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SUBJECT: Forwards preliminary rept of Jul 1983 tendon surveillance, in response to 830308 ltr. Repair program for tendon 75 & procurement of replacement stressing components initiated. Testing expected to be completed by 831201.

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SUBJECT: Forwards preliminary rept of Jul 1983 tendon surveillance, in response to 830502 ltr,re repair program for tendon 73 & procurement of replacement stressing components initiated. Testing expected to be completed by 831201.

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JOHN E. MAIER
Vice President

TELEPHONE
AREA CODE 716 546-2700

November 21, 1983

Director of Nuclear Reactor Regulation
Attention: Mr. Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Containment Vessel Evaluation Program
R. E. Ginna Nuclear Power Plant
Docket No. 50-244

Dear Mr. Crutchfield:

In our letter dated June 13, 1983, we responded to your letter dated March 8, 1983 and provided information regarding the loss of prestress in the Ginna containment tendons. We also stated that additional information would be provided within 90 days of completion of the tendon surveillance scheduled to begin in mid-July. This letter documents the status of the surveillance program, as we have discussed with you and your Staff in the past months, and updates the schedule for the submittal of the additional information.

The tendon surveillance began in mid-July. The results for the first twelve tendons showed excellent agreement with pretest predictions. Attachment A contains a preliminary report for the surveillance. Following the testing of the twelfth tendon, tendon no. 75, the stressing rod became disengaged from the tendon head coupling causing damage to these components. This caused a slight misorientation of the tendon head and damage to some of the wires. While tendon no. 75 was not in a configuration desirable for long-term performance, the containment was in a condition bounded by the plant FSAR. We initiated a repair program for tendon no. 75 and procurement of replacement stressing components. In mid-October, proper orientation of tendon no. 75 was reestablished. Retesting of tendon no. 75 and testing of the remaining six untested tendons is currently in progress. We expect to complete the testing by December 1, 1983. Thus, the additional information requested by your letter will be submitted by March 1, 1984 along with a final report on the tendon surveillance.

Very truly yours,

John E. Maier

Attachment

A001
1/1

Ginna Station
July 1983 Tendon Surveillance

Preliminary Report

INTRODUCTION

In July 1983, a containment tendon surveillance program was initiated. The program included lift-off testing of 18 of the 160 Ginna containment tendons. Lift-off force for each tendon was to be compared with pre-test predictions. This report presents results for the lift-off testing of the first 12 tendons tested. The balance of the tendon testing is currently in progress and a final report of the complete surveillance program will be prepared following completion of the surveillance program.

MEASURED TENDON LIFT OFF FORCES

The measured tendon lift-off forces were obtained from two calibrated measurement systems. One system uses the gauge pressures of the stressing ram as input into the calibration equation:

$$\text{Force (kips)} = 0.896 + 0.1274 \times \text{Gauge Pressure (psig)}$$

This equation resulted from a linear regression fit of the force-gauge pressure data obtained during the calibration of the pressure gauge and stressing ram as one unit.

The second measurement system consists of the calibrated strain gaged stressing rod, which measures the force in the tendon directly. The calibration equation for this system is:

$$\text{Force (kips)} = 0.2004 \times \text{Strain (micro inches/inch)}$$

Both measurement systems obtained tendon forces that were generally in good agreement at all increasing and decreasing pressure levels indicating that confirming force data was obtained. At lift-off, the agreement in forces was excellent. The official tendon forces are considered to be the lift-off values measured just prior to applying the 6% force increment and using the strain gaged stressing rod results. As a practical matter, because they were so close, any of the four lift-off forces that were recorded for each tendon could have been used. The official lift-off forces are presented in column (1) of Table 1.

From column (1) of the table, the average force of the 12 tendon sample is 714 kips. The sample includes two tendons (35 and 36) that were retensioned in May 1969, as part of a 23 tendon group, but not in June 1980 when the remaining 137 tendons were retensioned. As expected, the lift-off forces for #35 and #36 were lower than the remaining sample tendons. Therefore, to make use of the forces from the 12 sample tendons to obtain the expected average tendon force for all 160 tendons in the containment, a weighted average should be constructed. This was done, resulting in the expected average tendon force of 716.

In the Ginna Technical Specification, Section 4.4.4.2 provides the acceptance criterion for the lift-off forces. The criterion requires that the average stress of the sample tendons not be less than 144,000 psi, which translates into 636 kips. The 636 kips represents the minimum required average tendon force for the tendons. Considering that in this surveillance the tendon sample includes tendons that were not retensioned in June 1980, the weighted average of the sample forces (rather than the absolute average) should be compared to the 636 kips requirement. The weighted average of 716 kips exceeds the minimum requirement of 636 kips by 12.6%.

COMPARISON WITH PREDICTED FORCES

In order to determine if the tendons are experiencing an abnormal rate of force loss with time, the measured lift-off force for each sample tendon was compared with the force predicted for the tendon. These predicted forces are shown in column (2) and column (3) of Table 1.

Two methods for predicting the lift-off forces are presented, denoted in Table 1 as "ESR RELAX. WITH RT" and "16% RELAX. WITH RT." The difference in the methods is due to different stress relaxation properties assumed for the tendon wires. These properties result from the evaluation of the stress relaxation testing program performed at Lehigh University. The method for establishing the stress relaxation values is summarized below. A detailed report on this work will be provided as part of the final report on the completed tendon surveillance program.

In one case, the individual Effective Stress Relaxation (ESR) values of the tendons as determined from the June 1980 lift-off tests were used. These are the values of stress relaxation which individual tendons had to exhibit in order for the predicted and measured forces to be equal in June 1980, after deducting other known losses. The ESR values were then reduced by the factors developed from the Lehigh restressed wire tests to take into account the fact that the tendons were retensioned in June 1980. These factors significantly reduce the ESR values and, consequently, result in higher values of predicted tendon force. In the second case, a stress relaxation curve developed from the Lehigh tests on both the unrestressed and the restressed wires was used. From the test results of the sample wires (prior to restressing) for Tendon 76 (heat #30091) and Tendon 51 (heat #19477), 90°F stress relaxation curves were constructed by linear interpolation between the 68°F and 104°F test curves. The 90°F temperature was selected as an average value for the 85°F to 95°F range which the tendons are expected to have experienced during most of their existence in the containment. This resulted in one curve for heat #30091, with a 16.7% stress relaxation value at 100,000 hours, and one curve for heat #19477, with a 14.2% stress relaxation value at 100,000 hours. The time of 100,000 hours was selected since the June 1980 lift-off tests occurred at approximately 100,000 hours after original tensioning in 1969. In these tests, the average ESR value was

approximately 15% for each of the three heats tested. Therefore, since this value was within the 14.2% and 16.7% values described above, 15% at 100,000 hours was selected to establish the one stress relaxation curve to be used for all the tendons for future force predictions. This curve was determined by scaling the 16.7% curve for heat #30091 at 15% at 100,000 hours. The 16.7% curve was selected instead of 14.2% curve to establish the shape of the 15% curve because the 16.7% curve was based on longer-time data; consequently, its shape was established more accurately out to 40 years. The resulting curve with 15% at 100,000 hours exhibits a 40-year relaxation of 15.9%; therefore, it is referred to as the 16% RELAXATION case in Table 1. Finally, the same factors discussed above to account for the retensioning effect (to reduce relaxation) were applied to the 16% curve, and this is noted as 16% RELAX. WITH RT in the table.

The two relaxation cases described above were in effect for the July 1983 surveillance as part of the task to determine if one curve, 16% RELAX. WITH RT, could be used for all the tendons to predict forces which are in reasonable agreement with those measured.

A comparison of the lift-off forces with the two predictions generally shows good agreement. For 8 of the 12 tendons, the forces in the tendons exceed the predicted values. For the remaining 4 tendons, the amount by which the measured forces are less than predicted is small and well within the 5% tolerance allowed. The actual percent differences are shown in columns (4) and (5) of Table 1.

CONCLUSIONS

The results of the partially completed tendon surveillance, in which 12 of the 18 sample tendons have been lift off tested, indicate that the forces in the tendons are being maintained at the levels expected, and that no abnormal force losses have occurred.

Based on the forces measured in the sample tendons, the average force level of the tendons in the containment is 716 kips, exceeding the Technical Specification minimum required value of 636 kips by 12.6%.

CAF/110

TENDON NO.	LIFT OFF FORCES (KIPS) MEASURED	PREDICTED ESR RELAX. WITH RT	PREDICTED 16% RELAX. WITH RT	MEAS-PRED / PRED (%) ESR RELAX. WITH RT	MEAS-PRED / PRED (%) 16% RELAX. WITH RT
	(1)	(2)	(3)	(4)	(5)
13	730	693	711	5.3	2.7
18	727	703	721	3.4	0.8
35*	662	661	650	0.2	1.8
36*	664	686	661	-3.2	0.5
40	731	714	711	2.4	2.8
51	709	718	712	-1.3	-0.4
53	731	697	711	4.8	2.8
60	711	712	707	-0.1	0.6
62	715	723	720	-1.1	-0.7
75	723	705	709	2.5	2.0
155	745	709	703	5.1	6.0
160	721	711	709	1.4	1.7
AVE.	714	703	702		
WT. AVE.	716				

*Retensioned in May 1969.

TABLE 1. MEASURED AND PREDICTED TENDON FORCES