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 FACIL: 50-251 Turkey Point Plant, Unit 4, Florida Power and Light C 05000251
 AUTH. NAME AUTHOR AFFILIATION
 TOMONTO, R.J. Florida Power & Light Co.
 PLUNKETT, T.F. Florida Power & Light Co.
 RECIP. NAME RECIPIENT AFFILIATION

SUBJECT: LER 92-009-00: on 921117, measured prestress force on
 containment tendon lower than predicted lower limit. Caused
 by increased tendon wire steel relaxation loss at higher
 tendon temp. Lift-off forces restored. W/921217 ltr.

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DEC 17 1992

L-92-344
10 CFR 50.73
10 CFR 50.36

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

Gentlemen:

Re: Turkey Point Unit 4
Docket No. 50-251
Reportable Event: 92-009
Date of Event: November 17, 1992
Containment Tendon Surveillance - Measured Prestress Force Lower than Predicted

The attached Licensee Event Report (LER) 251-92-009 is provided pursuant to the requirements of 10 CFR 50.73 (a)(2)(i)(B) to provide information on the subject event. In accordance with NUREG-1022, Supplement 1, this LER will also satisfy the requirements of Technical Specification 3.6.1.6, submittal of a Special Report.

Very truly yours,

T. F. Plunkett
Vice President
Turkey Point Nuclear

TFP\RJT\rt

Attachment

cc: Stewart D. Ebnetter, Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, Turkey Point Plant

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S PDR

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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Turkey Point Unit 4										DOCKET NUMBER (2) 05000251		PAGE (3) 1 OF 9		
TITLE (4) Containment Tendon Surveillance - Measured Prestress Force Lower than Predicted														
EVENT DATE (5)				LER NUMBER (6)			RPT DATE (7)			OTHER FACILITIES INV. (8)				
MON	DAY	YR		YR	SEQ #	R#	MON	DAY	YR		NAME		DOCKET # (S)	
11	17	92		92	009	00	12	17	92					
OPERATING MODE (9)			1 10 CFR 50.73(a)(2)(i)(B) and OTHER (Special Report)											
POWER LEVEL (10) 100			(Specify in Abstract below and in text)											
LICENSEE CONTACT FOR THIS LER (12)														
Robert J. Tomonto, Licensing Engineer										TELEPHONE NUMBER				
										305-246-7327				
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)														
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	NFRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	NFRDS				
SUPPLEMENTAL REPORT EXPECTED (14)										EXPECTED SUBMISSION DATE (15)		MONTH	DAY	YEAR
YES	(if yes, complete EXPECTED SUBMISSION DATE)					NO	X							
ABSTRACT (16)														
<p>On November 17, 1992 at approximately 0917 EST, with Turkey Point Unit 3 in Mode 5 (COLD SHUTDOWN) and Unit 4 in Mode 1 (POWER OPERATION), Unit 4 entered LIMITING CONDITION FOR OPERATION (LCO) 3.6.1.6 a., with Unit 4 containment hoop tendon 35H38 measuring an observed lift-off value less than 90% of the predicted lower limit (PLL). ACTION a. of Technical Specification 3.6.1.6 required that with one tendon below 90% of the PLL, restore the tendon to the required level of integrity within 15 days, perform an engineering evaluation of the containment and provide a Special Report to the Commission within 30 days. In accordance with SURVEILLANCE REQUIREMENTS 4.6.1.6.1, adjacent tendons were checked for their lift-off force. Tendons 35H39, 35H40, 35H41 and 35H42 measured lift-off values between PLL and 90% of PLL.</p> <p>Tendons 35H38, 35H39, 35H40, 35H41 and 35H42 were retensioned and on November 19, 1992, at approximately 1715 EST, Unit 4 exited LCO ACTION 3.6.1.6 a.</p> <p>This event is reportable under 10 CFR 50.73 (a)(2)(i)(B). Operability of tendon 35H38 is established based upon a revision to the calculated value for the predicted lower limit and minimum required prestress force for the Unit 4 containment. These values were initially calculated assuming a maximum containment design pressure of 59 psig, and were subsequently revised to 55 psig.</p> <p>Technical Specification 5.2.2, DESIGN FEATURES - DESIGN PRESSURE AND TEMPERATURE, states that "the containment building is designed and shall be maintained for a maximum internal pressure of 59 psig". Operability of tendon 35H38 is established based upon the licensing basis provided in the original Turkey Point Safety Evaluation Report which states that 55 psig is an acceptable design pressure. FPL will submit license amendments to revise the Technical Specification design pressure to reflect the licensing basis design pressure.</p>														



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I. DESCRIPTION OF THE EVENT

The following sequence of events was derived from the Reactor Operator's log and the equipment out-of-service log.

0910 11/17/92 Unit 3 in Mode 5 (COLD SHUTDOWN) and Unit 4 in Mode 1 (POWER OPERATION)

FPL performed the Unit 4 twentieth year tendon surveillance. Hoop tendon 35H38 measured a low lift-off force of 5.94 kips/wire which is equivalent to 89.6% of the predicted lower limit (PLL). Unit 4 entered LIMITING CONDITION FOR OPERATION 3.6.1.6 a., with a 15 day ACTION statement requiring the tendon to be restored to the required level of integrity.

1530 11/17/92 Hoop tendon 35H39 measured a low lift-off force of 6.09 kips/wire or 91.8% of PLL. Tendon 35H39 declared Out-of-Service.

1640 11/17/92 Hoop tendon 35H40 measured a low lift-off force of 6.12 kips/wire or 92.3% of PLL. Tendon 35H40 declared Out-of-Service.

1115 11/18/92 Hoop tendon 35H41 measured a low lift-off force of 6.01 kips/wire or 90.6% of PLL. Tendon 35H41 declared Out-of-Service.

1200 11/18/92 Hoop tendon 35H42 measured a low lift-off force of 6.13 kips/wire or 92.5% of PLL. Tendon 35H42 declared Out-of-Service.

1130 11/19/92 Retensioned tendon 35H42, returned tendon to service

1405 11/19/92 Retensioned tendon 35H41, returned tendon to service

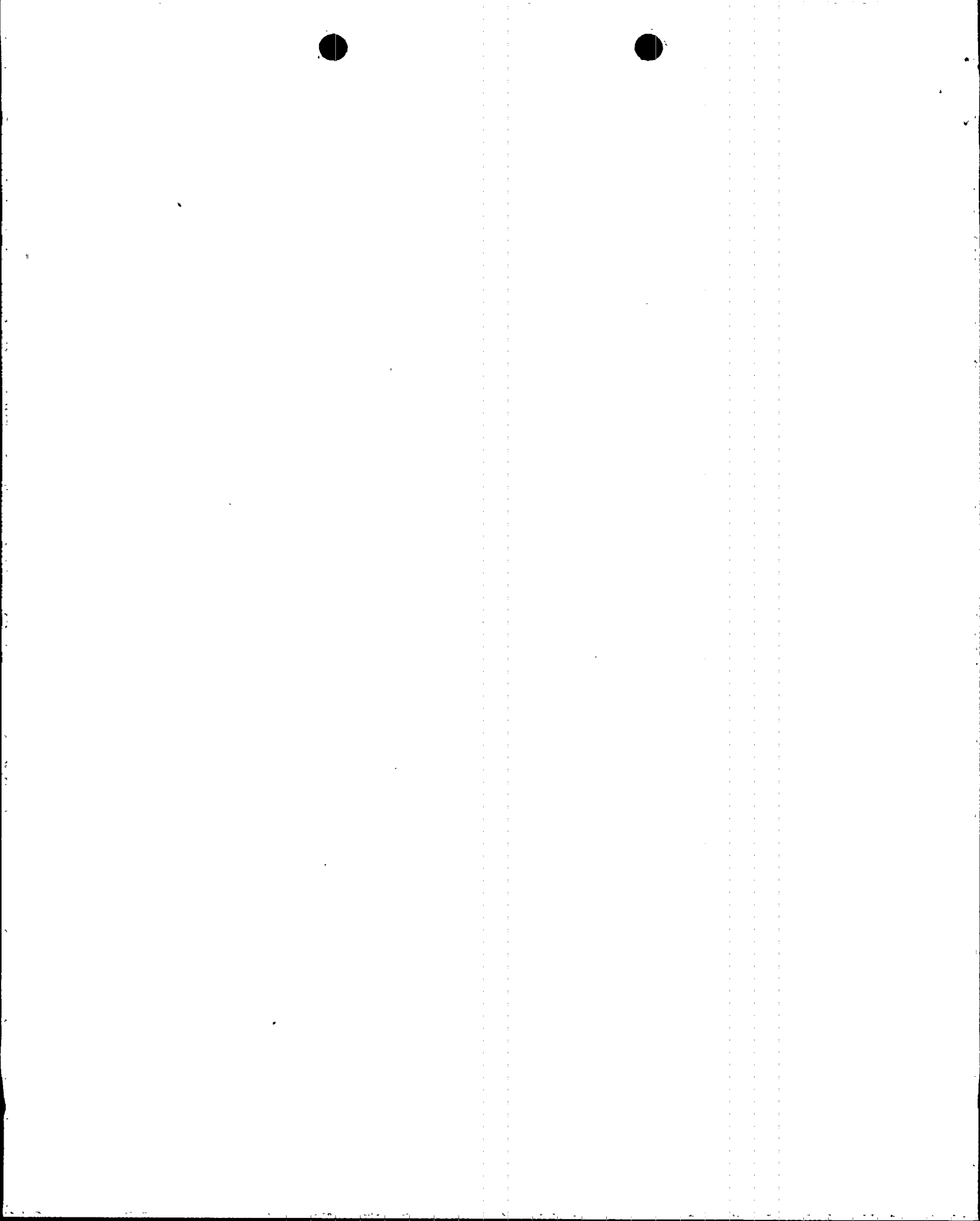
1715 11/19/92 Retensioned tendons 35H38, 35H39 and 35H40, returned tendons to service. Exited LCO ACTION 3.6.1.6 a.

This event is reportable under 10 CFR 50.73 (a) (2) (i) (B). Operability of tendon 35H38 is established based upon a revision to the calculated value for the predicted lower limit and minimum required prestress force for the Unit 4 containment. These values were initially calculated assuming a maximum containment design pressure of 59 psig and were subsequently revised to 55 psig, which is 110% of current containment peak internal pressure based on design basis LOCA.

Technical Specification 5.2.2, DESIGN FEATURES - DESIGN PRESSURE AND TEMPERATURE states the following:

"The containment building is designed and shall be maintained for a maximum internal pressure of 59 psig ...".

A maximum containment pressure of 55 psig was assumed in the original Turkey Point Safety Evaluation Report (Ref. 5.10) which stated the following:



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"The applicant has now calculated that the peak accident pressure would be 50 psig. Since our current guidelines for containment design suggest that the design pressure should be at least 10% higher than the calculated peak accident pressure, 55 psig would be an acceptable design pressure".

The methodology for calculating both the predicted lower limit and the minimum required prestress limit has been transmitted to the NRC by FPL Letters L-92-262, dated September 14, 1992 and L-92-287, dated November 5, 1992.

In order to establish operability of tendon 35H38 the maximum containment pressure in the containment structural analysis assumed a value of 55 psig.

II. CAUSE OF THE EVENT

By FPL letter L-92-262, dated September 14, 1992, FPL reached the following conclusion from the Turkey Point Unit 3 twentieth year tendon surveillance:

Based on the engineering evaluation (FPL letter L-92-262), FPL determined that the tendon wire steel relaxation loss increases with the increase in temperature experienced by the tendon. It was also determined that the measured Unit 3 containment internal temperature during surveillance averaged 114 °F which results in hoop tendon temperature of approximately 90 °F, which corresponds to higher tendon wire steel relaxation losses than those used in the original design. Therefore, the probable cause for the low lift-off forces measured for the Turkey Point Unit 3 containment hoop tendons was increased tendon wire steel relaxation loss occurring at a higher tendon temperature (approximately 90 °F).

Based on the results of this evaluation, it is estimated that a 12% tendon wire steel relaxation loss rate should be used to predict the undisturbed tendon lift-off forces in future surveillances. It is also concluded that creep loss calculated based on the average sustained concrete compressive stress should be used to more accurately predict the tendon lift-off forces in each group (hoop, vertical and dome) in future surveillances.

FPL believes the root cause of the Unit 4 low lift-off forces to be equivalent to the root cause of the low lift-off values observed in Unit 3. Consistent with the Unit 3 containment twentieth year surveillance tendon report, a more detailed engineering evaluation is being prepared to investigate the cause and the extent of low lift-off values in the Unit 4 containment structure post-tensioning system. This evaluation will also determine the length of time that the Unit 4 Turkey Point post-tensioning system will continue to satisfy the licensing basis requirements.

III. ANALYSIS OF THE EVENT

FPL's engineering evaluation provides the following:

- The licensing basis for the containment design pressure.
- Justification for the acceptability of the low lift-off condition on hoop tendon 35H38 and adjacent tendons.



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1.0 Licensing Basis For Containment Design Pressure

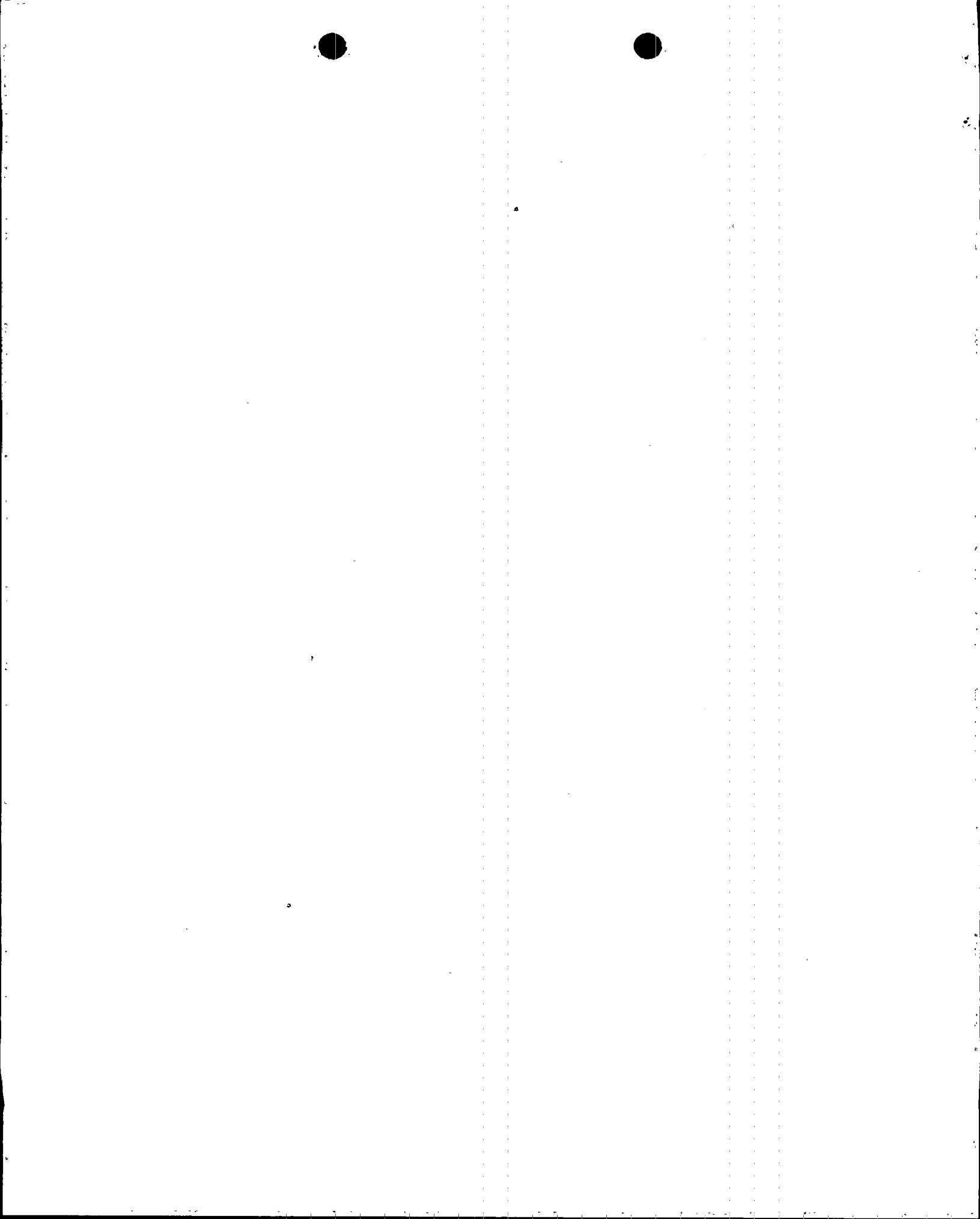
Containment tendon surveillance inspections performed to date for Turkey Point Units 3 and 4 have assumed a containment internal pressure of 59 psig for calculating the minimum design prestress forces. However, due to the low lift-off forces data obtained for hoop tendon 35H38, FPL has calculated the minimum design prestress force required to meet 55 psig. The measured low lift-off forces are then evaluated using the minimum design prestress force for 55 psig to determine the acceptability of the containment post-tensioning system.

Background

The containment licensing basis pressure of 55 psig was established during the early stages of plant licensing (circa 1965 - 1966) and has carried through to current licensing documents. The Preliminary Safety Analysis Report (PSAR) and Updated Final Safety Analysis Report (UFSAR) indicated that a 55 psig reference containment licensing basis pressure was conservatively established for the design basis (29-inch double-ended pipe break) loss-of-coolant accident (LOCA), based on a 49.9 psig calculated peak pressure plus a 10% safety margin. The structural proof test was conducted at 115% design pressure to verify structural integrity. [Reference PSAR Sections 5.4.1.a and 12.2.3; and Reference UFSAR Revision 4 dated August 12, 1970, Section 5.1.1]

Other LOCA cases, assuming partial safeguards availability, were also considered. These cases did not constitute design basis accident scenarios, but rather provided an indication of potential containment performance requirements beyond-the-licensing-basis for purposes of establishing a conservative design for the containment. These scenarios were considered in response to Atomic Energy Commission (AEC) questions, to address uncertainties in the availability of accumulators. As a result, these other cases assumed partial safeguards operation with no core cooling; conditions that are beyond the required postulation of a single active or passive failure [Reference PSAR Supplement 2, Questions 1.0 and 3.0, dated 9/2/66]. The value of 55 psig was determined as the licensing basis analysis for partial safeguards availability, by operating on diesel power, and providing core cooling by having 2/3 of the available safety injection water reach the core.

To accommodate these hypothetical, beyond-the-licensing-basis scenarios, the containment structure was originally designed assuming a peak pressure of 59 psig; however, the design basis LOCA calculated peak pressure was 49.9 psig, and "55 psig was considered as nominal structural design pressure, thus allowing a margin of 10% over the calculated peak accident pressure." [Reference UFSAR Revision 4 dated August 12, 1970, Section 5.1.1]



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Based on the AEC Safety Evaluation Report (SER): 55 psig is the licensing basis containment design pressure; this value is based on a calculated design basis LOCA peak pressure of 49.9 psig plus a safety margin; and the internal pressure of 59 psig was selected based on non-licensing basis LOCA scenarios. This is consistent with the AEC conclusions presented in the plant SER, (Section 5.4 of Reference 5.10) which states:

"Although the building is designed to withstand a pressure of 59 psig, the preoperational structural proof test was performed at about 63 psig rather than at 68 psig (115% of 59 psig). The design pressure was established at the construction permit stage based upon an early containment pressure transient analysis which did not take credit for the action of the accumulators in suppressing a secondary pressure peak. The applicant has now calculated that the peak accident pressure would be 50 psig. Since our current guidelines for containment design suggest that the design pressure should be at least 10% higher than the calculated peak accident pressure, 55 psig would be an acceptable design pressure. On this basis we have accepted the 63 psig proof test (115% of 55 psig)".

The LIMITING CONDITION FOR OPERATION for structural integrity ensures that the containment will withstand the maximum pressure in the event of a LOCA. [Reference 5.2, Bases Section 3/4.6.1.6; and Reference 5.1, Section 5.1.1]

1.1 Licensing Basis

Early performance requirements for the containment were added to address the uncertainty in component availability for LOCA scenarios. The licensing basis for containment design pressure is 55 psig based on a calculated design basis LOCA peak pressure of 49.9 psig plus a margin of safety. Because the calculated peak pressure is less than the licensing basis containment design pressure of 55 psig, as required at the operating license stage, using 55 psig for calculating minimum design prestress forces does not impact the margin of safety.

2.0 Engineering Evaluation of Hoop Tendon 35H38 Low Lift-Off Condition

The Turkey Point Unit 4 containment is a post-tensioned, reinforced concrete structure comprised of a vertical cylinder with a shallow dome and supported on a conventional reinforced concrete foundation base slab. The vertical cylinder wall is provided with a system of vertical and hoop tendons. Vertical tendons are anchored at the top surface of the ring girder and at the bottom of the base slab. Each hoop tendon is anchored at alternate vertical buttresses nominally 120 degrees apart. Tendons in the dome consist of three groups of tendons oriented at 120 degrees with respect to each other and are anchored at the vertical face of the dome ring girder.



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The tendon surveillance program for the Turkey Point Nuclear Plant Unit 4 containment structure post-tensioning system has been performed at one, three and five years after the containment Initial Structural Integrity Test (ISIT), and every five years thereafter. Three dome, five hoop, and four vertical tendons were selected for the twentieth year tendon surveillance on a random basis, excluding those tendons which were previously inspected for earlier surveillances. The Turkey Point Unit 4 twentieth year tendon surveillance is performed in accordance with the requirements of References 5.6 and 5.9.

To date, a wire has been removed for inspection from dome tendon 1D40, and hoop tendon 42H83. In addition, grease samples have been removed for each surveillance tendon inspected to date. The visual inspection of the tendon wire and sheath filler samples have revealed no abnormal wire corrosion or grease discoloration.

Also, the concrete at the tendon anchorage area adjacent to the bearing plates for all hoop tendons has been inspected. This inspection has revealed that no cracks were found which exceed the acceptance width of 0.01 inches noted in Reference 5.8, Section IWL-3221.3(d).

FPL has calculated that the minimum design prestress force for hoop tendons required to withstand 55 psig containment internal pressure is 5.94 kips/wire at the anchorage (Reference 5.5). Considering the 55 psig internal pressure and the minimum required prestress force of 5.94 kips/wire for hoop tendons, this calculation has determined that the conclusions of the original containment analysis will not be adversely affected.

The following are the predicted lower limit (PLL) and the minimum design prestress force at the anchorage for hoop tendons:

Twentieth Year Predicted Lower Limit = 6.63 kips/wire
(Reference 5.6)

Minimum Design Prestress Force = 5.94 kips/wire
(at anchorage for Hoop Tendons)
(Reference 5.5)

The lift-off forces which are below the predicted lower limit occurred in one of the hoop surveillance tendons (35H38) and its adjacent tendons (35H39, 35H40, 35H41 and 35H42). Due to accessibility problems below tendon 35H38, all adjacent tendon lift-off testing was performed above tendon 35H38. The following summarizes the results of the lift-off forces on hoop tendon 35H38 and its adjacent tendons:



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<u>Tendon</u>	<u>Measured Normalized Lift-Off Force (kips/wire)</u>	<u>Percentage of PLL</u>
35H38	5.94	89.6%
35H39	6.09	91.9%
35H40	6.12	92.3%
35H41	6.01	90.6%
35H42	6.13	92.5%
<hr/>		
Average	6.06 kips/wire	91.4%

As shown, the individual lift-off force and the average lift-off force for the group is equal to or larger than the minimum design prestress force (5.94 kips/wire). Therefore, it is concluded that the subject tendon group presently provides adequate prestress force to maintain the containment integrity. This conclusion is consistent with the guidance provided in Section 7.1.5 of Regulatory Guide 1.35 (Reference 5.7) and Section IWL-3221.1 (a) of ASME Code (Reference 5.8).

A more detailed engineering evaluation is being prepared to investigate the cause and the extent of low lift-off values in the Unit 4 containment structure post-tensioning system. This evaluation will also determine the length of time that the Unit 4 Turkey Point post-tensioning system will continue to satisfy the licensing basis requirements. A report will be submitted to the NRC by January 29, 1993.

3.0 Design Margins Available in the Post-Tensioning System

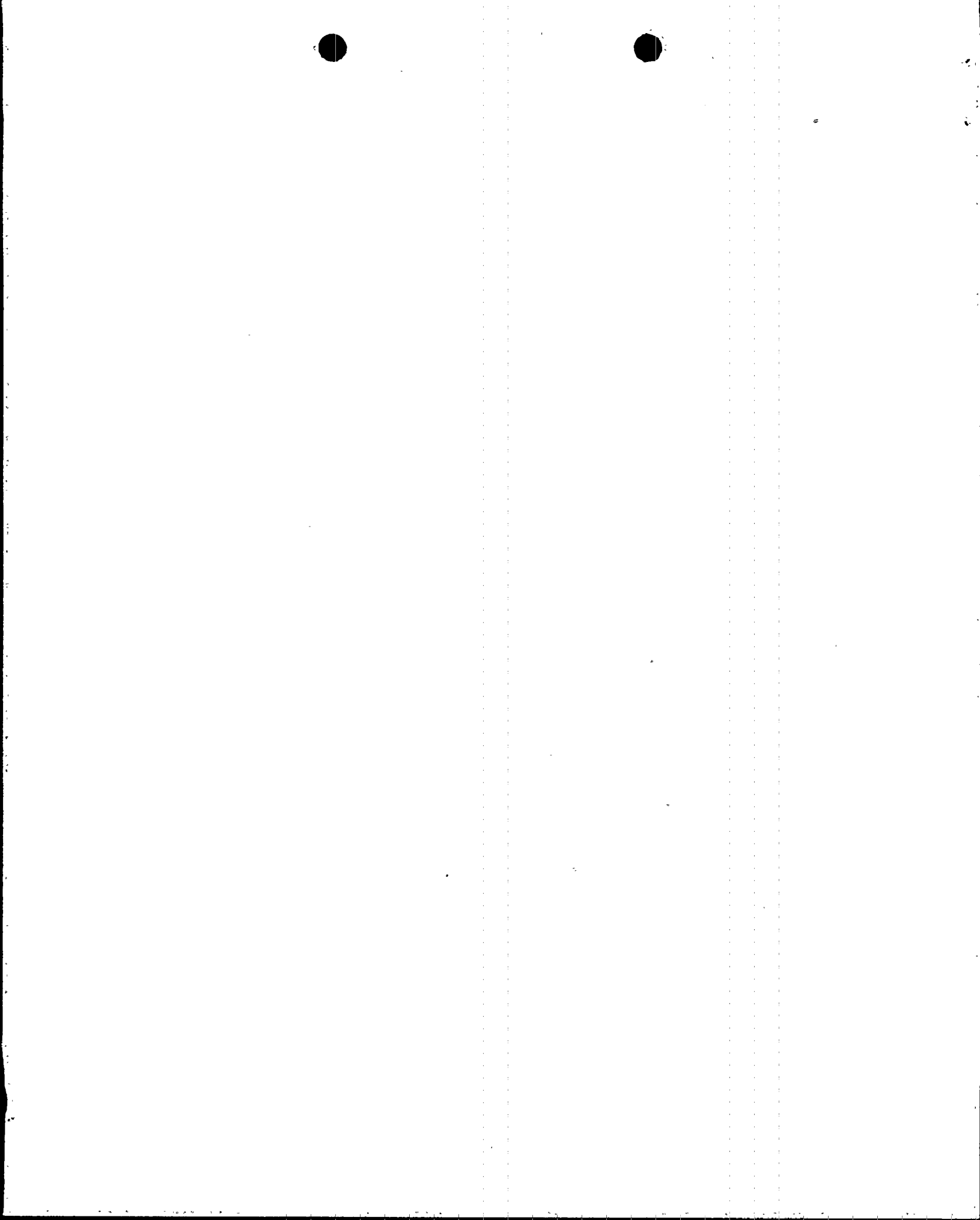
Turkey Point UFSAR (Reference 5.1), Section 5.1.2 states that any three adjacent tendons in any tendon group can be lost without significantly affecting the strength of the containment structure. This design feature considers the load redistribution capabilities of the containment shell.

4.0 Conclusion

The licensing basis containment design pressure is 55 psig as established in the original Turkey Point Safety Evaluation Report (Reference 5.10) and is the appropriate basis for containment structural analysis to evaluate the containment post-tensioning system.

Based on the available margins existing in the design of the Turkey Point post-tensioning system and the level of prestress force available in the subject hoop tendons, it is concluded that the Unit 4 hoop tendon group presently have sufficient prestress force to maintain the containment integrity.

A more detailed engineering evaluation is being prepared to investigate the cause and the extent of low lift-off condition in the Unit 4 containment structure post-tensioning system. This evaluation will also determine the length of time that the Unit 4 Turkey Point post-tensioning system will continue to satisfy the Turkey Point licensing basis requirements. A report will be submitted to the NRC by January 29, 1993.



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5.0 References

- 5.1 Turkey Point Units 3 and 4 Updated Final Safety Analysis Report (UFSAR), Revision 10, dated July 1992, Section 5.0
- 5.2 Technical Specifications, Amendment 152/147, Sections 4.6.1.6.1(a) and 3.6.1.6.
- 5.3 Bechtel Calculation No. C-SJ539-05, "Evaluation of the Fifteenth Year Tendon Surveillance Lift-Off Forces", Revision 0
- 5.4 Non-Conformance Report N-92-0306
- 5.5 Bechtel Calculation No. C-SJ561-03, "Evaluation of the Unit 4 Twentieth Year Tendon Surveillance Low Lift-Off Forces", Revision 0
- 5.6 Bechtel Technical Requirements Document 21701-561-CP-1, Revision 0, for Unit 4 Twentieth Year Tendon Surveillance
- 5.7 Regulatory Guide 1.35, "In-service Inspection of UngROUTED Tendons in Prestressed Concrete Containment", Revision 3, dated July 1990
- 5.8 ASME Code, 1989 Edition, Section XI - Division 1, Article IWL-3000 "Acceptance Standards"
- 5.9 Turkey Point Plant Procedure 0-SMM-51.2, "Containment Tendon Inspection", dated June 26, 1992
- 5.10 AEC Letter from R. C. DeYoung to Dr. J. Coughlin, Florida Power and Light Company, Safety Evaluation by the Division of Reactor Licensing, Turkey Point Units 3 and 4, dated March 16, 1972



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IV. CORRECTIVE ACTIONS

1. In accordance with Turkey Point Plant Technical Specifications ACTION 3.6.1.6 (a), the lift-off forces in tendons 35H38, 35H39, 35H40, 35H41 and 35H42 have been restored to their required level of integrity by retensioning each tendon to a level equal to or above the twentieth year predicted lower limit (6.63 kips/wire). The following summarizes the new lift-off forces for the subject tendons:

<u>Tendon</u>	<u>Measured Average Lift-Off (kips)</u>	<u>Percentage of Predicted Lower Limit</u>
35H38	622.3	104.3%
35H39	618.7	103.7%
35H40	631.8	105.9%
35H41	614.4	103.0%
35H42	623.2	104.4%

2. A more detailed engineering evaluation is being prepared to investigate the cause and the extent of low lift-off values in the Unit 4 containment structure post-tensioning system. This evaluation will also determine the length of time that the Unit 4 Turkey Point post-tensioning system will continue to satisfy the Turkey Point licensing basis requirements. A report will be submitted to the NRC by January 29, 1993. (This report will be submitted as a Supplemental LER, only if the cause of the low lift-off condition differs from the cause stated in this LER.)
3. License amendments will be submitted to the NRC revising the design pressure of the containment buildings from 59 psig to 55 psig (Technical Specification 5.2.2 and BASES 3/4.6.1.4). These amendments will be submitted to the NRC no later than June 1, 1993.

V. ADDITIONAL INFORMATION

No similar LERs have been identified.

