force (column 4) is defined as follows: No. of effective wires at installation (or previous inspection) X Ave. predicated wire force shown on Fig. 2 at time of inspection.

LEGEND

LOCATION: T or B - top or bottom (vertical tendon).

SHIM THICKNESS: Clear distance between bearing plate and stressing washer.

PREVIOUS: At time of installation or previous surveillance.

ORIGINAL: At time of starting current surveillance.

Contractor Review by: _____ Date: _____

F.P.C. Approval by: _____ Date: _____

DATA SHEET 8

PRESTRESS FORCE CONFIRMATION TEST

HOOP TENDONS

INSPECTION PERIOD 7-1

TENDON I.D. 1	LOCATION 2	PREVIOUS FORCE (kips) 3	EXPECTED LIFT-OFF FORCE (kips) 4		LIFT-OFF CONDITION GAGE PRESS. (Ksi) 5	FORCE (kips) 6	FORCE AVG. OF 2 ENDS (kips) 7	WIRE FORCE 8	SHIM THICKNESS (in.) PREVIOUS 9	ORIGINAL 10	LOCK-OFF GAGE PRESS. (Ksi) 11	FORCE (kips) 12	FINAL SHIM THICKNESS (in.) 13	REACTOR BLDG TEMP °F INT. 14	EXT. 15	DATE INSP. 16	INSP. BY INITIALS 17
1. 13H10	5-1	1595	1434.4	3	7.1	1503	1524	9,351	7	7	7.15	1513	7	107°	71°	[illegible]	[illegible]
				5	7.1	1545.5			7¼	7¼	7.1	1545.5	7¼				
2. 13H19		1626	1434.4	3	7.15	1551	1495	9,224	6¾	6¾	7.1	1500	7¼	109°	53°	[illegible]	[illegible]
				5	6.5	1411.5			6¾	6¾	6.6	1435	6¾				
3. 13H31			1435.6	3	7.15	1557	1605.5	9,850	6¾	6¾	7.15	1557	6¾	95°	51°	[illegible]	[illegible]
				5	7.5	1654			5¾	5¾	7.4	1611	5¾				
4. 13H47			1434.4	3	7.45	1519	1500	9,351	8¼	7¼	7.4	1515	7¼	93°	48°	[illegible]	[illegible]
				5	7.5	1612.5			6	6	7.4	1611	6				
5. 13H49			1434.4	3	7.5	1546	1573.5	9,655	7	7	7.4	1576	7	105°	59°	[illegible]	[illegible]
				5	7.45	1557			5¾	5¾	7.1	1544.5	5¾				
6. 14H21			1435.6	5	6.7	1451.5	1500	9,217	5¾	5¾	6.7	1451.5	5¾	106°	41°	[illegible]	[illegible]
7. 14H37			1434.4	3	7.3	1546	1413	8,915	5¾	5¾	7.2	1524	5¾	104°	34°	[illegible]	[illegible]
				5	6.85	1411			6¾	6¾	6.7	1421.5	6¾				
8. 14H37			1435.6	3	6.8	1415	1457	8,940	6	6	6.8	1422	6	104°	62°	[illegible]	[illegible]
				5	6.5	1411.5			7	7	6.5	1413.5	7				
9. [illegible]			1434.4	3	7.1	1503	1454	8,952	6¾	6¾	6.95	1444	6¾	111°	74°	[illegible]	[illegible]
				5	6.5	1415.5			7¼	7¼	6.6	1411	7¼				
10. 5H-11			1434.4	3	7.15	1571	1474	9,044	6¾	6¾	7.0	1503	6¾	107°	63°	12/15/79	[illegible]
				5	6.7	1457.5			5¾	5¾	6.7	1457.5	5¾				
					6.5	1391			6¾	7	6.4	1392.5	7				

NOTE A:
FORCE CALCULATION: (1) Force @ Lift-off = Jack Pressure x Jack Piston Area
OR: (2) Determine force from calibration curve

NOTE B:
Reactor Building internal temperature will be read using CI-274-TE or CI-275-TE (temperature read at Johnson Panel 11-B)

NOTE C:
Wire Force (Column 8) is defined as follows:

$$W.F. = \frac{\text{Column 7}}{163 \times \text{Column 4 of Data Sheet 3}}$$

NOTE D:
Expected lift-off force (column 4) is defined as follows: No. of effective wires at installation (or previous inspection) X Ave. predicted wire force shown on Fig. 3 at time of inspection.

LEGEND

LOCATION: 1 to 6 - Number of buttress nearest to end of tendon.

SHIM THICKNESS: Clear distance between bearing plate and stressing washer.

PREVIOUS: At time of installation or previous surveillance.

ORIGINAL: At time of starting current surveillance.

Contractor Review by: _____ Date: _____

F.P.C. Approval by: _____ Date: _____

DOCKET COPY

Florida Power
CORPORATION

April 21, 1976

3F0476-05

Mr. Ernest Volganeau, Director
Directorate of Regulatory Operations
U.S. Nuclear Regulatory Commission
Washington, D.C. 20545

SUBJECT: SEPARATION IN CONCRETE OF CONTAINMENT STRUCTURE DOME.

Subject: Docket No. 50-302

Dear Mr. Volganeau:

Pursuant to 10CFR50.55E, we wish to follow up our verbal (telephone) notification of 4/19/76 regarding a separation in the concrete of the Crystal River Unit #3 containment structure dome. We have now documented the apparent extent of this separation. To recap, the following is the sequence of events of the investigation.

On Wednesday, April 14, 1976, while placing cinch anchors in the dome concrete of the Reactor Building, it was noted that there appeared to be a hollow area about one inch beneath the surface. Investigation on Friday, April 16, by saw cutting and removing a section of concrete approximately one foot wide by three feet long, showed that the depth of the hollow area went deeper as it went higher on the dome. By core drilling on Saturday and Sunday, April 17 and 18, it was further determined that the separation continued across the dome and went as deep as 15" and separated as much as 1-3/4 inches. By using acoustic methods, the lower perimeter of the separated area was determined to extend all around the dome in pours "G", "H" and "J".

Our engineers are now evaluating the present condition of the structure.

Sketches marked I, II, III, IV, V, and VI illustrate the apparent extent of the separation as indicated by the limited data available at this time.

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We will advise you when we have reached final resolution of this problem.

If you have any questions, please advise us.

Very truly yours,

J. T. Rodgers
Asst. Vice President

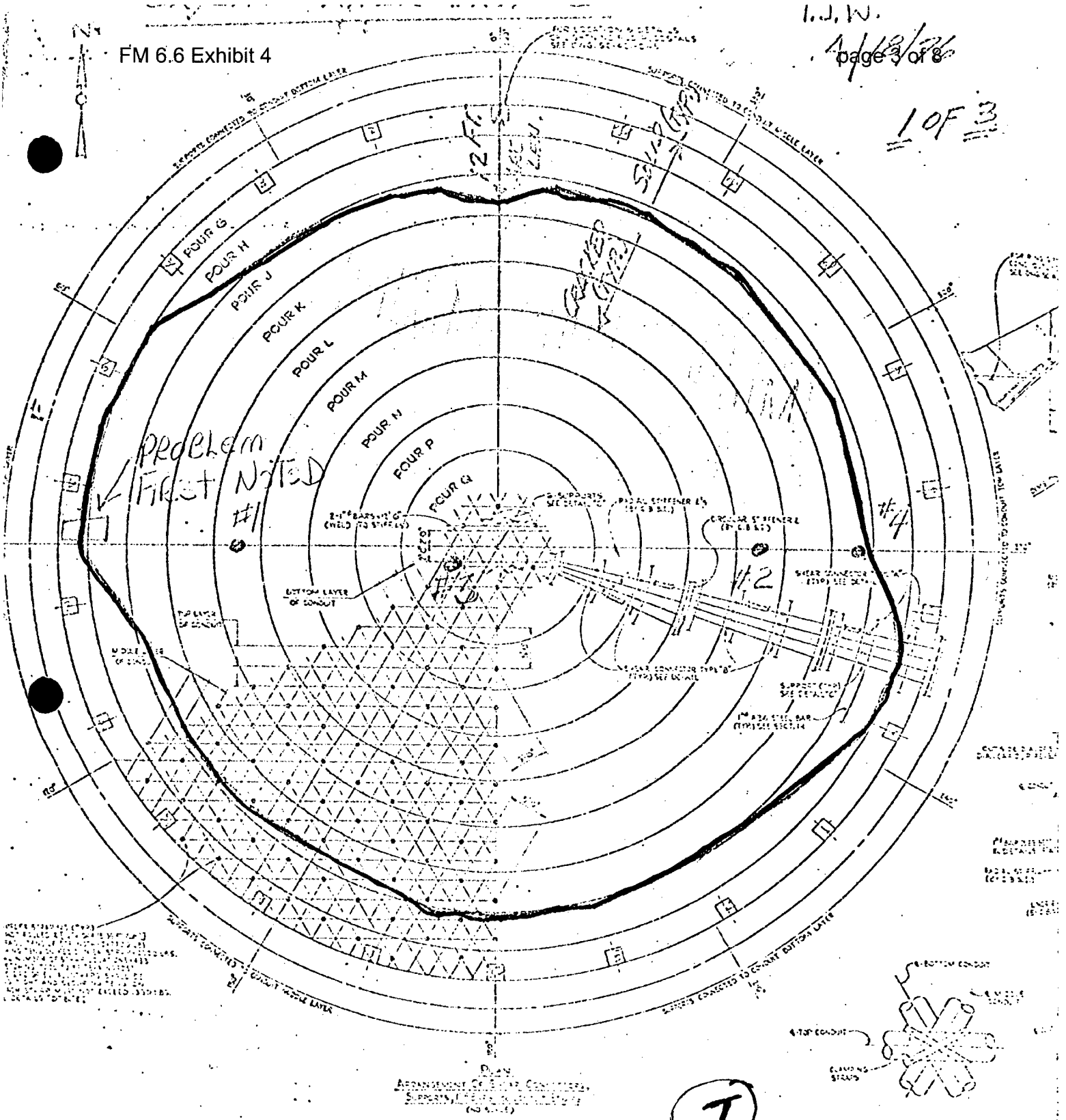
JTR/iw
Attachments.

cc: Mr. Norman C. Moseley
Director, Region II

MICROFILMED

I.J.W.
4/18/86

1 OF 3



I

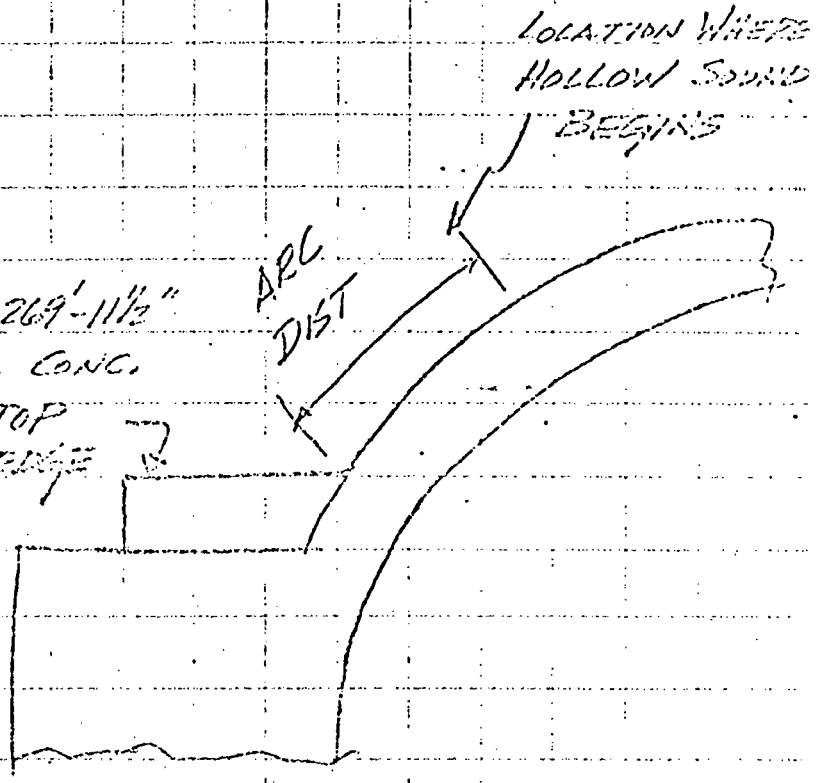
PLAN VIEW

LINE BETWEEN SOUND & CRACKED PORTION OF REACTOR BLDG. DOME

BASED ON SOUNDING WITH TEST HAMMER

501

AZIMUTH R.B.	ARC DIST. FROM TOP OF LEDGE TO WHERE HOLLOW SOUND BEGINS (FT.)
0°	12 FT.
8°-8'	10
16°-18'	9.5
24°-29'	9.0
32°-40'	8.5
40°-51'	8.5
49°-02'	7.5
57°-13'	4
65°-24'	4
73°-35'	3
81°-46'	3.5
90°-0'	3.5
98°-08'	7.5
106°-19'	9.5
114°-30'	10
122°-41'	9.5
130°-52'	10
139°-03'	10
147°-14'	10
155°-25'	10
163°-36'	9.5
171°-47'	8
180°-0'	8
	8



II

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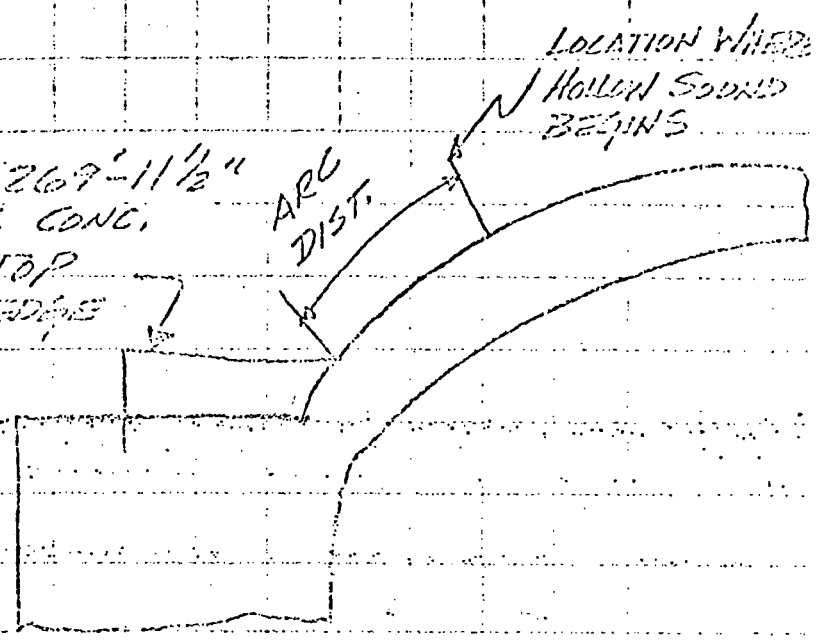
509

AZIMUTH R.B.	ARC, DIST FROM TOP OF LEDGE TO LOCATION WHERE HOLLOW SOUND BEGINS (FT.)
196°-22'	8 FT.
204°-38'	8
212°-44'	8
220°-45'	8
229°-06'	7
237°-17'	5.5
245°-28'	4
253°-39'	3.5
261°-50'	6
270°-0'	9
278°-12'	9.5
286°-23'	10
294°-34'	9.5
302°-45'	10.5
310°-56'	10.5
319°-07'	10
327°-18'	10
335°-29'	9.5
343°-40'	10
351°-48'	9.5



SECTION THRU DOME

III

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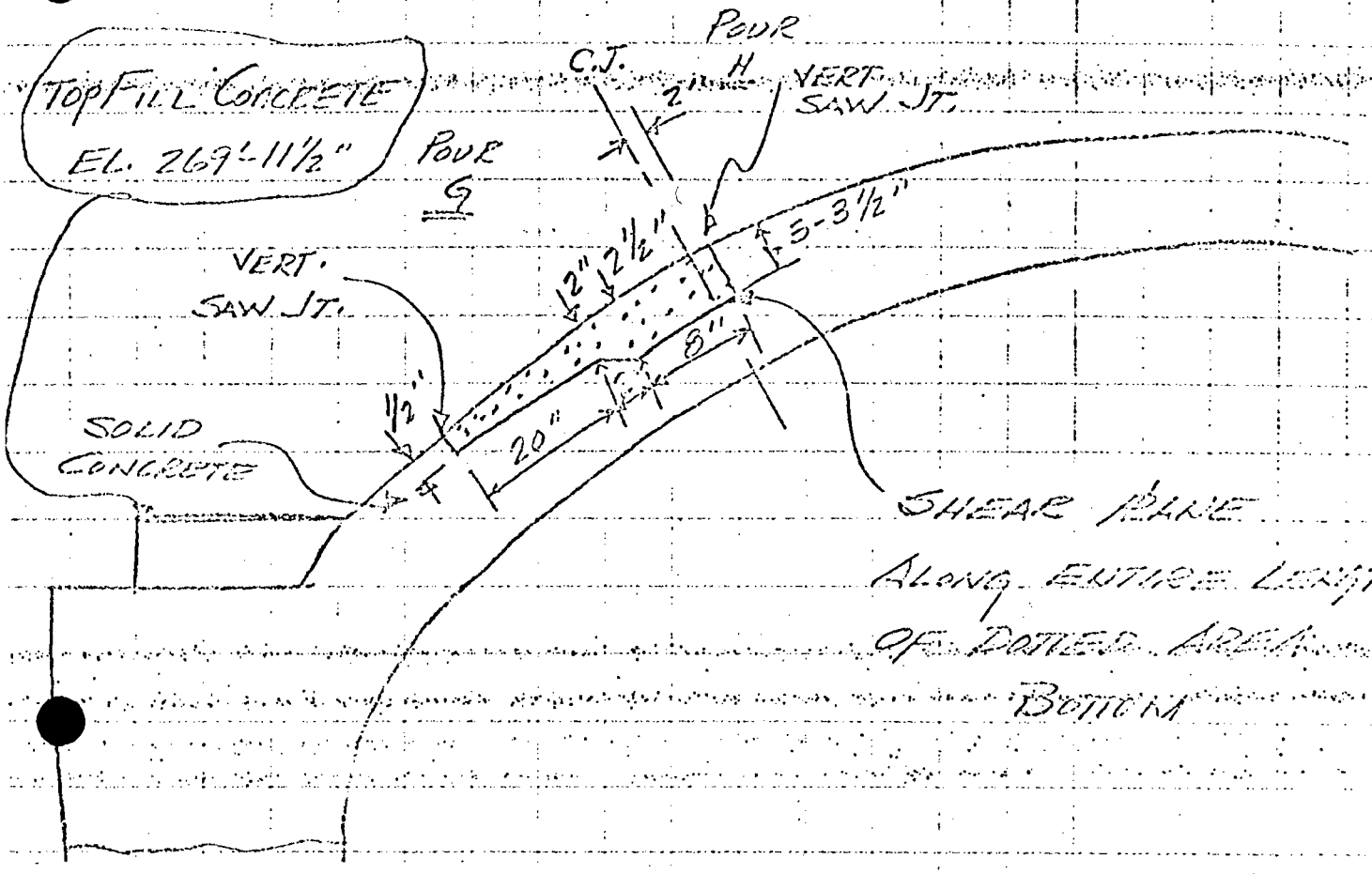
APRIL 17, 1986
TJW.



SECTION THRU DOME

DOTTED AREA REPRESENT CONCRETE REMOVED BY SAWING AROUND THE PLAN PERIMETER OF THE SECTION.
REFER TO ENCLOSED PHOTOGRAPHS.

IV

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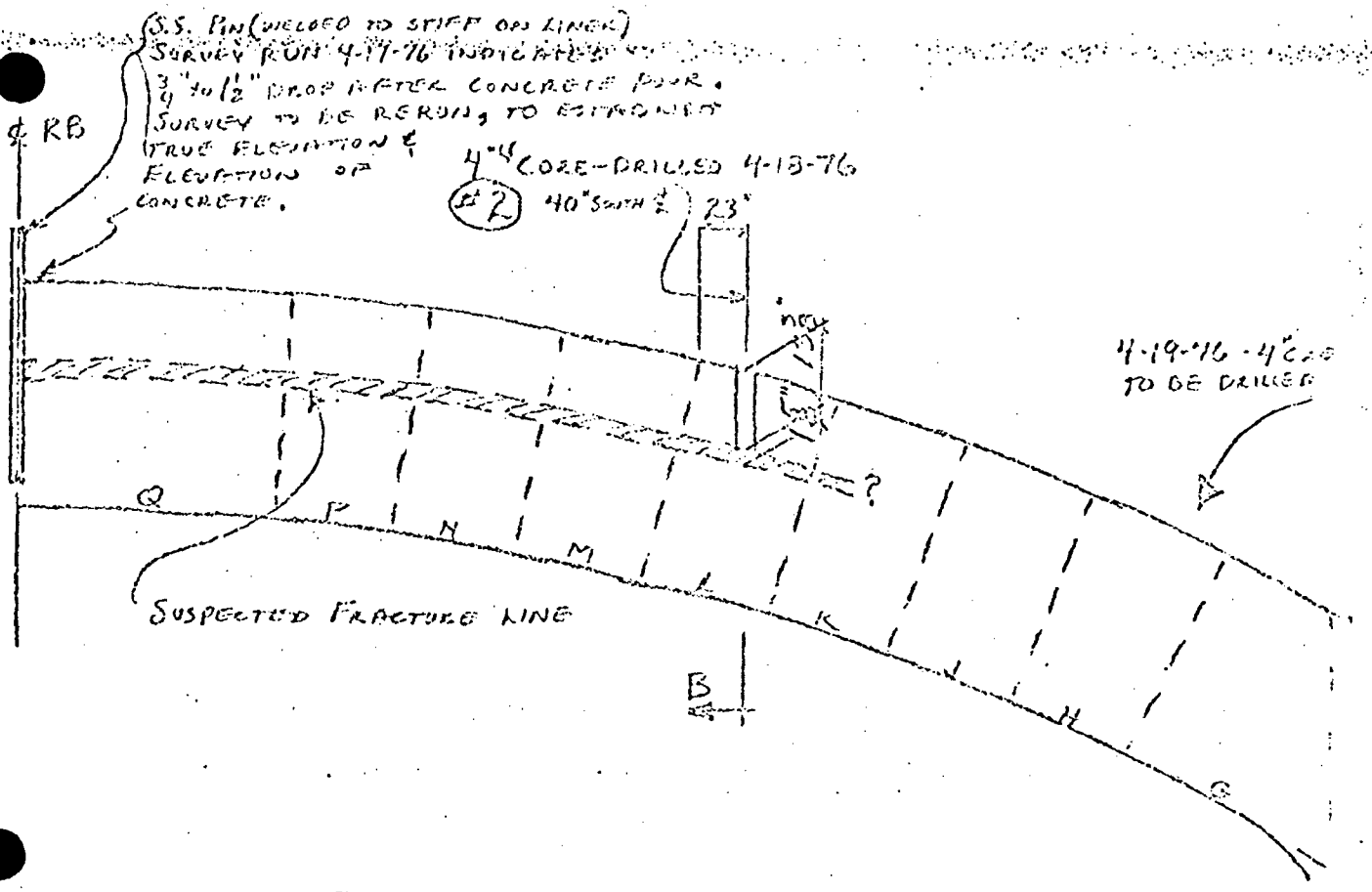
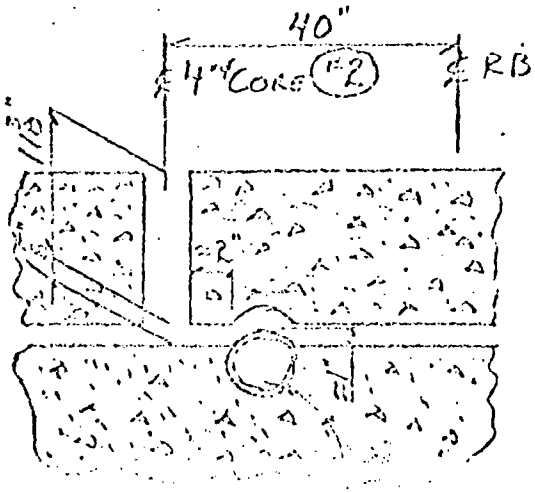


DOME SECTION - EAST HALF ON AZ 90°-270°

NOT TO SCALE



SECTION B

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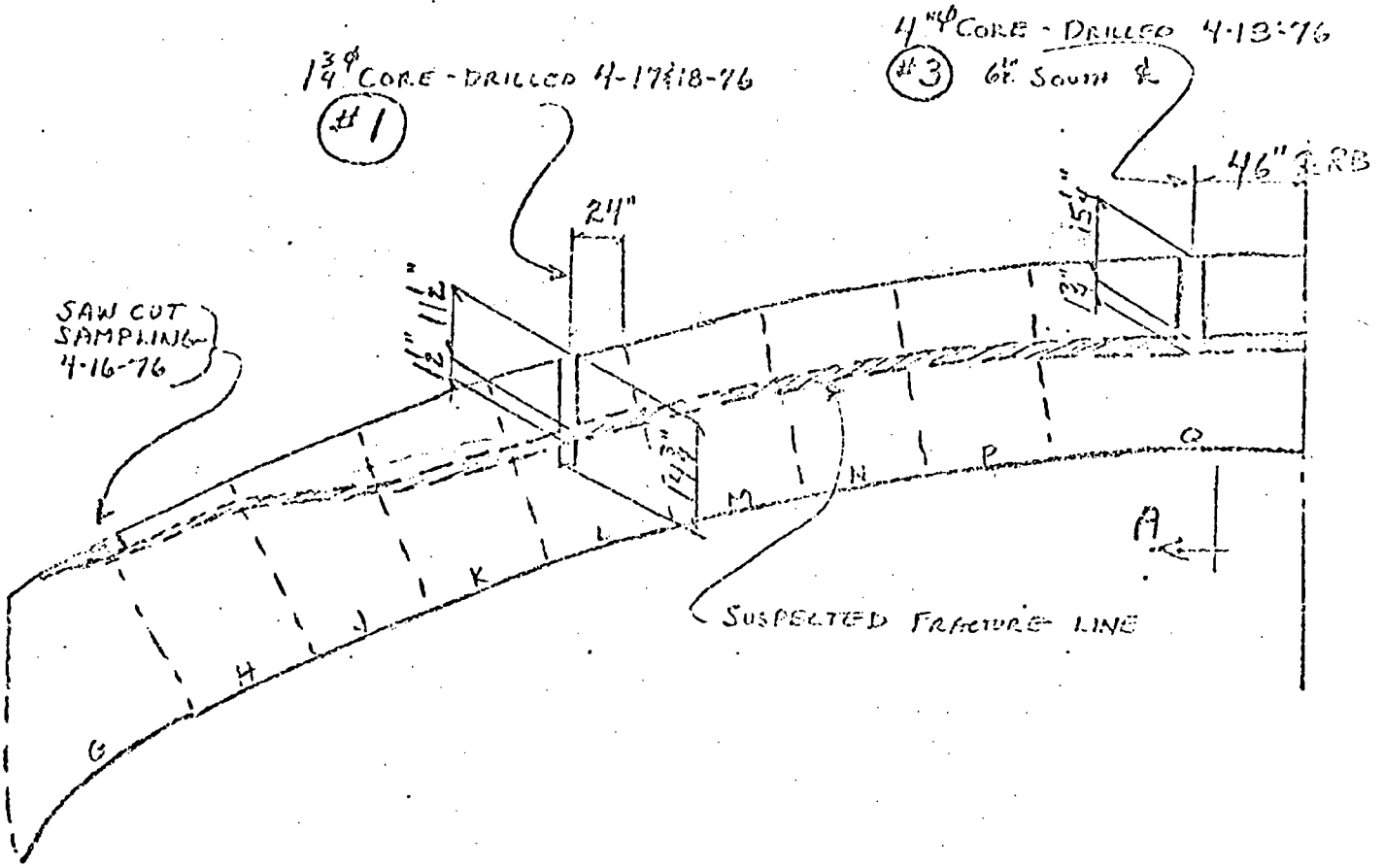
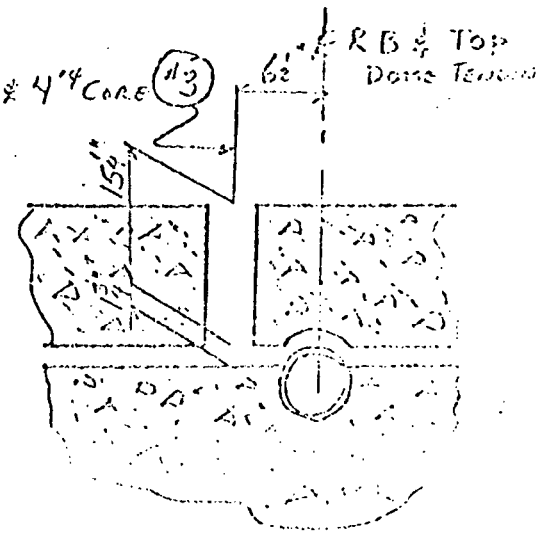
V



DOME SECTION - WEST HALF ON AZ 90°-270°

NOT TO SCALE



SECTION A

NOTE:
CORE #1 & #2 WERE DRILLED AT SAME LOCATION AS TEST CORES TAKEN IN 1974 AT TIME OF POUR.

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VI

DO NOT CIRCULATE

Appl Folder

FLORIDA POWER AND LIGHT COMPANY

TURKEY POINT UNIT 3

DOCKET NO. 50-250

CONTAINMENT DOME REPORT

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1.0 INTRODUCTION

This report describes the Turkey Point Unit 3 containment dome, delamination of the dome concrete during post tensioning of tendons, the subsequent investigation and analysis of this phenomena, and the repair and test program. When about two thirds of the dome tendons had been tensioned, it was noted that concrete cracking and sheathing filler leakage was developing and that in some areas of the dome, the concrete felt springy when walked on. The dome was struck with a sledge hammer and, in some areas, it sounded as if it were hollow. The concrete was locally removed in some of these areas and shallow (approximately 1/2" to 4") delamination planes were found running almost parallel with the surface, but eventually intersecting it. A full investigation was begun to determine both the extent and cause of the delaminations, and to cover the following:

1. Construction Procedures
2. Core Sampling
3. Concrete Removal
4. Materials Properties
5. Analysis of Loads During Construction

As a result of the investigation, it has been determined that insufficient contact area in the southern portion of the meridional construction joint and around the ventilation blockouts, together with unbalanced post-tensioning loads, were the major causes of the delaminations. After the post-tensioning was complete, there was no evidence that the dome was not capable of indefinitely resisting the applied loads. From detensioning there was no detectable loss in the tendon forces due to the delaminations.

Concrete replacement procedures have been prepared and will include modifications to the original placement procedures shown to be desirable during the analysis of the delamination causes.

The completed dome will meet performance requirements and the adequacy will be demonstrated during structural tests.

The firm of T. Y. Lin, Kulka, Yang and Associate, the consultant in the design of the containment, has participated in the investigation program and the concrete replacement method selection.

ATTACHMENT C

ORIGINAL TENDON STRESSING SEQUENCES

NOTE

The original tendon stressing sequences as determined at the time of original tendon installation are still utilized in various calculations and procedures for the tendon surveillance program. Reference 11 contains tendon stressing sequences and related information which was used as a basis for this calculation effort. As part of this calculation, this original stressing information was tabulated in an Excel spreadsheet to allow for faster sort/select capabilities and easier determination of the stressing sequence for an individual tendon. Information from the Reference 11 Calculation, as related to stressing sequences, was tabulated and included within this Attachment. The data was input by the sequence number and then verified with the source input. In addition to the basic sort by sequence number to match the input data, a second sort was generated from the same data to represent the sort by tendon number.

Note that during the input and tabulation of the stressing sequences for this calculation, some minor errors were discovered in the base data. These items are noted and explained in the attached information, along with any assumptions made in the use of the data.

Also note that the original stressing sequences as tabulated and presented herein, as well as the Original Stressing Liftoff data in Enclosure 9 of SP-182, Revision 11, have not been updated to reflect those tendons detensioned and retensioned since the original tensioning effort. (The original stressing liftoff values have been routinely presented within Surveillance Procedure, SP-182, Enclosure 9.) As more and more tendons become retensioned in the future, there will be a resulting effect on elastic shortening, normalization factors, as well as related calculations which may need to be considered in future efforts.

Florida Power Corporation - Crystal River Unit No. 3
Reactor Building Prestressing System
Dome Tendons

DOC ID:S-95-0082
ATTACHMENT C
PAGE C2

Stress Sequence Sorted by Sequence Number

Sequence No.	Tendon No.	Tendon No.	Tendon No.	Tendon No.	Tendon No.	Tendon No.	Tendon No.
1	D130	D211	D331				
2	D128	D215	D327				
3	D123	D219	D323				
4	D115	D223	D319				
5	D111	D227	D315				
6	D119	D231	D311				
7	D107	D235	D307				
8	D303						
9	D207	D335					
10	D135						
11	D139	D203	D341				
12	D141	D204	D338				
13	D210	D333					
14	D133	D213	D329				
15	D129	D217	D325				
16	D125	D321					
17	D121	D225	D317				
18	D117	D229	D313				
19	D113	D233	D309				
20	D109	D238	D305				
21	D105	D301					
22	D104	D240	D302				
23	D101	D236	D306				
24	D106	D232	D310				
25	D110	D314					
26	D118	D122	D228	D318	D322	D326	
27	D126	D132	D134	D212	D216	D220	D224
27	D330						
28	D138	D140	D205	D208	D222	D226	D334
28	D336	D337	D340				
29	D116	D120	D124	D127	D131	D136	D209
29	D230	D234	D237	D328	D332		
30	D202	D206	D214	D218	D304	D308	D312
30	D316	D320	D324				
31	D108	D112					
32	D102	D103	D114	D137	D201	D221	D239
32	D241	D339					

Note:
Data extracted from Reference 11 calculation information attached.

FILE:DOME.XLW (STRESSEQ)
15-Mar-96 12:08 PM

Florida Power Corporation - Crystal River Unit No. 3
Reactor Building Prestressing System
Dome Tendons

DOC ID:S-95-0082
ATTACHMENT C
PAGE C3

Stress Sequence Sorted by Tendon Number

Tendon No.	Sequence No.	Tendon No.	Sequence No.	Tendon No.	Sequence No.
D101	23	D201	32	D301	21
D102	32	D202	30	D302	22
D103	32	D203	11	D303	8
D104	22	D204	12	D304	30
D105	21	D205	28	D305	20
D106	24	D206	30	D306	23
D107	7	D207	9	D307	7
D108	31	D208	28	D308	30
D109	20	D209	29	D309	19
D110	25	D210	13	D310	24
D111	5	D211	1	D311	6
D112	31	D212	27	D312	30
D113	19	D213	14	D313	18
D114	32	D214	30	D314	25
D115	4	D215	2	D315	5
D116	29	D216	27	D316	30
D117	18	D217	15	D317	17
D118	26	D218	30	D318	26
D119	6	D219	3	D319	4
D120	29	D220	27	D320	30
D121	17	D221	32	D321	16
D122	26	D222	26	D322	26
D123	3	D223	4	D323	3
D124	29	D224	27	D324	30
D125	16	D225	17	D325	15
D126	27	D226	26	D326	26
D127	29	D227	5	D327	2
D128	2	D228	26	D328	29
D129	15	D229	18	D329	14
D130	1	D230	29	D330	27
D131	29	D231	6	D331	1
D132	27	D232	24	D332	29
D133	14	D233	19	D333	13
D134	27	D234	29	D334	28
D135	10	D235	7	D335	9
D136	29	D236	23	D336	26
D137	32	D237	29	D337	26
D138	28	D238	20	D338	12
D139	11	D239	32	D339	32
D140	28	D240	22	D340	28
D141	12	D241	32	D341	11

FILE:DOME.XLW (STRESSEQ)
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Florida Power Corporation - Crystal River Unit No. 3
Reactor Building Prestressing System
Hoop Tendons

DOC ID:S-95-0082
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Stress Sequence Sorted by Sequence Number

Sequence No.	Tendon No.	Tendon No.	Tendon No.	Tendon No.	Tendon No.	Tendon No.	Tendon No.
1	51H05						
2	13H47	51H47					
3	35H45	35H47					
4	13H41	13H43	35H43	51H45			
5	35H41	51H43					
6	13H37	13H39	35H39	51H39	51H41		
7	13H35	35H37	51H35	51H37			
8	13H33	35H35	51H31	51H33			
9	13H29	13H31	35H31	35H33	51H27	51H29	
10	13H27						
11	13H25	35H25	35H27	35H29			
12	13H23	35H23	51H25				
13	13H21	35H19	35H21	51H21	51H23		
14	35H17	51H17	51H19				
15	13H17	13H19	35H15	51H15			
16	13H13	35H13	51H11	51H13			
17	13H09	13H11	35H11	51H09			
18	51H07						
19	13H05	13H07	35H05	35H07	35H09	51H03	
20	13H01	13H03	35H01	35H03	51H01		
21	42H01	46H01	46H03	62H01			
22	42H03	42H05	46H05	62H03			
23	42H07	46H07	46H09	62H05	62H07	62H09	
24	42H09	42H11	46H11	46H13	62H11	62H13	
25	42H13	46H15	62H15	62H17			
26	42H15	46H17	62H19				
27	42H17	42H19	46H19	62H21			
28	46H21	46H23	62H23				
29	42H21	42H23	46H25	62H25			
30	42H25	42H27	62H27	62H29			
31	42H29	46H27	46H29	46H30	62H31		
32	42H31	46H31	46H33	62H33			
33	42H33	42H35	46H35	62H35			
34	42H37	46H37	62H37				
35	42H39	46H39	46H41	62H39	62H41		
36	42H41	42H43	46H43	46H45	62H43		
37	42H45	46H47	62H45				
38	42H47	46H40	46H42	46H44	46H46	62H44	62H46
38	62H47						
39	42H40	42H42	42H44	42H46	46H38	62H38	62H40
39	62H42						
40	42H36	42H38	46H32	46H34	46H36	62H36	

FILE:HOOP.XLW (STRESSEQ)
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Florida Power Corporation - Crystal River Unit No. 3
Reactor Building Prestressing System
Hoop Tendons

DOC ID:S-95-0082
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Stress Sequence Sorted by Sequence Number

Sequence No.	Tendon No.	Tendon No.	Tendon No.	Tendon No.	Tendon No.	Tendon No.	Tendon No.
41	42H30	42H32	42H34	46H26	46H28	62H28	62H30
41	62H32	62H34					
42	42H20	42H22	42H24	42H26	42H28	46H24	62H22
42	62H24	62H26					
43	42H16	42H18	46H22	62H18	62H20		
44	42H10	42H12	42H14	46H18	46H20	62H12	62H14
44	62H16						
45	42H04	42H08	46H12	46H14	46H16	62H04	62H06
45	62H08	62H10					
46	42H02	46H06	46H08	46H10	62H02		
47	13H44	13H45	13H46	46H02	46H04		
48	13H38	13H40	13H42	51H44	51H46		
49	13H32	13H34	13H36	35H42	35H44	35H46	51H38
49	51H40	51H42					
50	35H40	51H32	51H34	51H36			
51	13H24	13H26	13H28	13H30	35H36	35H38	
52	13H22	51H28	51H30				
53	13H16	13H18	13H20	51H26			
54	13H10	13H12	13H14	35H30	35H32	35H34	
55	13H02	13H04	13H06	13H08	35H24	35H26	35H28
56	35H18	35H20	35H22	51H20	51H22	51H24	
57	35H12	35H14	35H16	51H16	51H18		
58	35H06	35H08	35H10	51H10	51H12	51H14	
59	35H02	35H04	51H04	51H06	51H08		
60	13H15	42H06	51H02				

Note:
Data extracted from Reference 11 calculation information attached.

FILE:HOOP.XLW (STRESSEQ)
15-Mar-96 12:16 PM

Florida Power Corporation - Crystal River Unit No. 3
Reactor Building Prestressing System
Hoop Tendons

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Stress Sequence Sorted by Tendon Number

Tendon No.	Sequence No.	Tendon No.	Sequence No.	Tendon No.	Sequence No.
13H01	20	35H01	20	42H01	21
13H02	55	35H02	59	42H02	46
13H03	20	35H03	20	42H03	22
13H04	55	35H04	59	42H04	45
13H05	19	35H05	19	42H05	22
13H06	55	35H06	58	42H06	60
13H07	19	35H07	19	42H07	23
13H08	55	35H08	58	42H08	45
13H09	17	35H09	19	42H09	24
13H10	54	35H10	58	42H10	44
13H11	17	35H11	17	42H11	24
13H12	54	35H12	57	42H12	44
13H13	16	35H13	16	42H13	25
13H14	54	35H14	57	42H14	44
13H15	60	35H15	15	42H15	26
13H16	53	35H16	57	42H16	43
13H17	15	35H17	14	42H17	27
13H18	53	35H18	56	42H18	43
13H19	15	35H19	13	42H19	27
13H20	53	35H20	56	42H20	42
13H21	13	35H21	13	42H21	29
13H22	52	35H22	56	42H22	42
13H23	12	35H23	12	42H23	29
13H24	51	35H24	55	42H24	42
13H25	11	35H25	11	42H25	30
13H26	51	35H26	55	42H26	42
13H27	10	35H27	11	42H27	30
13H28	51	35H28	55	42H28	42
13H29	9	35H29	11	42H29	31
13H30	51	35H30	54	42H30	41
13H31	9	35H31	9	42H31	32
13H32	49	35H32	54	42H32	41
13H33	8	35H33	9	42H33	33
13H34	49	35H34	54	42H34	41
13H35	7	35H35	8	42H35	33
13H36	49	35H36	51	42H36	40
13H37	6	35H37	7	42H37	34
13H38	48	35H38	51	42H38	40
13H39	6	35H39	6	42H39	35
13H40	48	35H40	50	42H40	39
13H41	4	35H41	5	42H41	36
13H42	48	35H42	49	42H42	39
13H43	4	35H43	4	42H43	36
13H44	47	35H44	49	42H44	39
13H45	47	35H45	3	42H45	37
13H46	47	35H46	49	42H46	39
13H47	2	35H47	3	42H47	38

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Florida Power Corporation - Crystal River Unit No. 3
Reactor Building Prestressing System
Hoop Tendons

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Stress Sequence Sorted by Tendon Number

Tendon No.	Sequence No.	Tendon No.	Sequence No.	Tendon No.	Sequence No.
46H01	21	51H01	20	62H01	21
46H02	47	51H02	60	62H02	46
46H03	21	51H03	19	62H03	22
46H04	47	51H04	59	62H04	45
46H05	22	51H05	1	62H05	23
46H06	46	51H06	59	62H06	45
46H07	23	51H07	18	62H07	23
46H08	46	51H08	59	62H08	45
46H09	23	51H09	17	62H09	23
46H10	46	51H10	58	62H10	45
46H11	24	51H11	16	62H11	24
46H12	45	51H12	58	62H12	44
46H13	24	51H13	16	62H13	24
46H14	45	51H14	58	62H14	44
46H15	25	51H15	15	62H15	25
46H16	45	51H16	57	62H16	44
46H17	26	51H17	14	62H17	25
46H18	44	51H18	57	62H18	43
46H19	27	51H19	14	62H19	26
46H20	44	51H20	56	62H20	43
46H21	28	51H21	13	62H21	27
46H22	43	51H22	56	62H22	42
46H23	28	51H23	13	62H23	28
46H24	42	51H24	56	62H24	42
46H25	29	51H25	12	62H25	29
46H26	41	51H26	53	62H26	42
46H27	31	51H27	9	62H27	30
46H28	41	51H28	52	62H28	41
46H29	31	51H29	9	62H29	30
46H30	31	51H30	52	62H30	41
46H31	32	51H31	8	62H31	31
46H32	40	51H32	50	62H32	41
46H33	32	51H33	8	62H33	32
46H34	40	51H34	50	62H34	41
46H35	33	51H35	7	62H35	33
46H36	40	51H36	50	62H36	40
46H37	34	51H37	7	62H37	34
46H38	39	51H38	49	62H38	39
46H39	35	51H39	6	62H39	35
46H40	38	51H40	49	62H40	39
46H41	35	51H41	6	62H41	35
46H42	38	51H42	49	62H42	39
46H43	36	51H43	5	62H43	36
46H44	38	51H44	48	62H44	38
46H45	36	51H45	4	62H45	37
46H46	38	51H46	48	62H46	38
46H47	37	51H47	2	62H47	38

FILE:HOOP.XLW (STRESSEQ)
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Florida Power Corporation - Crystal River Unit No. 3
Reactor Building Prestressing System
Vertical Tendons

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Stress Sequence Sorted by Sequence Number

Sequence No.	Tendon No.	Tendon No.	Tendon No.	Tendon No.	Tendon No.	Tendon No.	Tendon No.
1	12V13	23V01	45V11	56V01			
2	12V19	23V05	45V17	56V05			
3	12V21	23V09	56V09				
4	23V13	34V01	56V13	61V01			
5	23V17	34V05	56V21	61V09			
6	23V21	61V05					
7	12V01	34V15	45V01	61V13			
8	12V05	34V18	45V05	61V17			
9	12V07	34V21	45V09	61V21			
10	12V15	23V03	45V15	56V03			
11	12V17	23V07	45V19	56V07			
12	12V23	23V11	45V23	56V11			
13	23V15	34V03	56V15	61V03			
14	23V19	34V07	56V19	61V07			
15	56V23	61V11					
16	12V03	34V13	45V03	61V15			
17	12V09	34V19	45V08	61V19			
18	34V23	45V10	61V23				
19	23V02	23V04	45V06	45V12			
20	12V14	23V06	23V08	45V02	45V14	45V16	45V18
21	12V18	12V22	12V24	34V02	45V20	45V22	
22	45V13	45V24	61V02	61V04			
23	12V16	23V10	23V12	23V16	34V04	34V10	56V22
23	56V24						
24	23V14	23V18	23V20	23V22	23V23	23V24	56V14
24	56V16	56V18	56V20				
25	12V06	34V12	34V22	34V24	61V06	61V08	
26	34V06	34V17	34V20	61V10	61V12	61V14	61V16
26	61V18	61V22	61V24				
27	12V02	12V04	56V02	56V04	56V06	56V08	56V12
28	12V08	12V10	12V11	12V12	34V14	34V16	56V10
29	56V17	61V20					
30	34V08	34V09	45V04	45V07	45V21		
31	12V20	34V11					

Note:
Data extracted from Reference 11 calculation information attached.

FILE:VERT.XLW (STRESSEQ)
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Florida Power Corporation - Crystal River Unit No. 3
Reactor Building Prestressing System
Vertical Tendons

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ATTACHMENT C
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Stress Sequence Sorted by Tendon Number

Tendon No.	Sequence No.	Tendon No.	Sequence No.	Tendon No.	Sequence No.
12V01	7	34V01	4	56V01	1
12V02	27	34V02	21	56V02	27
12V03	16	34V03	13	56V03	10
12V04	27	34V04	23	56V04	27
12V05	8	34V05	5	56V05	2
12V06	25	34V06	26	56V06	27
12V07	9	34V07	14	56V07	11
12V08	28	34V08	30	56V08	27
12V09	17	34V09	30	56V09	3
12V10	28	34V10	23	56V10	28
12V11	28	34V11	31	56V11	12
12V12	28	34V12	25	56V12	27
12V13	1	34V13	16	56V13	4
12V14	20	34V14	28	56V14	24
12V15	10	34V15	7	56V15	13
12V16	23	34V16	28	56V16	24
12V17	11	34V17	26	56V17	29
12V18	21	34V18	8	56V18	24
12V19	2	34V19	17	56V19	14
12V20	31	34V20	26	56V20	24
12V21	3	34V21	9	56V21	5
12V22	21	34V22	25	56V22	23
12V23	12	34V23	18	56V23	15
12V24	21	34V24	25	56V24	23
23V01	1	45V01	7	61V01	4
23V02	19	45V02	20	61V02	22
23V03	10	45V03	16	61V03	13
23V04	19	45V04	30	61V04	22
23V05	2	45V05	8	61V05	6
23V06	20	45V06	19	61V06	25
23V07	11	45V07	30	61V07	14
23V08	20	45V08	17	61V08	25
23V09	3	45V09	9	61V09	5
23V10	23	45V10	18	61V10	26
23V11	12	45V11	1	61V11	15
23V12	23	45V12	19	61V12	26
23V13	4	45V13	22	61V13	7
23V14	24	45V14	20	61V14	26
23V15	13	45V15	10	61V15	16
23V16	23	45V16	20	61V16	26
23V17	5	45V17	2	61V17	8
23V18	24	45V18	20	61V18	26
23V19	14	45V19	11	61V19	17
23V20	24	45V20	21	61V20	29
23V21	6	45V21	30	61V21	9
23V22	24	45V22	21	61V22	26
23V23	24	45V23	12	61V23	18
23V24	24	45V24	22	61V24	26

FILE:VERT.XLW (STRESSEQ)
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Pages Taken from Reference 11 Calculation

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N = 32 sequences

Stressing Sequence CR#3 Dome Tendons

n=		n=		
1.	D331, D211, D130	25.	D314,	D110, [redacted]
2.	D327, D215, D128	26.	D318, D228	D118
3.	D323, D219, D123		D322	D122
4.	D319, D223, D115		D326	
5.	D315, D227, D111	27.	D330	D212 D126
6.	D311, D231, D119			D216 D134
7.	D307, D235, D107			D224 D132
8.	D303, [redacted], [redacted]			D220
9.	D335, D207, [redacted]	28.	D334	D205 D138
10.	[redacted], [redacted], D135		D336	D208 D140
11.	D341, D203, D139		D337	D222
12.	D338, D204, D141		D340	D226
13.	D333, D210, [redacted]	29.	D328	D209 D116
14.	D329, D213, D133		D332	D230 D120
15.	D325, D217, D129			D234 D124
16.	D321, [redacted], D125			D237 D127
17.	D317, D225, D121			D131
18.	D313, D229, D117			D136
19.	D309, D233, D113	30.	D304	D202
20.	D305, D238, D109		D308	D206
21.	D301, [redacted], D105		D312	D214
22.	D302, D240, D104		D316	D218
23.	D306, D236, D101		D320	
24.	D310, D232, D106		D324	
count shaded tendons as sequence 32.		31.		D108
[redacted] = Tendons detensioned and retensioned after sequence 31.				D112

TABLE 3-7

ACTUAL TENDON STRESSING LOG

Date	DOME Tendons
10-25-74	D331
10-30-74	D211
10-31-74	D130
11-4-74	D215
11-5-74	D128
11-7-74	D327, D219
11-8-74	D323, D123, D319
11-11-74	D223, D115, D227, D315, D111, D311, D119
11-12-74	D231, D107, D235, D307, D239*
11-13-74	D103*, D102*
11-14-74	D207, D303, D135, D201*, D335
11-15-74	D139, D339*, D341, D203, D141
11-18-74	D204, D338, D137*, D133, D210, D333, D213
11-19-74	D329, D129, D125, D325, D217, D121
11-20-74	D221*, D225, D321
11-21-74	D117, D317, D113, D313, D229, D109
11-22-74	D233, D309, D105
11-25-74	D238, D241*, D305, D301
11-26-74	D302, D104, D101, D240, D236, D232
11-27-74	D306, D310, D314, D106, D110, D114*
12-2-74	D118, D122, D318, D228, D322, D326
12-3-74	D224, D330, D216, D220, D132, D212, D126, D134
12-4-74	D138, D208, D334, D336, D337, D340, D140, D205, D222, D226
12-5-74	D230, D332, D234, D328, D237, D136, D131, D127, D209, D124, D120, D116
12-6-74	D206, D320, D324, D316, D312, D308, D304, D202, D214, D218
12-9-74	D112, D108, D201, D103
12-10-74	D137
12-11-74	D114, D102
12-12-74	D221
3-31-75	D339
4-2-75	D239, D241

*Denotes tendons which were detensioned and retensioned at a later date to satisfy Nonconformance Reports.

123 TOTAL

10-9-74	23V14, 23V18, 23V20, 23V22, 23V23, 23V24, 56V14, 56V16, 56V18, 56V20
10-10-74	12V6, 34V12, 34V22, 34V24, 61V6, 61V8,
10-11-74	34V6, 34V17, 34V20, 61V10, 61V12, 61V14, 61V16, 61V18, 61V22, 61V24
10-14-74	12V2, 12V4, 56V2, 56V4, 56V6, 56V8, 56V12
10-15-74	12V8, 12V10, 12V11, 12V12, 34V14, 34V16, 56V10
10-16-74	61V20
10-18-74	56V17
10-31-74	45V4, 45V7
11-11-74	45V21
1-25-75	34V8, 34V9
1-27-75	34V11
1-28-75	12V20

144 TOTAL

Quadrant No. 2 — 12V14, 12V16, 12V18, 12V20, 12V22, 12V24, 61V2, 61V4, 61V6, 61V8, 61V10, 61V12, 61V14, 61V16, 61V18, 61V20, 61V22, 61V24

Quadrant No. 3 — 56V2, 56V4, 56V6, 56V8, 56V10, 56V12, 56V14, 56V16, 56V18, 56V20, 56V22, 56V24, 45V2, 45V4, 45V6, 45V8, 45V10, 45V12.

Quadrant No. 4 — 45V14, 45V16, 45V18, 45V20, 45V22, 45V24, 34V2, 34V4, 34V6, 34V8, 34V10, 34V12, 34V14, 34V16, 34V18, 34V20, 34V22, 34V24.

CONTINGENCY PLAN

Sequence 1 through 18: If we are unable to complete the stressing of a tendon in a given sequence, a tendon one or two spaces away will be stressed in its stead. This will complete the sequence. A tendon will be considered stressed when lift off is achieved within the specified pressure limits.

If we are unable to place the minimum 4" shim, the stressing will be performed in accordance with the procedure noted on drawing PV-1A for all tendons in that catagory

B. Dome Tendons

Each dome tendon shall be stressed from both ends simultaneously using two (2) sets of stressing equipment. The tendons may be stressed singly, in pairs of three at a time. The dome tendons shall be stressed in the following sequence from sequence No. 1 through Sequence No. 41. All the tendons in one sequence must be stressed before the next sequence is stressed. A tendon will be considered stressed when lift off is achieved within the specified pressure limits.

Sequence No.			
1.	~~D131~~ D130	D211	D331
2.	~~D127~~ D128	D215	D327
3.	D123	D219	D323
4.	~~D119~~ D115	D223	D319
5.	~~D115~~ D111	D227	D315
6.	~~D111~~ D119	D231	D311
7.	D107	D235	D307
8.	D103	D239	D303
9.	~~D135~~ D102	D207	D335

10.	~~D139~~ D135	~~D203~~ D201	D339
11.	~~D141~~ D139	~~D201~~ D203	D341
12.	~~D137~~ D141	~~D205~~ D204	~~D337~~ D338
13.	~~D133~~ D137	~~D209~~ D210	D333
14.	~~D135~~ D133	D213	D329
15.	~~D131~~ D129	D217	D325
16.	~~D127~~ D125	D221	D321
17.	~~D123~~ D121	D225	D317
18.	~~D119~~ D117	D229	D313
19.	~~D115~~ D113	D233	D309
20.	~~D111~~ D109	~~D237~~ D238	D305
21.	~~D107~~ D105	D241	D301
22.	~~D102~~ D104	D240	D302
23.	~~D106~~ D101	D236	D306
24.	~~D110~~ D106	D232	D310
25.	D114	D228	D314
26.	D118	D224	D318
27.	D122	D220	D322
28.	D126	D216	D326
29.	D130	D212	D330
30.	D134	D208	D334
31.	D138	D204	D338
32.	D140	D222	D340
33.	D136	D226	D336
34.	D132	D230	D332
35.	D128	D234	D328
36.	D124	D238	D324
37.	D120	D202	D320
38.	D116	D206	D316
39.	D112	D210	D312
40.	D108	D214	D308
41.	D104	D218	D304

see page 27 for remaining sequences

Contingency Plan

Sequence No. 1 through No. 21: If we are unable to complete stressing of a tendon in a given sequence, the closest practical adjacent tendon, no more than two tendons away, in the same series will be stressed in its stead to complete the sequence.

Sequence No. 22 through No. 31: If we are unable to complete the stressing of a tendon in a given sequence, the closest practical tendon in the same series will be stressed in its stead to complete the sequence. In the meantime, the remaining stressing may proceed up to two (2) sequences in advance of the incompletely stressed tendon.

Introduction:

The intent of this chapter is to outline the procedure to be followed in stressing the vertical, dome and horizontal tendons. The sequence in which the individual tendons are stressed is specified. Due to the many construction related problems the stressing crews may have to contend with, a degree of flexibility in proceeding with the stressing of a particular sequence is provided to minimize delays in the stressing operation.

6.2 Stressing Sequence:

A. Vertical Tendons

The verical tendons shall be stressed from the top end only, using four (4) sets of stressing equipment. The tendons will be stressed in the following sequence from Sequence No. 1 through Sequence No. 18. All the tendons in one sequence must be stresses before the next sequence is started to be stressed. After 50% of the vertical tendons are stressed, (following sequence No. 18) the remaining tendons in each quadrant may be stressed in a random sequence (1 Ram working in each quadrant).

ASSUMED IN ERROR SINCE CORRECTED HERE AND ADDED TO SEQUENCE
M.M. 3/12/96

Sequence No.

1.	23V1	12V13	56V1	45V~~13~~ 11
2.	23V5	12V~~17~~19	56V5	45V17
3.	23V9	12V21	56V9	~~45V21~~
4.	23V13	61V1	56V13	34V1
5.	23V17	61V~~8~~9	56V~~17~~21	34V5
6.	23V21	61V~~8~~5	56V21	34V9
7.	12V1	61V13	45V1	34V13
8.	12V5	61V17	45V5	34V17
9.	12V~~9~~7	61V21	45V9	34V21
10.	23V3	12V15	56V3	45V15
11.	23V7	12V~~19~~17	56V7	45V19
12.	23V11	12V23	56V11	45V23
13.	23V15	61V3	56V15	34V3
14.	23V19	61V7	56V19	34V7
15.	~~23V23~~	61V11	56V23	~~34V11~~
16.	12V3	61V15	45V3	34V~~15~~
17.	12V~~7~~9	61V19	45V7	34V19
18.	~~12V11~~	61V23	45V~~11~~	34V23

Quadrant No. 1. 23V2, 23V4, 23V6, 23V8, 23V10, 23V12, 23V14, 23V16, 23V18, 23V20, 23V22, 23V24, 12V2, 12V4, 12V6, 12V8, 12V10, 12V12

See pg 27C continued

CR#3
Page 28a

Cat Tendons stressing sequence

19. 23V2, 23V4, 45V6, 45V12

20. 12V14, 23V6, 23V8, 45V2, 45V14, 45V16, 45V18

21. 45V20, 45V22, 12V18, 12V22, 12V24, 34V2

22. 45V13, 45V24, 61V2, 61V4

add to Seq 24 23V22 found on pg 27b

23. 12V16, 23V10, 23V12, 23V16, 34V10, 56V22, 56V24, 34V4

24. 23V14, 23V18, 23V20, 23V23, 23V24, 56V14, 56V16, 56V18, 56V20

25. 12V6, 34V12, 34V22, 34V24, 61V6, 61V8

26. 34V6, 34V17, 34V20, 61V10, 61V12, 61V14, 61V16, 61V18, 61V22, 61V24

27. 12V2, 12V4, 56V2, 56V4, 56V6, 56V8, 56V12

28. 12V8, 12V10, 12V11, 12V12, 34V14, 34V16, 56V10

29. 61V20, 56V17, 45V4, 45V7 ?

Note error found 12/14/95.

30. 45V4, 45V7, 45V21, 34V8, 34V9

31. 34V11, 12V20

PUT 45V4 & 45V7 WITH SEQUENCE 30!

REASON - PER T. DeMOSS CALC, APPA DATA SHT 1, 45V4 IS QUADRANT Q3, SEQ 30. ALSO CLOSER TO 11/11/74, 45V21 IN SEQUENCE 30. 61V20 IS SEQ 29, 10/16/74 and 56V17 is Seq 29 10/18/7: on pg 27B

M. Marcellaz
3/12/96

ACTUAL TENDON STRESSING LOG

Vertical Tendons

Date	
8-30-74	56V1
9-3-74	12V13, 23V1
9-4-74	23V5, 45V11
9-9-74	12V19, 56V5
9-10-74	12V21, 23V9, 45V17, 56V9
9-11-74	23V13, 34V1, 56V13, 61V1
9-12-74	23V17, 23V21, 34V5, 56V21, 61V9
9-13-74	12V1, 45V1, 61V5, 61V13
9-16-74	12V5, 45V5, 61V17
9-18-74	34V15, 34V18
9-19-74	12V7, 12V15, 12V17, 23V3, 23V7, 34V21, 45V9, 45V15, 45V19, 56V3, 61V21
9-20-74	12V23, 23V11, 34V3, 45V23, 56V7, 56V11, 56V15, 61V3
9-23-74	23V15, 23V19, 34V7, 56V19, 61V7
9-25-74	56V23, 61V11
9-27-74	12V3
9-30-74	45V3, 61V15
10-1-74	12V9, 34V13, 34V19, 34V23, 45V8, 45V10, 61V19, 61V23
10-2-74	23V2, 23V4, 45V6, 45V12
10-3-74	12V14, 23V6, 23V8, 45V2, 45V14, 45V16, 45V18
10-4-74	45V20, 45V22
10-7-74	12V18, 12V22, 12V24, 34V2, 45V13, 45V24, 61V2, 61V4
10-8-74	12V16, 23V10, 23V12, 23V16, 34V10, 56V22, 56V24, 34V4

See pg 27b for next pg info.

Hoop Tendons

Date		
1-23-74	1	51H5
12-26-74	2	13H47, 51H47
12-27-74	3	~~34~~35H45, 35H47
12-31-74	4	13H41, 13H43, 35H43, 51H45
1-2-75	5	35H41, 51H43
1-3-75	6	13H37, 13H39, 35H39, 51H39, 51H41
1-6-75	7	13H35, 35H37, 51H35, 51H37
1-7-75	8	13H33, 35H35, 51H31, 51H33
1-8-75	9	13H29, 13H31, 35H31, 35H33, 51H27, 51H29
1-9-75	10	13H27
1-10-75	11	13H25, 35H25, 35H27, 35H29
1-14-75	12	13H23, 35H23, 51H25
1-15-75	13	~~12~~13H21, 51H21, 51H23, 35H21, 35H19
1-16-75	14	35H17, 51H17, 51H19
1-17-75	15	13H17, 13H19, 35H15, 51H15
1-20-75	16	13H13, 35H13, 51H11, 51H13
1-21-75	17	13H9, 13H11, 35H11, 51H9
1-22-75	18	51H7
1-23-75	19	13H5, 13H7, 35H5, 35H7, 35H9, 51H3
1-24-75	20	13H1, 13H3, 35H3, 35H1, 51H1
1-29-75	21	42H1, ~~36H1~~ 46H1, 46H3, 62H1
1-30-75	22	42H3, 42H5, 46H5, 62H3

NOTE
Corrected earlier
There is no 36H1 group
∴ 46H1 correct
M.M.
3/12/86

1-31-75	23	42H7, 46H7, 46H9, 62H5, 62H7, 62H9
2-3-75	24	42H9, 42H11, 46H11, 46H13, 62H11, 62H13
2-4-75	25	42H13, 46H15, 62H15, 62H17
2-5-75	26	42H15, 46H17, 62H19
2-6-75	27	42H17, 42H19, 46H19, 62H21
2-7-75	28	46H21, 46H23, 62H23
2-10-75	29	42H21, 42H23, 46H25, 62H25
2-11-75	30	42H25, 42H27, 62H27, 62H29.
2-12-75	31	42H29, 46H27, 46H29, 46H30, 62H31
2-13-75	32	42H31, 46H31, 46H33, 62H33
2-14-75	33	42H33, 42H35, 46H35, 62H35
2-17-75	34	42H37, 46H37, 62H37
2-18-75	35	42H39, 46H39, 46H41, 64H41 → 62H41
2-19-75	36	42H41, 42H43, 46H43, 46H45, 62H43
2-20-75	37	42H45, 46H47, 62H45
2-25-75	38	42H47, 46H40, 46H42, 46H44, 46H46, 62H46, 62H47, 62H44
2-26-75	39	42H40. 42H42, 42H44, 42H46, 46H38, 62H38, 62H40, 62H42
2-27-75	40	42H36, 42H38, 46H32, 46H34, 46H36, 62H36
2-28-75	41	42H30, 42H32, 42H34, 46H26, 46H28, 62H28, 62H30, 62H32, 62H34
3-3-75	42	42H20, 42H22, 42H24, 42H26, 42H28, 46H24, 62H22, 62H24, 62H26
3-4-75	43	42H16, 42H18, 46H22, 62H18, 62H20
3-5-75	44	42H10, 42H12, 42H14, 46H18, 46H20, 62H12, 62H14, 62H16
3-6-75	45	42H4, 42H8, 46H12, 46H14, 46H16, 62H4, 62H6, 62H8, 62H10,
3-7-75	46	42H2, 46H6, 46H8, 46H10, 62H2
3-10-75	47	13H44, 13H45, 13H46, 46H2, 46H4
3-11-75	48	13H38, 13H40, 13H42, 51H44, 51H46

3-12-75	49	13H32, 13H34, 13H36, 35H42, 35H44, 35H46, 51H38, 51H40, 51H42
3-13-75	50	35H40, 51H32, 51H34, 51H36
3-17-75	51	13H24, 13H26, 13H28, 13H30, 35H36, 35H38
3-18-75	52	13H22, 51H28, 51H30
3-19-75	53	13H16, 13H18, 13H20, 51H26
3-20-75	54	13H10, 13H12, 13H14, 35H30, 35H32, 35H34
3-21-75	55	13H2, 13H4, 13H6, 13H8, 35H24, 35H26, 35H28
3-24-75	56	35H18, 35H20, 35H22, 51H20, 51H22, 51H24
3-25-75	57	35H12, 35H14, 35H16, 51H16, 51H18
3-26-75	58	35H6, 35H8, 35H10, 51H10, 51H12, 51H14
3-27-75	59	35H2, 35H4, 51H4, 51H6, 51H8
3-28-75	60	51H2
3-31-75		42H6
11-20-75		13H15

Sequence No. 32 through No. 41: If we are unable to complete the stressing of a tendon in a given sequence, the closest practical tendon in the same series will be stressed in its stead to complete this sequence. In the meantime, stressing may proceed up to four (4) sequeneces in advance of the incompletely stressed tendon.

C. Horizontal Tendons

Each horizontal tendon shall be stressed from both ends simultaneously using two (2) sets of stressing equipment. The horizontal tendon shall be stressed in the following sequence from sequence no. 1 through sequence no. 48. All the tendons in one sequence must be stressed before th next sequence is stressed. After 50% of the horizontal tendons are stressed (following sequence no. 48) the remai ing tendons in each buttress will be stressed in the butt sequence shown. A tendon will be considered stressed whe lift off is achieved within the specified pressure limits

Odd Numbered Buttresses

Sequence No.	1.	13H47	35H47	51H47
	2.	13H45	35H45	51H45
	3.	13H43	35H43	51H43
	4.	13H41	35H41	51H41
	5.	13H39	35H39	51H39
	6.	13H37	35H37	51H37
	7.	13H35	35H35	51H35
	8.	13H33	35H33	51H33
	9.	13H31	35H31	51H31
	10.	13H29	35H29	51H29
	11.	13H27	35H27	51H27
	12.	13H25	35H25	51H25
	13.	13H23	35H23	51H23
	14.	13H21	35H21	51H21
	15.	13H19	35H19	51H19
	16.	13H17	35H17	51H17
	17.	13H15	35H15	51H15
	18.	13H13	35H13	51H13
	19.	13H11	35H11	51H11
	20.	13H9	35H9	51H9
	21.	13H7	35H7	51H7
	22.	13H5	35H5	51H5
	23.	13H3	35H3	51H3
	24.	13H1	35H1	51H1

Move to even numbered buttresses and stress going up.

25.	24H1	46H1	62H1
26.	24H3	46H3	62H3
27.	24H5	46H5	62H5
28.	24H7	46H7	62H7
29.	24H9	46H9	62H9
30.	24H11	46H11	62H11
31.	24H13	46H13	62H13
32.	24H15	46H15	62H15
33.	26H17	46H17	62H17
34.	24H19	46H19	62H19
35.	24H21	46H21	62H21
36.	24H23	46H23	62H23
37.	24H25	46H25	62H25
38.	24H27	46H27	62H27
39.	24H29	46H29	62H29
40.	24H31	46H31	62H31
41.	24H33	46H33	62H33
42.	24H35	46H35	62H35
43.	24H37	46H37	62H37
44.	24H39	46H39	62H39
45.	24H41	46H41	62H41
46.	24H43	46H43	62H43
47.	24H45	46H45	62H45
48.	24H47	46H47	62H47

Buttress 24 Sequence: 24H46, 24H44, 24H42, 24H40, 24H38, 24H36, 24H34, 24H32, 24H30, 24H28, 24H26, 24H24, 24H22, 24H20, 23H18, 24H16, 24H14, 24H12, 24H10, 24H8, 24H6, 24H4, 24H2

Buttress 46 Sequence: 46H46, 46H44, 46H42, 46H40, 46H38, 46H36, 46H34, 46H32, 46H30, 46H28, 46H26, 46H24, 46H22, 46H20, 46H18, 46H16, 46H14, 46H12, 46H10, 46H8, 46H6, 46H4, 46H2

Buttress 62 Sequence: 62H46, 62H44, 62H42, 62H40, 62H38, 62H36, 62H34, 62H32, 62H30, 62H38, 62H26, 62H24, 62H22, 62H20, 62H18, 62H16, 62H14, 62H12, 62H10, 62H8, 62H6, 62H4, 62H2

Buttress 13 Sequence: 13H2, 13H4, 13H6, 13H8, 13H10, 13H12, 13H14, 13H16, 13H18, 13H20, 13H22, 13H24, 13H26, 13H28, 13H30, 13H32, 13H34, 13H36, 13H38, 13H40, 13H42, 13H44, 13H46

Buttress 35 Sequence: 35H2, 35H4, 35H6, 35H8, 35H10, 35H12, 35H14, 35H16, 35H18, 35H20, 35H22, 35H24, 35H26, 35H28, 35H30, 35H32, 34H34, 35H36, 35H38, 35H40, 35H42, 35H44, 35H46

Buttress 51 Sequence: 51H2, 51H4, 51H6, 51H8, 51H10, 51H12, 51H14, 51H16, 51H18, 51H20, 51H22, 51H24, 51H26, 51H28, 51H30, 51H32, 51H34, 51H36, 51H38, 51H40, 51H42, 51H44, 51H46.

CONTINGENCY PLAN

Sequence No. 1 through No. 48: Except for sequence No. 1 and No 25, tendons may be stressed singly, in pairs or three at a time. On sequence No. 1 and No. 25, all three tendons shall be stressed simultaneously. IF we are unable to complete the stressing of a tendon or tendons in a given sequence, we will proceed to the next sequence and ocntinue to stress the tendons in that sequence where practical. This is limited to one (1) sequence beyond the unstressed tendon or tendons.

Following Sequence No. 48: Tendons may be stressed singly, in pairs or three at a time. If we are unable to complete the stressing of any tendons in a buttress sequence we will proceed to stress the remaining tendons in that buttress, limited to twelve (12) tendons beyond the unstressed tendon.

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power
A Progress Energy Company

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 0.62% 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)

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power
A Progress Energy Company

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)			
8752	4/6/01	331.036	-11.329	1,809,369	1/9/02	331.018	-12.836	1,807,763	5500	0.09
8783	8/1/01	333.733	-9.037	1,893,241.1	1/9/02	335.843	-9.335	1,904,970.1	5700	0.62
8833	8/1/01	334.599	-3.885	1,903,329.3	1/8/02	332.645	-4.175	1,891,901.5	5700	0.60
7711	1/9/02	1.654	0.104	14163	1/17/12	1.642	0.158	14115	8500	0.34

RAM 7711 USED FOR WIRE TESTING

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

IDENTIFICATION NUMBER 12V20 CUT LENGTH 188'-5 3/4"

SHOP WASHER ID: PC 121 CR 589 FIELD WASHER ID: PC 120 CR 291

1. GAI/QA vendor inspection cover letter number-FPC # 9957 DATE 2/25/74

2. Date tendon received on-site 1-21-74 RMR Number 36077

3. Date installed in conduit 7-9-74 Installation NCR's

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 9-3-74 Buttonheading NCR's

   Bad wires 0 Accept. Reheads Total Ineffective wires

5. Date stressed 1-28-75 Stressing NCR's

   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	12 5/8 / 12 3/8	NA / NA	12 5/8 / 12 7/8
Lift-Off Pressure - Predicted/Actual	6870 / 6700	" / "	N/A
Shim Thickness/80% Ultimate Pressure	15" FOUND 9" / 7810	4" / "	N/A

PJJ 12-12-77

Unseated/Broken Wires Total effective wires after stressing 163

6. Date Bulk-filled 1-30-75 Bulk-Filling NCR's

   Time since installation 6 months Inlet Pressure 150 lbs Outlet Temp. 130°

   Date end caps refilled: Shop Field

7. Data compiled by D. Waller Organization Salem

   Date 4/1/77

8. Additional Comments:

1ST SURVEILLANCE

Florida Power CORPORATION

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

TENDON IDENTIFICATION NUMBER 12 V 20 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	1449 / 1785	NA / NA	N/A
Shim Thickness/80% Ultimate Pressure (J)	15" /	/	N/A

Unseated/Broken Wires 1 (CRACKED BUTTONHEAD) Total effective wires after stressing 16 ~~162~~

6. Date Bulk-filled AGAIN 2-1-78 Bulk-Filling NCR's _____

   Time since installation _____ Inlet Pressure _____ Outlet Temp. _____

   Date end caps refilled: Shop 2-1-78 Field NA.

7. Data compiled by D.J. Giffin Organization FPC

   Date 5-15-78

8. Additional Comments: INSPECTED FIRST SURVEILLANCE (12-12-77)

1) MINOR FIELD RUST ON STRESSING WASHER; HOWEVER STILL CORR. CAT. 1

2) LOCK-OFF FORCE (SAME AS LIFT-OFF)

3) HAIR LINE CRACKING (LESS THAN 0.004") AT BOTTOM ANCHORAGE (12-6-77)

4) TOP SHIM - RECORDS SHOW (9") TOP SHIM - ACTUAL FIELD (15")

5) LIFT-OFF EXCEEDED TECH. SPEC. UPPER LIMIT (1721 K) ADJACENT TENDON LIFT-OFFS TAKEN

1ST Surveillance

Florida Power CORPORATION

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

TENDON IDENTIFICATION NUMBER 12V20 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 163

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. Giff Organization FPC

   Date 8-14-78

8. Additional Comments: One (1) cracked button head was acceptable

2nd Surveillance

Florida Power CORPORATION

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

TENDON IDENTIFICATION NUMBER 12V20 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 _____

	TOP. SHOP END	BOTTOM FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	N/A	N/A	N/A
Lift-Off ~~Pressure~~ FORCE / ~~Predicted/Actual~~ LOCK OFF FORCE (KIPS)	1740/1740	—N/A—	N/A
Shim Thickness/~~80% Ultimate Pressure~~	15"	4"	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 4/14/80 Bulk-Filling NCR's —

   Time since installation — Inlet Pressure — Outlet Temp. —

   Date end caps refilled: Shop 4/14/80 Field 4/14/80

7. Data compiled by J. S. Hen Organization GAI

   Date 4/22/81

8. Additional Comments: LIFT OFF ONLY AT 2nd SURVEILLANCE.
   DATE OF LIFT/LOCK OFF — 4/11/80.
   LIFT OFF EXCEEDED TECH SPEC UPPER LIMIT OF 1721K.

Florida Power CORPORATION

3 - Surveillance

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

TENDON IDENTIFICATION NUMBER 12V20 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.a Date stressed _____ Stressing NCR's _____

   Date restressed _____ Restressing NCR's _____

	TOP SHOP END	BOTTOM FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	~~/~~	~~N/A / ~~	~~/~~
5b. Lift-Off ~~Pressure~~ FORCE / ~~Predicted/Actual~~ LOCK-OFF FORCE (KIPS)	/	N/A / N/A	N/A
Shim Thickness/~~80% Ultimate Pressure~~	/ N/A	/ N/A	N/A

   Unseated/Broken Wires _____ Total effective wires after stressing _____

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

   Time since installation N/A Inlet Pressure _____ Outlet Temp. _____

   Date end caps refilled: Shop _____ Field _____

7. Data compiled by _____ Organization _____

   Date _____

8. Additional Comments: TENDON TO BE LOCKED OFF AT 1630 KIPS PER MODIFICATION No. 81-4-73, WORK REQUEST No. 23372. COMPLETE ITEM 5b, 6, 7, 8.

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

TENDON NO. 12V20

Inspection Period and Date	Location	LIFT OFF CONDITION Force (kips)	Avg. Force (kips)	Shim Thickness (in)	Elong-ation (in)	Total Effective Wires	RETENSIONING Force (kips)	Avg. Force (kips)	Shim Thickness (in)	Elong-ation (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	T	1598		15"	12 3/8"		N/A		N/A	N/A				
1/28/75	B	N/A	N/A	4"	N/A	163	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1 st	T	1785		15"	N/A		1785		15"	N/A				1. Lift-off high - adjacent tendons tested
12/12/77	B	N/A	N/A	4"	N/A	163	N/A	N/A	4"	N/A	163	111°	65	2. Hairline cracking at Bott. Anchorage
2 nd	T	1740		15"	N/A		1740		15"	N/A				1. Lift-off only
4/11/80	B	N/A	N/A	4"	N/A	163	N/A	N/A	4"	N/A	163	71°	78°	
	NOTE - See MAR 81-4-73													

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

TENDON IDENTIFICATION NUMBER 45V3 CUT LENGTH 188'-6 1/4

SHOP WASHER ID: PC 121 CR 776 FIELD WASHER ID: PC 120 CR 221

1. GAI/QA vendor inspection cover letter number-FPC # 10.010 DATE 3/1/74

2. Date tendon received on-site 2-11-74 RMR Number 36961

3. Date installed in conduit 7-23-74 Installation NCR's

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 8-21-74 Buttonheading NCR's

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 9-30-74 Stressing NCR's

   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	12 1/4 / 12 1/2	NA / NA	12 1/4 / 12 1/2
Lift-Off Pressure - Predicted/Actual	6800 / 6800	" / "	N/A
Shim Thickness/80% Ultimate Pressure	14" / 17770	4" / "	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 11-7-74 Bulk-Filling NCR's 1687

   Time since installation 4 months Inlet Pressure 160-405 Outlet Temp. 123°

   Date end caps refilled: Shop Field

7. Data compiled by R. Rauch 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 45 V 3 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	1499.6 / ~~1668~~ 1678	/	N/A
Shim Thickness/80% Ultimate Pressure	/	/	N/A

REMOVED/Unseated/Broken Wires 1 (R/M) Total effective wires after stressing 162

6. Date Bulk-filled AGAIN 1-16-78 Bulk-Filling NCR's _____

   Time since installation _____ Inlet Pressure _____ Outlet Temp. _____

   Date end caps refilled: Shop 1-16-78 Field N.A.

7. Data compiled by D. J. Giffin Organization FPC

   Date 5-15-78

8. Additional Comments: INSPECTED FIRST SURVEILLANCE (12-9-77)
   1) MINOR FIELD RUST ON STRESSING WASHER, HOWEVER, STILL CORR. CAT. 1
   WIRE HAD CORROSION CAT. #1, #2, #3 RUST ON DIFFERENT SEGMENTS (ACCEPTABLE)
   2) HAIRLINE CRACKING (LESS THAN 0.002") AT BOTTOM ANCHORAGE (12-6-77)
   3) LOCK-OFF FORCE (SAME AS LIFT-OFF)

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

TENDON NO. 45V3

Inspection Period and Date	Location	LIFT OFF CONDITION Force (kips)	Avg. Force (kips)	Shim Thickness (in)	Elong-ation (in)	Total Effective Wires	RETENSIONING Force (kips)	Avg. Force (kips)	Shim Thickness (in)	Elong-ation (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	T	1639		14"	12½"		N/A		N/A	N/A				
9/30/74	B	N/A	N/A	4"	N/A	163	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1 st	T	1678		14"	N/A		1678		14"	N/A				1. Hairline cracking at bottom anchorage
12/9/77	B	N/A	N/A	4"	N/A	163	N/A	N/A	4"	N/A	162	103	63	2. One wire removed

Florida Power

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

IDENTIFICATION NUMBER 56V1 CUT LENGTH 188'-6"

SHOP WASHER ID: PC 121 CR 841 FIELD WASHER ID: PC 120 CR 175

1. GAI/QA vendor inspection cover letter number-FPC # 10050 DATE 3/8/74

2. Date tendon received on-site 2-20-74 RMR Number 37257

3. Date installed in conduit 7-17-74 Installation NCR's

   Wires removed 0 Wires replaced 0 Total Ineffective wires 0

4. Date buttonheaded 8-13-74 Buttonheading NCR's

   Bad wires 0 Accept. Reheads 0 Total Ineffective wires 0

5. Date stressed 8-30-74 Stressing NCR's

   Date restressed Restressing NCR's

	SHOP END	FIELD END	TOTAL
Elongation (1500 psi to 80% ult.)-Pred./Act.	12'/8" / 12'13/16"	NA / NA	12'/8" / 12'13/16"
Lift-Off Pressure - Predicted/Actual	6800 / 7400 / 7050 PSI	" / "	N/A
Shim Thickness/80% Ultimate Pressure	14" / 17770	4" / "	N/A

   Unseated/Broken Wires 0 Total effective wires after stressing 163

6. Date Bulk-filled 11-8-74 Bulk-Filling NCR's

   Time since installation 4 months Inlet Pressure 118 PSI Outlet Temp. 134°

   Date end caps refilled: Shop Field

7. Data compiled by D. Walls Organization Salem

   Date 4/4/77

8. Additional Comments:

FM 6.6 Exhibit 9

1ST SURVEILLANCE

Florida Power CORPORATION

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

TENDON IDENTIFICATION NUMBER S6 V1 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	1499.6 / 1718.5	/	N/A
LOCK-OFF FORCE BELOW			
Shim Thickness/80% Ultimate Pressure	/	/	N/A

Unseated/Broken Wires 2 (CRACKED BUTTONHEADS) Total effective wires after stressing 163 / 161 see next page

6. Date Bulk-filled 1-17-78 Bulk-Filling NCR's _____
   AGAIN
   Time since installation ~~[illegible]~~ Inlet Pressure _____ Outlet Temp. _____

   Date end caps refilled: Shop 1-17-78 Field NA

7. Data compiled by D. J. Griffin Organization FPC

   Date 5-15-78

8. Additional Comments: INSPECTED FIRST SURVEILLANCE (12-9-77)
   1) MINOR FIELD RUST ON STRESSING WASHER; HOWEVER
   2) LOCK-OFF FORCE (1675.5 K)
   3) HAIR LINE CRACKING (LESS THAN 0.002") AT BOTTOM ANCHORAGE (12-6-77)

1ST SURVEILLANCE

Florida Power CORPORATION

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

TENDON IDENTIFICATION NUMBER 56 V1 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 163

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. Giffin Organization FPC

   Date 8-14-78

8. Additional Comments: Two (2) cracked buttonhead reported in the first surveillance were acceptable

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

TENDON NO. 56V1

Inspection Period and Date	Location	LIFT OFF CONDITION Force (kips)	Avg. Force (kips)	Shim Thickness (in)	Elong-ation (in)	Total Effective Wires	RETENSIONING Force (kips)	Avg. Force (kips)	Shim Thickness (in)	Elong-ation (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	T	1784 1699		14"	12 13/16"		N/A		N/A	N/A				1. Two original lift-off pressures were recorded in tendon history
8/30/74	B	N/A	N/A	4"	N/A	163	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1 st	T	1719		14"	N/A		1676		14"	N/A				1. Hairline cracking at bottom anchorage
12/9/77	B	N/A	N/A	4"	N/A	163	N/A	N/A	4"	N/A	163	107	66	
2 nd	T	1707		14"	N/A		1707		14"	N/A				1. One wire removed 2. Water inside tendon
4/3/80	B	N/A	N/A	4"	N/A	163	N/A	N/A	4"	N/A	162	70	84	