Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402-2801

September 20, 2010

10 CFR 50.55 (e)

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

In the Matter of) Docket Nos. 50-438 and 50-439
Tennessee Valley Authority)

TENNESSEE VALLEY AUTHORITY (TVA) – BELLEFONTE NUCLEAR PLANT (BLN) UNITS 1 (CPPR-122) AND 2 (CPPR-123) – CONTAINMENT VERTICAL TENDON COUPLING FAILURE – THIRD INTERIM REPORT

The purpose of this letter is to provide the NRC with the third interim report on the subject matter which was initially reported to the NRC Operations Center on December 10, 2009 as Problem Evaluation Report 200119. The enclosure to this letter contains the third interim report. The attachment to the enclosure provides the list of commitments made in this submittal. TVA expects to submit the next report by March 31, 2011.

Sincerely,

Daniel Pratt
General Manager
Bellefonte Project

Enclosure:
1. 10 CFR 50.55(e) Third Interim Report Bellefonte Nuclear Plant (BLN) Containment Vertical Tendon Coupling Failure

cc: See page 2

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10 CFR 50.55(E) THIRD INTERIM REPORT
BELLEFONTE NUCLEAR PLANT (BLN)
CONTAINMENT VERTICAL TENDON COUPLING FAILURE

Description of Deficiency

Inspection of failed Unit 1 Reactor Building Containment Vertical Tendon V9 indicates a potential for an unknown common mode failure mechanism for BLN Containment vertical tendon rock anchor couplings. Unit 1 Reactor Building Containment Vertical Tendon V9 experienced a failure of the rock anchor/tendon anchor coupling on August 17, 2009, at approximately 1400 CDT. The time of failure was identified based on a loud noise being reported by several individuals. Initial investigation failed to reveal the source of the noise. The failed tendon was discovered on August 24, 2009, during a tour of the U1 Tendon Gallery, elevation 607. Potentially unsafe conditions delayed inspection of the failed coupling for proper installation or component specific damage until November 23, 2009. That inspection showed no signs of component-specific damage or improper installation, thus indicating the potential for an unknown common mode failure.

Safety Significance

TVA made a determination of the mechanism of failure and a preliminary assessment of the extent of the condition. If multiple containment tendons had been found to be losing the capability to carry tendon design force, and this condition was left uncorrected, this could have jeopardized the ability of the containment structure to perform its design function.

Cause of Deficiency

The failure mode was determined to be hydrogen-induced stress corrosion cracking (SCC). The root cause of the failure was determined to be water in contact with the grease surrounding the failed coupling in a high stress area. For this morphology to occur, a high stress level in the coupling combined with sulfides and water in the grease must exist.

Interim Progress

To determine extent of condition, grease analysis, review and evaluation of tendon history, and NDE testing of potentially two high risk tendons and two randomly selected tendons were performed. Extent of condition has been thus far limited to the one tendon which has experienced SCC. There has been no indication of SCC of any tendon component. The remaining activities to close the extent of condition evaluation, as well as other planned future actions, are provided in this report.

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- Actions Taken Since Last Report and Results

  To determine the extent of condition the following actions have been completed since the March 29, 2010 report.
  - Grease analysis has been completed on 185 of 185 vertical, and 12 of 264 horizontal tendons. The lower grease can for vertical tendon V-41 contained approximately one teaspoon of free water. No other reportable conditions as specified in Regulatory Position 7.4 of Regulatory Guide 1.35, R3 (RG 1.35) have been identified.
  - Vertical tendons V-41 and V-121 were identified as having a higher probability of coupling SCC. This was due to the presence of free water when grease was sampled from tendon V-41 and the fact that V-121 was exposed to water during construction.
  - Vertical tendons V-41 and V-121 were selected for NDE testing based on the higher potential for coupling SCC, and dome tendon D3C17 and horizontal tendon 106BD were selected randomly for testing. All four tendons were detensioned, disassembled, cleaned and components NDE examined with ASME Code Section V magnetic particle and ultrasonic techniques. Linear phased array and straight beam UT techniques were utilized during the ultrasonic examinations. No indications of SCC were identified during the NDE examinations of components for the four tendons.
  - One tendon wire from V-121 failed during detensioning. A detailed failure analysis is being conducted in conjunction with tensile testing as defined in RG 1.35, section 5.3. The results of the tendon wire metallurgical failure analysis and tensile test results will be reported in the next interim report.
  - The couplings from V-41 and V-121 were sent to the TVA Central Labs to validate the field magnetic particle and ultrasonic examination results. Both couplings were split axially and magnetic particle examined in the lab. No indications were identified. Metallurgical axial cross sections through the threaded area of the couplings were examined for the presence of SCC. No cracking was identified. The two couplings will undergo mechanical testing, chemical analysis and microstructure characterization and the results will be reported in the next interim report.
  - Work has been authorized for the development of a containment vertical tendon detensioning plan, taking into consideration the Crystal River concrete voiding experience in which the sequence of detensioning was found to be a factor in concrete cracking. Once a detensioning plan has been developed, an independent review will be conducted prior to the start of containment detensioning activities. TVA will then detension the tendons in order to perform the remaining NDE in support of completion of the Extent of Condition evaluation.
  - Coupling design improvements are being considered to improve the corrosion resistance of replacement couplings. As indicated, several activities remain to be completed to close the extent of condition evaluation. These are: mechanical testing, chemical analysis and microstructure characterization of the couplings from tendons V-41 and V-121; and failure analysis and tensile tests of the tendon wire from V-121, which failed during detensioning.

- Further Action Planned
  - Complete failure analysis and tensile testing of failed tendon wire from V-121, and report results.
  - Complete mechanical testing, chemical analysis and microstructure characterization of couplings from tendons V-41 and V-121, and report results.
  - Develop a containment vertical detensioning plan considering Crystal River concrete voiding experience in order to detension prior to performance of NDE in support of completing the Extent of Condition evaluation.

BLN corrective action program Problem Evaluation Report (PER) number 200119 continues to be used to document and manage the V-9 coupling failure assessment and the corrective actions which will be implemented to prevent recurrence.

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ATTACHMENT TO
10 CFR 50.55(E) THIRD INTERIM REPORT
BELLEFONTE NUCLEAR PLANT (BLN)
CONTAINMENT VERTICAL TENDON COUPLING FAILURE

LIST OF COMMITMENTS

1. TVA will submit an update to this interim report prior to March 31, 2011.