ENCLOSURE 1

SAFETY EVALUATION
CONTAINMENT VESSEL TENDONS SURVEILLANCE PROGRAM.
R.E. GINNA NUCLEAR POWER PLANT
ROCHESTER GAS AND ELECTRIC CORPORATION
DOCKET NO. 50-244

1.0 INTRODUCTION

In 1977, as a result of required surveillance, the vertical prestressed tendons at Ginna Nuclear Plant were found to have lost prestress in excess of that predicted to be lost over the 40-year lifetime of the plant. The tendons are connected to rock anchors and are tensioned to prestress the concrete containment in the axial direction thereby increasing its capability to resist the internal pressure and earthquake loads.

In order to assure containment resistance to the design loads, the tendons were retensioned in 1980 to meet the design requirements. Also, an investigation was made by the licensee to determine the cause(s) of the prestress loss and to evaluate the adequacy and capability of the containment building/rock anchor system.

The results of the stress relaxation tests on tendon wires, conducted at Lehigh University since 1980 and the results of the latest surveillance after tendon retensioning, performed in July and November 1983, were submitted to NRC in April 1984.

Franklin Research Center (FRC) was contracted in July 1984, to provide expert capability and experience to review the reports to verify the adequacy and integrity of the containment structure. FRC, assisted by

Geotechnical Engineers Inc., completed its technical evaluation in March 1985.

2.0 EVALUATION

Even though the Licensee identified tendon stress relaxation as the main cause of excessive loss of prestress tension, FRC selected the following topics for further detailed evaluation:

1. Lift-off Force Measurement
2. Creep of Concrete
3. Creep of Elastomeric Pads
4. Wall Tendon Stress Relaxation
5. Rock Anchors

FRC's findings and conclusions are:

1. In order to include the effect of retensioning on the relaxation of the tendon, the licensee has developed the "factor method" for tendon relaxation prediction. This method will be used to analyze and control the source of tendon force loss. The method appears to be more accurate than other techniques used in tendon surveillance prior to 1980. However, there are only three test specimens from the same tendon wire; consequently, the tendon relaxation predicted will be only as accurate as this small tendon sample population will permit.

2. The improvement of measuring accuracy for tendon displacement (or stressing jack ram displacement) when used in conjunction with

improved tendon force measurement would provide data to evaluate the behavior of the rock anchors.

3. The consistency of relaxation test results for test specimens from two tendon wires that represent two material heats may not be sufficiently representative of all six heats of material used in the tendons.

4. The methods employed by the licensee for rock creep analysis are based upon an incorrect extrapolation analysis that ignores shear mode creep.

FRC recommends:

1. Since there are insufficient data upon which the refined relaxation prediction methods are based, the licensee should maintain lift-off force surveillance of the wall tendons to offset the deficiency.

2. Continue the experimental investigation of tendon wire relaxation using a larger and broader sample of test specimens. This would provide a better foundation of knowledge to guide future lift-off surveillance programs and aid in the explanation of any further unexpected behavior.

3. Introduce more accurate measurement and recording methods for tendon elongation and stressing jack displacements to enable

comparative estimates of tendon system behavior in an effort to discern rock anchor slippage.

4. Re-examine previous analysis for rock creep and provide analysis based upon more comprehensive methods including shear mode effects and extrapolation of rock test data.

The staff concurs with the FRC's conclusions. We also agree that FRC recommendations should be adopted by the licensee. In particular, improvement in the measurements of future tendon force and displacement, the expansion of test data bases, and the re-examination of rock creep analysis as recommended by FRC would further enhance our understanding about the behavior of these tendons and should be incorporated into the licensee's surveillance program. Such improvements should be included in the licensee's furture surveillance program.

3.0 CONCLUSION

Based on FRC's review of licensee's reports and FRC's evaluation, the staff concurs with the licensee that stress relaxation as the cause of the loss of tendon forces has been reasonably established. From the results of lift-off tests in July 1981 and July 1983, and from readings of the four load cells, it appears that the tendon forces are stable and there are no abnormal tendon force losses. In view of the above, the staff concludes that the adequacy and integrity of the containment structure is assured.

However, the staff requires that the FRC's recommendations be incorporated into the licensee's future surveillance program and that licensee submit to NRC, for review, the results of tendon surveillance to be performed.

4.0 REFERENCES

1. Letter from R.W. Kober of RGE to D.M. Crutchfield of NRC, dated March 26, 1984, subject: Containment Vessel Tendon Evaluation Program, R.E. Ginna Nuclear Power Plant (GAI Report 2512).

2. Letter from R.W. Kober of RGE to D.M. Crutchfield, dated April 10, 1984, subject: Containment Vessel Tendon Evaluation Program, R.E. Ginna Nuclear Power Plant (GAI Report 2521).

3. Tendon Evaluation Report - Rochester Gas and Electric Corp., R.E. Ginna Nuclear Power Plant by Franklin Research Center, dated March 29, 1985.