



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

March 29, 2012

10 CFR 50.55(e)

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

Bellefonte Nuclear Plant, Units 1 and 2
Construction Permit Nos. CPPR-122 and CPPR-123
NRC Docket Nos. 50-438 and 50-439

Subject: **CONTAINMENT VERTICAL TENDON COUPLING FAILURE – FIFTH INTERIM REPORT**

- Reference(s):
1. U.S. Nuclear Regulatory Commission Operations Center Event Report No. 45559, dated December 10, 2009 [ML093490942].
 2. Letter from TVA to NRC, "Bellefonte Nuclear Plant (BLN) Units 1 (CPPR-122) and 2 (CPPR-123) – Containment Vertical Tendon Coupling Failure – First Interim Report," dated December 10, 2009 [ML093480158].
 3. Letter from TVA to NRC, "Bellefonte Nuclear Plant (BLN) Units 1 (CPPR-122) and 2 (CPPR-123) – Containment Vertical Tendon Coupling Failure – Second Interim Report," dated March 29, 2010 [ML100900090].
 4. Letter from TVA to NRC, "Bellefonte Nuclear Plant (BLN) Units 1 (CPPR-122) and 2 (CPPR-123) – Containment Vertical Tendon Coupling Failure – Third Interim Report," dated September 20, 2010 [ML102660164].
 5. Letter from TVA to NRC, "Containment Vertical Tendon Coupling Failure – Fourth Interim Report," dated March 29, 2011 [ML110940042].

The purpose of this letter is to provide the NRC with the fifth interim report on the subject matter which was initially reported to the NRC Operations Center on December 10, 2009

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(Reference 1) as Problem Evaluation Report (PER) 200119. TVA has submitted four interim reports on this subject matter (References 2, 3, 4, & 5).

Enclosure 1 of this letter contains the fifth interim report. Enclosure 2 provides the commitment made in this submittal.

TVA will submit the next report by March 31, 2013 or earlier if new information becomes available.

Sincerely,

A handwritten signature in black ink, appearing to read 'K. David Stinson', with a stylized flourish at the end.

K. David Stinson
Vice President
Bellefonte Project

Enclosure(s):

1. 10 CFR 50.55(e) Fifth Interim Report Bellefonte Nuclear Plant (BLN)
Containment Vertical Tendon Coupling Failure
2. List of Commitments

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**10 CFR 50.55(e) FIFTH INTERIM REPORT
BELLEFONTE NUCLEAR PLANT (BLN)
CONTAINMENT VERTICAL TENDON COUPLING FAILURE**

Description of Deficiency

The inspection of the failed Unit 1 reactor building containment vertical tendon V9 rock anchor coupling indicated a potential for an unknown common mode failure mechanism for BLN containment vertical tendon rock anchor couplings. The Unit 1 reactor building containment vertical tendon V9 experienced 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. However, the initial investigation did not determine the source of the noise. The failed tendon was discovered on August 24, 2009, during a tour of the U1 tendon gallery, elevation 607. Because of the potential for unsafe conditions, inspection of the failed coupling for proper installation or component specific damage was delayed 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 reduced the capability of the containment structure to perform its design function. TVA has completed an analysis of containment structure integrity considering both the single tendon coupler failure and the subsequent detensioning that was performed to support the extent of condition assessment and determined that the containment structure is maintaining its design capability. Thus, the interim condition is not causing structural degradation.

Cause of Deficiency

Hydrogen-induced stress corrosion cracking (SCC) was determined to be the failure mode. A root cause of the failure was performed and determined the failure was the result of water in contact with the grease surrounding the failed coupling in a high stress area. Both a high stress level in the coupling and the presence of sulfides and water in the grease are required conditions for this morphology to occur.

Interim Progress

To determine extent of condition, TVA has conducted grease analysis consistent with NRC Regulatory Guide 1.35, reviewed and evaluated tendon history, and performed non-destructive evaluation (NDE) testing of two potentially high risk tendons and two randomly selected tendons, as detailed in the third interim report (Reference 4). The results of the analysis and testing of those tendons showed no signs of SCC, as detailed in the fourth interim report (Reference 5). The extent of condition evaluation has found

no indication of SCC of any tendon component other than the one failed tendon coupling that was initially reported.

Actions Taken Since Last Report

Work has been authorized for the development of a containment vertical tendon detensioning plan, taking into consideration the Crystal River containment concrete delamination experience in which the sequence of detensioning was found to be a factor in concrete cracking. TVA continues to closely monitor the concrete delamination experience at Crystal River and will incorporate applicable lessons learned in the Bellefonte detensioning plan.

Further Actions Planned

- Evaluate potential coupling design changes intended to improve the corrosion resistance of replacement couplings.
- Complete a containment vertical detensioning plan, taking into consideration the Crystal River containment concrete delamination experience, and conduct an independent review of the plan prior to the start of additional containment detensioning activities.
- Issue design drawings and initiate procurement of replacement couplers for tendons that must be retensioned before additional tendons are detensioned to support completion of the extent of condition evaluation.
- Following approval of the final detensioning plan, detension the tendons according to the plan to perform the remaining NDE to support completion of 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 tendon coupling failure assessment and the corrective actions that will be implemented to prevent recurrence.

Enclosure 2
TVA Letter Dated March 29, 2012

**10 CFR 50.55(e) FIFTH INTERIM REPORT
BELLEFONTE NUCLEAR PLANT (BLN)
CONTAINMENT VERTICAL TENDON COUPLING FAILURE**

LIST OF COMMITMENTS

1. TVA will submit an update to this interim report by March 31, 2013.