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SUBJECT: Special rept:on 880721,discovered that ultimate strength of vertical tendom wire below min specified value.

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SPECIAL REPORT

LOW MATERIAL ULTIMATE STRENGTH FOR VERTICAL TENDON WIRE

DESCRIPTION

On July 21, 1988, during the performance of the fifteenth year tendon surveillance of the Turkey Point Unit 4 containment post-tensioning system, the results of the tensile tests for wire samples taken from surveillance tendon 12V29 of the vertical tendon group revealed that the ultimate strength of the wire was below the minimum specified value of 240,000 psi by approximately 1 percent. As a result, the plant entered an action statement requiring restoration of the containment vessel to the required level of integrity within 72 hours, performance of an engineering evaluation of the containment, and the submission of a Special Report to the Commission within 15 days. This action statement is part of procedure O-ADM-021, "Technical Specification Implementation Procedure," and not a part of the current Technical Specifications to which Turkey Point is licensed. As this report is not required by Turkey Point's current Technical Specifications, it is being submitted as a voluntary Special Report in accordance with O-ADM-021.

The Turkey Point Unit 4 reactor containment structure consists of a flat reinforced concrete base mat, an upright prestressed concrete cylinder and a shallow prestressed concrete dome. The prestressing force is provided by an unbonded post-tensioning system. The system consists of 180 vertical, 489 horizontal, and 165 dome tendons. Each tendon consist of 90 - 1/4 inch diameter wires. The tendons are inserted inside sheathing ducts embedded in the concrete, and anchored on both ends by means of steel anchor blocks. The wires are anchored to the anchor blocks by cold formed button heads. The tendon ducts are filled with a corrosion inhibiting grease, and the end anchorages are covered with tightly bolted caps.

The post-tensioning system for the Turkey Point Unit 4 containment has been in service since 1972. Periodic inspections have been performed previously on the tendon system in accordance with Technical Specification requirements.

In order to perform the surveillance, one wire was removed from a designated surveillance tendon in each directional tendon group (dome, vertical, and hoop) for tensile testing. Tensile tests were performed on three samples cut from each removed wire, one at each end and one at mid-length. The results of these tests revealed that two samples cut from the wire removed from vertical tendon 12V29 did not conform to the minimum ultimate tensile strength value of 240,000 psi. The minimum ultimate tensile strength of the wire was reported as 238,000 psi which is approximately one percent below the minimum value established by specification ASTM A421.

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ANALYSIS

This deficiency involves only the ultimate tensile strength of the wire. The results of the tensile testing provides evidence that the yield strength of the wire meets the specified minimum value of 192,000 psi in accordance with the requirements of the ASTM A421-65 specification. Although the original jacking force in the tendons is related to the material ultimate strength, the design of the post-tensioning system is based upon the stress in the wire not exceeding the yield strength. Since the actual yield strength values were higher than the required yield strength of 192,000 psi, the deficiency of 1% in the ultimate strength of one wire in tendon 12V29 will not have any detrimental effect on the load carrying capabilities of the tendon.

The results of the tensile testing also show that the total elongation at fracture conforms to the ASTM specified minimum value of four percent. In addition, the results of the wire inspection indicated no deterioration of the tendon wires, and the corrosion level was within acceptable limits.

The containment post-tensioning system is designed to provide additional margins beyond the design criteria requirements:

- 1) As described in the FSAR, three vertical tendons spaced approximately 120 degrees apart have been provided over and above the structural requirements for the purpose of inspection and obtaining lift-off readings. In addition, as stated in the FSAR, any three adjacent vertical tendons can be lost without significantly affecting the strength of the containment structure. This design feature considers the load redistribution capabilities of the containment shell.
- 2) Recent evaluations and testing to assess the ultimate capacity of reactor building containment structures similar to the Turkey Point containment design have shown an ultimate capacity of 2.5 to 3.0 times the design pressure.

No abnormal conditions which could have resulted in this deviation were identified.

Based on the design margins incorporated in the post-tensioning system and the fact that the measured yield strength exceeds the required yield strength, it is concluded that the functional capability of the post-tensioning system and the structural integrity of the containment structure are not adversely affected by the low recorded value of ultimate strength in the wire taken from tendon 12V29.

CORRECTIVE ACTIONS

Tendon 12V29 was retensioned to its initial lift-off value (minus zero percent, plus six percent).



AUGUST, 4 1988

L-88-335

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

Gentlemen:

Re: Turkey Point Unit 4
Docket No. 50-251
Special Report - Low Material Ultimate
Strength for Vertical Tendon Wire

In accordance with Turkey Point Administrative Procedures the attached Special Report is provided for your information.

Should there be any questions on this information, please contact us.

Very truly yours,

W. F. Conway
W. F. Conway
Senior Vice President - Nuclear

WFC/RG/gp

Attachment

cc: Dr. J. Nelson Grace, Regional Administrator,
Region II, USNRC
Senior Resident Inspector, USNRC, Turkey Point Plant

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