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September 17, 2004

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop P1-137
Washington, DC 20555-0001

ULNRC05053

Ladies and Gentlemen:

DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
FACILITY OPERATING LICENSE NPF-30
SPECIAL REPORT
TWENTIETH YEAR INSERVICE CONTAINMENT BUILDING TENDON SURVEILLANCE AND CONCRETE INSPECTION

The enclosed Special Report contains an engineering evaluation submitted in accordance with Final Safety Analysis Report (FSAR) Section 16.6.1.2.b.

During the performance of the twentieth year tendon surveillance and concrete inspection, FSAR 16.6.1.2.1(d).2 acceptance criteria was exceeded on four tendons. This was due to the volume of the sheathing filler grease injected exceeding the FSAR stated allowance on those four tendons. The attached Special Report and engineering evaluation are applicable to all four tendons found with this condition. The observation of the first tendon in this condition occurred on August 20, 2004, and the 30-day reporting requirement is based upon this date. Based on the enclosed engineering evaluation, the observed voids in the sheathing filler grease do not indicate degradation of the post-tensioning system. The structural integrity of the containment building structure is assured.

This letter does not contain new commitments. If there are any questions, please contact us.

Sincerely,

Keith D. Young
Manager, Regulatory Affairs

Enclosure

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A047

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SPECIAL REPORT
Attachment to ULNRC05053

EVALUATION OF THE TWENTIETH YEAR INSERVICE TENDON SURVEILLANCE AND EXTERIOR CONCRETE INSPECTION FOR THE CALLAWAY PLANT CONTAINMENT BUILDING

TENDON SHEATHING FILLER GREASE VOIDS
GREATER THAN 5% OF NET SHEATHING DUCT VOLUME

REFERENCE TECHNICAL SPECIFICATION BASIS DOCUMENT SECTION 3.6.1.2,
TECHNICAL SPECIFICATION ADMINSTRATIVE CONTROL DOCUMENT SECTION 5.5.6
AND THE FINAL SAFETY ANALYSIS REPORT (FSAR) SECTION 16.6.1.2.1(d).2

GREASE VOID FINDINGS

During performance of the Callaway Plant's twentieth year containment tendon surveillance and concrete inspection it was discovered that the net refill volume of the sheathing filler grease exceeded 5% of the net duct volume on four tendons. This void condition did not meet the acceptance criteria stated in the FSAR Section 16.6.1.2.1(d).2.

The FSAR requires verification of operability of the sheathing filler material, by assuring the "amount of grease replaced does not exceed 5% of the net duct volume, when injected at ±10% of the specified installation pressure." Since a void greater than 5% was discovered after filling, restoration of the tendon sheathing filler grease and the FSAR action statement 16.6.1.2.b was immediately satisfied with the exception of the Special Report. The NRC staff concurred with this position in a meeting on the same subject for the first year tendon surveillance on July 19, 1985.

The grease void conditions are documented in the surveillance contractor's non-conformance reports, FN 923-002 and FN 923-003, and AmerenUE's corrective action documents 200406604, 200406889, 200406929 and 200407012.

The measured voids are:

Tendon Surveillance Greasing Summary

Tendon	Percent Void
44CB	12.80
48AC	5.81
V13	6.91
V30	9.76

BACKGROUND

The Callaway containment building is a post-tensioned, reinforced concrete structure comprised of a vertical cylinder with a hemispherical dome roof and is supported by a reinforced concrete slab. A continuous access gallery is provided beneath the foundation slab for inspection of the vertical tendons. Three concrete buttresses are provided for anchorage of the horizontal tendons. Anchorages are designed such that the tendons can be detensioned, inspected and retensioned readily during the life of the plant. The vertical cylinder wall is provided with a system of vertical and horizontal (hoop) tendons. Vertical tendons are continuous to form inverted U's that extend over the dome. The configuration of the

tendons in the dome is based on a three-way system consisting of two groups of vertical tendons oriented at 90 degrees with respect to each other and a horizontal (hoop) group extending from the spring line to approximately 45 degrees from the horizontal. Hoop tendons in both the wall and the dome are placed in a 240 degree system in which three tendons form two completed rings using three buttresses for anchoring the tendons. Each tendon is comprised of a maximum of 170 - 1/4 inch diameter wires, terminating at each end with a cold formed buttonhead at the anchorage fixture.

The essential criterion for operability of the tendon system is to maintain the required prestressing force over the life of the plant. This prestressing force for an individual tendon is commonly referred to as the "lift-off" force. Additional characteristics of a tendon are determined by performing visual examinations and tensile testing of the wire removed from a minimum of one horizontal and one vertical tendon during each tendon surveillance activity. An individual tendon has a maximum of 170, 1/4 inch diameter wires. This number of wires provides a redundant system so that a defect in an individual wire will not compromise the strength of the entire tendon.

DISCUSSION OF FILLER MATERIAL

The essential criterion for the operability of the sheathing filler material is to prevent corrosion of both the tendon wires and the anchorage components. The material used in the Callaway Plant post-tensioning system, Visconorust 2090P-4, accomplishes this by a characteristic which gives the filler grease an affinity to adhere to steel surfaces, an ability to emulsify any moisture in the system which nullifies its rusting tendency, and resistance to moisture, mild acids and alkalis. In addition, protection is afforded by each tendon wire being individually pre-coated with grease, Amber 1601, prior to initial installation.

Previous surveillance results indicate that grease voids do not affect the corrosion inhibiting properties of the grease. Tensile tests on the removed wires, and visual inspections of the filler grease and tendon components, indicate that the filler grease is performing its intended function of prohibiting or arresting corrosion of the tendons.

The void in the tendon sheathing, as indicated by the refill volume varying from 5.81% to 12.80%, may be attributed to a number of factors:

1) Visconorust 2090P-4 has a coefficient of expansion which yields an expansion of about 1% per every 20°F. Initial filling temperatures of the filler grease averaged 160°F. Cold weather conditions can cool the filler material to 40°F, giving a contraction of 6% of the net duct volume. During the twentieth year in-service surveillance of the tendons, the temperature of the insitu filler grease was in the range of approximately 80°F, giving a contraction of approximately 4% from initial fill.

2) Characteristics of the initial filling method may induce air entrapment into the filler grease. Pumping operations can introduce air into filler material and may add up to as much as 2% of the net duct volume. The tendons at Callaway Plant were initially greased between April and October, 1981 by Inryco using current industry standard filling procedures.

3) Calculated voids between the wires that compromise the tendon bundle are approximately 7% of the net duct volume. During the initial filling operations, the tendon bundle was cold (ambient temperature of 65°F) and as the heated filler grease (exit temperature of 140°F) was pumped into the sheathing void, it solidified on the surface of the tendon bundle, leaving small voids between the wires. As the filler grease gradually heated the tendon bundle, it is possible that the voids between the wires allowed migration of the filler grease into the tendon bundle. Because this process is slow and gradual, it is reasonable to expect that it took place substantially after the filling operation was complete and possibly during the surveillance refill operation. In addition, this type of migration could also occur at other areas such as where tendons are in contact with the sheathing.

In addition, visual inspection of the exterior concrete of the containment building and of the grease caps after the initial greasing, and during the surveillance inspections, revealed very minor amounts of grease seepage from the tendon grease caps. Therefore, refill volumes in excess of the lost grease during the surveillance indicate that the voids existed within the tendon duct boundary.

The Callaway Plant tendons requiring net refill volume of the filler material in excess of the 5% criteria have not shown any abnormal visual deterioration. The lift-off force for those tendons was found to fall within or above the predicted limits. Visual inspection of the different components of the anchorage system, and wires removed from tendon 48AC and tendon V30, revealed proper coverage by the filler material with no signs of corrosion or presence of water.

CONCLUSIONS

As indicated above, the function of the filler grease protecting the post-tensioning system was maintained. As long as sufficient filler grease has been introduced into the system to coat the tendon wire bundle and anchorage system, corrosion protection is assured. Voids can be expected due to the characteristics of the filler grease and initial filling operations as noted above. Since each wire is individually pre-coated with Amber 1601, the degree of filling interstitial spaces, which comprise the net duct volume, is not directly related to the degree of coating which occurs, and therefore, is not a major indicator of the operability of the post-tensioning system. Based on the lift-off results, visual inspection, and results from the first, third, fifth, tenth, fifteenth and twentieth year surveillances, we have concluded that the structural integrity of the tendon and anchorage system has not been adversely affected by the measured voids.

It is concluded that "voids in excess of 5% of the net duct volume" have not resulted in any degradation of the post-tensioning system, assuring the structural integrity of the containment building structure.

SUMMARY

The evaluation of measured voids in the tendon sheath demonstrates that the voids have not caused degradation of the post-tensioning system.

Future scheduled surveillances of the post-tensioning system and full pressure integrated leak rate tests will monitor the structural parameters of the containment to detect any potential abnormal degradation, assure continued operability of the system, and verify containment building structural integrity.

This report has been filed to meet the 30-day Action Statement as specified in the FSAR Section 16.6.1.2.b.