UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION
ARKANSAS NUCLEAR ONE
FIVE YEAR CONTAINMENT TENDON SURVEILLANCE

INTRODUCTION

The prestressed concrete containment for the Arkansas Nuclear One, Unit 2 uses a system of ungrouted tendons to provide the required compression forces to prevent containment leakage in the event of an accident inside the containment. These tendons require periodic inspection to ensure the capability is available if needed. This inspection is required at the end of one year, three years, five years and every five years thereafter. The current inspection report is the third in the series.

BACKGROUND

The Arkansas containment is a prestressed concrete shallow domed shell which uses 186 - 1/4 inch diameter wire tendons inserted in metal sheaths cast in the concrete walls and dome. Three types of tendons (horizontal, vertical and dome) are used in the containment prestressing system. The horizontal tendons encircle the cylindrical part of the containment. Each tendon encircles 240 degrees of the cylinder and is anchored on each end at two of the three buttresses. The dome tendons are anchored to a large concrete ring at the top of the cylindrical shell. The vertical tendons in the cylindrical section are anchored at the aforementioned ring and the bottom of the containment base mat. The tendons are tensioned to provide a prestressing force of approximately 1400 kips.

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DISCUSSION

The information pertinent to the five year tendon surveillance is contained in a report entitled "FIVE YEAR VISUAL TENDON SURVEILLANCE OF THE ARKANSAS NUCLEAR ONE - UNIT 2 PRIMARY REACTOR CONTAINMENT BUILDING", revision 1 dated June 14, 1983. This report, submitted by the licensee, contains copies of the surveillance data and the procedures used in the surveillance.

Tendon surveillance is required by the licensee's Technical Specification for plant operation. Inspections are prescribed at periodic intervals after the initial tendon installation and tensioning. These intervals are at the end of one year, three years, five years, and each five years thereafter. The licensee has visually inspected a total of 21 tendons (5 vertical, 10 horizontal and 6 tendons in the dome).

Regulatory Guide 1.35, Revision 1 contains the staff position relative to the inspection of ungrouted tendons when identical containment structures are located on one site. The staff requires that the containment structures have no environmental or other apparent differences and that they were constructed by the same contractor in the same manner at the same time (continuous construction). If these conditions prevail then the second containment tendons need only be visually inspected. The Arkansas Nuclear One,Unit 2 FSAR Section 3.8.1.7.3 states that Unit 1 and Unit 2 containments were constructed continuously by the same contractor in the same manner. The units

are approximately 4 years apart in time and were designed and constructed by the same contractor. Therefore, only a visual inspection of the tendons is required.

The tendon surveillance conducted by the licensee was confined to a visual inspection of the physical condition of a randomly pre-selected group of surveillance tendons and a chemical analysis of the tendon sheath filler material. The tendons selected, from each of the three types, were 10 horizontal, 5 vertical, and 6 dome tendons. Three tendons (12H2, V101, and 3D111), one from each type were common to the 1, 3, and 5 year surveillance. The use of a common tendon during the first five years of tendon surveillance is required by the staff. The inspection consisted of removing the tendon caps, cleaning off the filler material and inspecting the tendon end anchorages for corrosion, cracks, and buttonhead size and condition.

The results of the visual inspection of the tendon end anchorage revealed no evidence of corrosion nor abnormal degradation. All areas were bright metal with no visible oxidation except for the field end of tendon 12H15, 32H37, 32H43 and the shop end of tendon 32H51. These tendon anchorages showed some area that were reddish brown color (no pitting) limited to 20% of the area of the anchorhead. This condition was considered acceptable by the licensee. The buttonheads on the ends of the individual wires that make up the tendon were examined for size and splits. Two tendons were

found with one split buttonhead each while a large number were listed as offsize. Specifically tendon 32H51, field end, had 96 offsize buttonheads while 10 other tendons ends had 10 or more offsize buttonheads. The licensee stated in the report that this was a measurement problem caused by the go/nogo gauge not being able to pass over pairs or groups of buttonheads. The licensee stated that on further inspection the buttonheads were not offsize but spaced too close for the go/nogo gauge to pass between them. The licensee did not explain how they determined the buttonheads were of the correct size. The licensee noted this condition was observed in the 3 year surveillance. The licensee stated in the report that none of the offsized buttonheads showed any signs of slips or splits.

Samples of the tendon sheathing filler material were taken from the tendon anchorages for analysis. The filler material was tested for the water content, water soluble chlorides, nitrates and sulfides using ASTM standards D-95, D-512, D-992 and Alpha respectively. The filler material was also tested for the neutralization number per ASTM D-644, D-974, and D-974 (modified). The 1983 version of the ASME code Section III Division 2 Subsection CC-2442 requires the use of ASTM D-974 (modified) for the neutralization number. The filler material met the requirements of all the ASTM standards used.

An exceptionally large amount of filler material was noted as being removed from two vertical tendons, V78 and V101. The amount noted in Table II of the report as removed (which was in reality leakage) was

44 gallons for each tendon while 57 and 45 gallons were replaced in tendons V78 and V101 respectively. This loss of material was attributed to an improperly sealed tendon cap. No mention was made in the report as to what happened to this material and why it was not discovered earlier. If the material dripped out of the tendon cap it must have been noticeable. V101 was a tendon common to the 1 year and 3 year surveillance, whereas, tendon V78 was only included in this surveillance. Therefore tendon V78 could have been deficient in filler material for some time. Only a nominal amount of filler material was removed and replaced in the other tendons. The amount was only in the order of a couple of gallons and is considered normal.

EVALUATION

The five year tendon surveillance for Arkansas Nuclear One Unit 1 was a visual inspection of the tendon anchorages, performed in accordance with the plants technical specifications and the requirements of Regulatory Guide 1.35, Rev. 1, June 1974, Regulatory Position C2. The regulatory position allows for a visual inspection of the tendon anchorages given certain conditions. The unit meets these conditions. The tendon selection was in accordance with the Regulatory Guide 1.35, Revision 1, Regulatory Position C5: 3 tendons from each of the groups (dome, vertical, and horizontal) were selected. The tendon anchorage assembly hardware was visually inspected for abnormal conditions, and none were found. Samples of the tendon sheath filler material were removed and tested. The tendon anchorage assembly hardware was

essentially free of corrosion with the only exceptions noted were a few small areas of surface oxidation. No pitting or severe corrosion was found by the licensee. No evidence of cracking of the concrete or bearing plates was noted. The samples of tendon filler material was tested and found to meet the requirements of the code and ASTM specifications.

Two tendons had an abnormal amount of filler material replaced. The material loss was attributed to the faulty installation of seals. One of the tendons was the common tendon for the first five years of surveillance while the other one was not. The licensee should establish a program for visually inspecting the tendon caps periodically for signs of leakage of the filler material especially the lower caps for the vertical tendons.

CONCLUSION

The five year tendon surveillance for Arkansas Nuclear One, Unit 2 was performed in accordance with the regulatory requirements and the tendons met the requirements imposed by the reference standards and the NRC staff requirements. The five year tendon surveillance is considered acceptable to the staff with the exception that the tendon caps should be monitored more frequently for signs of filler material leakage.

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