

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

400 Chestnut Street Tower II

October 28, 1982

WBRD-50-390/82-55
WBRD-50-391/82-52

U.S. Nuclear Regulatory Commission
Region II
Attn: Mr. James P. O'Reilly, Regional Administrator
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

Dear Mr. O'Reilly:

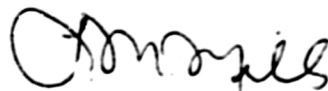
WATTS BAR NUCLEAR PLANT UNITS 1 AND 2 - DEFICIENCIES IN CEMENT MORTAR
LINING BY AMERON - WBRD-50-390/82-55, WBRD-50-391/82-52 - THIRD INTERIM
REPORT

The subject deficiency was initially reported to NRC-OIE Inspector
R. V. Crlenjak on May 21, 1982 in accordance with 10 CFR 50.55(e) as NCR
4117R. Interim reports were submitted on June 21 and August 6, 1982.
Enclosed is our third interim report. We expect to submit our next report
by May 19, 1983. We consider 10 CFR Part 21 applicable to this
deficiency.

If you have any questions, please get in touch with R. H. Shell at
FTS 858-2688.

Very truly yours,

TENNESSEE VALLEY AUTHORITY



L. M. Mills, Manager
Nuclear Licensing

Enclosure

cc: Mr. Richard C. DeYoung, Director (Enclosure)
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

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ENCLOSURE

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2
DEFICIENCIES IN CEMENT MORTAR LINING BY AMERON
NCR'S 4117R, 4133R R1, 4163R, 4270R
MBRD-50-390/82-55, MBRD-50-391/82-52
10 CFR 50.55(e)
THIRD INTERIM REPORT

Description of Deficiency

In order to alleviate the detrimental effects of corrosion on the flow passing capability of large carbon steel piping headers and, thereby, to help ensure adequate flow to system components over the plant lifetime, TVA decided to apply a cement mortar lining to the yard portion of the essential raw cooling water (ERCW) system at Watts Bar Nuclear Plant (see the final report dated September 23, 1981, on nonconformance report (NCR) WBNNEB8017).

During installation, cement mortar lining which does not comply with the governing specifications (i.e., TVA Technical Specification 5225 R0 and TVA Watts Bar Nuclear Plant Construction Specification N3M-921 R0) has been applied to the interior of the ERCW system piping by Ameron Pipe Lining Division of Kenilworth, New Jersey. The nature and apparent cause of these deviations from the specifications reported on NCR 4117R are as follows:

1. In some instances, mortar samples taken indicated higher slumps than those specified due to the addition of an excessive amount of water during batching.
2. In some instances, mortar temperatures exceeded the maximum specified due to the fact that some mortar components were stored in such a way that they were too warm before batching began.
3. During curing of the cement mortar lining, relative humidity readings consistently fell below the minimum specified value due to the requirement to remove end caps from the lined piping sections while taking relative humidity readings.
4. Surface cracks exist which exceed the maximum specified value due to improper curing and excessive heat caused by solar radiation on the exterior of the pipe.
5. In some instances, lining thicknesses are less than that specified.
6. In some instances, lined sections were left uncapped after exit of personnel.
7. One mortar sample taken indicated a slightly lower compressive strength than that specified.

Similar deviations from the specifications have been identified on NCR 4133R R1 and NCR 4163R. Also, one compressive strength sample significantly lower than that specified was documented on NCR 4133R R1.

NCR 4270 documents repairs by Ameron for which the acceptability is in question due to: (1) method of installation of mortar; (2) nonapplication of curing compound; and (3) possibly other matters relating to inspection of completed repairs.

Interim Progress

A visual inspection of the installed cement mortar lining was performed, and all available test data was reviewed. The corrective action for each deviation from the specification noted on NCR 4117R is as follows:

1. High slump - Compressive strength tests performed on samples taken at the same time the slump tests were performed do not indicate unacceptably low strength concrete. Therefore, the sections of lining for which high slump was recorded are acceptable. In the future, if high slumps are encountered, the mortar will be wasted.
2. High mortar temperature - Compressive strength tests performed on samples taken at the same time the high mortar temperatures were recorded do not indicate unacceptably low strength concrete. Therefore, the sections of lining for which high mortar temperatures were recorded are acceptable. In the future, steps will be taken to protect the mix components from solar heating and, if required, ice will be used in the mortar mix to reduce excessive temperatures.
3. Low relative humidity - Visual inspection of the lining did not reveal unacceptable cracking due to improper curing. Therefore, the section of lining for which low relative humidity was measured are acceptable. Tests performed with a strip chart type humidity recorder have shown that if end caps are placed on lined piping sections and if water is introduced into the pipe, an acceptable relative humidity will result. Since the act of measuring relative humidity is in and of itself detrimental to that end, a specification revision notice (SRN-N3M-921-3) has been issued to specify a procedure to ensure proper curing and to delete the requirement of humidity measurements.
4. Surface cracks - The areas of cement mortar lining in header 2A and 2B which had surface cracks were inundated with water for approximately 12 days. At the end of this period the water was removed from these piping segments and the surface cracks were remeasured. The results showed that the surface crack widths were reduced an average of 52 percent. Since the original maximum crack criteria had been established assuming inundation with water, SRN-N3M-921-6 was issued to increase the maximum acceptable surface crack width from 0.02 inches to 0.033 inches for those cracks which have not been inundated by water. The surface cracks have been repaired as required by the revised specification.

5. Mortar thickness - Minimum lining thickness requirements have been reviewed in light of the American Water Works Association's Standard for Cement Mortar Lining (AWWA-C602), which suggests 3/8-inch thickness for "old" pipe and 1/4-inch thickness for "new" pipe. After excavation and inspection of system piping, it has been determined that the pipe being lined fit the definition for "new" pipe and that thicknesses as thin as 1/4-inch are acceptable even though this thickness is less than the thickness originally specified. Accordingly, sections of lining for which the mortar thickness is less than that specified but greater than 1/4-inch are acceptable, and a specification revision notice (SRN-N3M-921-3) has been issued to revise the thickness requirements to allow lining thicknesses as small as 1/4-inch.
6. Caps on ends removed - Visual inspection of the lining did not reveal unacceptable cracking due to improper curing. Therefore, the sections of lining for which the end caps have been found to be removed are acceptable. The contractor has reinstructed his personnel on the importance of replacing end caps, and TVA has limited access into lined sections to authorized personnel.
7. Low compressive strength - The compressive strength of all samples are not significantly below that specified. Therefore, in accordance with a statistical analysis (CEB 820701 003), the section of lining for which the low compressive strength was measured is acceptable.

Also, corrective actions taken to rectify the nonconforming conditions reported on NCR 4117R has been taken for the similar nonconforming conditions reported on NCR 4133R R1 and NCR 4163R. The single average compressive strength sample reported on NCR 4133R R1 which was significantly lower than that specified has been analyzed statistically together with 127 other average compressive strength samples taken from the beginning of the project through July 21, 1982 (sample Nos. 8500 and 8627). All compressive strength sample data analyzed fall within a normalized distribution curve and therefore the segment of cement mortar lining which this compressive strength sample represents is concluded to be acceptable. Visual examination gives no indication of deficiencies and no remedial action is required. No actions to prevent similar low compressive strength samples are required since Ameron has completed the cement lining.

Corrective action for deficiencies reported on NCR 4270R is still being evaluated.