

TENNESSEE VALLEY AUTHORITY

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**OCT 06 1989**

WBRD-50-390/86-39  
WBRD-50-391/86-37

10 CFR 50.55(e)

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

Gentlemen:

In the Matter of the Application of )  
Tennessee Valley Authority )

Docket Nos. 50-390  
50-391

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2 - DEFICIENCIES IN EMBEDDED PLATE  
DESIGN AND CONTROL OF FIELD CHANGES - WBRD-50-390/86-39 AND WBRD-50-391/86-37 -  
FINAL REPORT

The subject deficiency was initially reported to NRC Inspector Gordon Hunegs on March 20, 1986, in accordance with 10 CFR 50.55(e) as Significant Condition Report (SCR) WBN CEB 8623. Previous interim reports were submitted on April 21, 1986, and August 31, 1987. On January 28, 1987, and May 18, 1988, letters extending report schedules were submitted. Enclosed is our final report.

Enclosure 2 provides a list of commitments made in this submittal.

Ken Barr was notified on September 21, 1989 of a two-week delay in submittal of this report.

If there are any questions, please telephone G. R. Ashley at (615) 365-8527.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

*W. R. Ray*  
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Enclosures  
cc: See page 2

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U.S. Nuclear Regulatory Commission

OCT 06 1989

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ENCLOSURE 1

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2  
DEFICIENCIES IN EMBEDDED PLATE DESIGN  
AND CONTROL OF FIELD CHANGES  
WBRD-50-390/86-39 AND WBRD-50-391/86-37  
SCR WBN CEB 8623  
10 CFR 50.55(e)

FINAL REPORT

Description of Deficiency

Sampling programs for investigation of the design evaluation of embedded plate field changes and an independent review of cable tray support calculations has identified discrepancies in documentation and deviations from design criteria that may affect the qualification of embedded plates.

The following specific items were identified:

1. The evaluation of field change requests (FCRs) for multiple attachments to embedded plates as specified in project construction specification N3C-928 assumed that existing major attachments to the embedded plate were qualified. This assumption may be invalid. The calculations for the sampling program and the review of the cable tray calculations indicate that when baseplate flexibility and installed location of the support on the embedded plate are considered, some cable tray support may overstress portions of the embedded plate. Also, some cable tray support calculations used the wrong allowable anchor stress. Other less significant errors were also identified.
2. Calculations for evaluation of field changes to embedded plates contain errors and do not fully conform to design criteria requirements.
  - A. The document reviews performed as part of the sampling programs have identified the following:
    1. Some embedded plate FCRs reference the wrong unique plate identification number. The erroneous reference numbers were not always identified during the Nuclear Engineering (NE) evaluation.
    2. Attachments were identified which are not shown on the latest FCR on an embedded plate. Revised or new FCRs have been written.
  - B. Independent review of the calculations performed by NE for evaluation of embedded plate FCRs identified the following items:
    1. Errors were found in the calculations performed for determination of the reactions for the supports attached to the embedded plate.

2. Some embedded plate FCRs were accepted using a standard review form. The calculations providing the basis for the form did not fully envelop the plate and anchorage configurations which could be encountered.

It has also been determined that the evaluation of embedded plates, identified by an embedded plate FCR in accordance with N3C-928 may not have considered the effects of loads on adjacent embedded plates. Additionally, embedded plates have been installed with plate edge adjacent to a concrete edge. The effects of the concrete edge on the embedded plate capacity may not have been considered in the design of the plate.

The root causes of the deficiencies noted herein are: (1) design methods/procedures (before DS-C1.7.1) that were used/followed for the design of the embedded plates/anchors did not adequately consider plate flexibility, (2) errors were made in the calculations, (3) failure to adequately document all field modifications, and (4) Project Construction Specification N3C-928 did not prescribe design requirements for considering the effects of loads on adjacent embedded plates when evaluating new attachments to existing embedded plates.

#### Safety Implications

Consideration of the effects of baseplate flexibility, field-installed support locations, or additional loads from unidentified attachments could result in portions of the embedded plates or studs being overstressed and/or the concrete capacity being exceeded under design basis accident conditions. Significantly overstressed embedded plates, studs, and/or concrete could result in loss of support of the cable tray, pipe, or other components supported by the plates. As such, this condition could adversely affect the safe operation of the plant.

#### Corrective Action

##### 1. Anchorage Designs for Large Supports

###### A. Cable Tray Supports on Embedded Plates

Complete a verification program for embedded plates used for anchorage of cable tray supports. The program includes verification that the as-built location of the cable tray supports attached to embedded plates has not resulted in a statistically significant number of embedded plates with stresses which exceed the allowables.

###### B. Cable Tray Supports on Surface Mounted Baseplates

Complete a review of the design for cable tray supports which use expansion-anchored plates to determine if baseplate flexibility and construction tolerances were adequately considered in the design. Perform review based on the anchorage allowables in effect for the original design. If errors are found, identify a condition adverse to quality (CAQ) document unless the deficiency is covered by an existing CAQ document.

C. Other Large Supports (Pipe; Heating, Ventilation, and Air Conditioning [HVAC])

The sampling program mentioned in the description of condition did not identify a potentially deficient condition for supports other than cable tray supports. Therefore, on the basis of previous samples, no additional investigations are required.

2. Implementation of N3C-928

A. Wrong Plate Numbers on FCRs

Initiate new or revised design change control documentation on the embedded plates which referenced the wrong plate number.

Other embedded plate FCRs may reference the wrong plate number. However, the visual examination by NE engineers was probably performed on the correct embedded plate since the FCR gives a description of the support being attached to the plate and that description is used to identify the violation. Also, the rejection rate for embedded plate FCRs is very low so the probability of approval of an FCR which should have been disapproved is also very low. No additional corrective action will be performed.

B. Sampled Embedded Plates with Support Without FCR

Complete a review of the documentation for the embedded plates which were identified in the sampling program which should have had an FCR. Determine if existing CAQ documents cover the deficiencies. Initiate additional CAQ documents if required.

C. Spacing to Adjacent Embedded Plates and Concrete Edges

Based on a complete drawing review, identify embedded plates that have one or both of these deficiencies.

Based on the size of the population, determine if a sampling program or a complete review should be performed for evaluation of the adjacent embedded plate or concrete edge deficiency.

3. Engineering Evaluation of Embedded Plate FCRs

A. Errors in Support Reaction Calculations

Complete a review of the calculations for the embedded plate FCRs which were determined to contain errors. Review the error for the embedded plate FCRs to determine if the error is likely to have occurred for other calculations. If additional errors are likely, initiate a CAQ document unless the deficiency is covered by an existing CAQ document.

B. Calculations for Evaluation of Embedded Plate FCRs

Identify calculations for embedded plate FCRs in the sample which used the standard review form and review or revise as required. If any of the calculations misused the review form, determine if the error is likely to have occurred for other calculations.

The effort described above is approximately 80 percent complete and to date no safety-significant deficiencies have been identified.

To prevent recurrence, the use of FCRs to provide modifications to existing embedded plates has been replaced by the design change notice (DCN) process. The DCN approval process ensures that proper engineering review is performed before implementing any modification to embedded plates.

TVA will complete corrective actions for this deficiency by fuel load for each unit.

ENCLOSURE 2

LIST OF COMMITMENTS

1. Complete a verification program for embedded plates used for anchorage of cable tray supports. The program includes verification that the as-built location of the cable tray supports attached to embedded plates has not resulted in a statistically significant number of embedded plates with stresses which exceed the allowables.
2. Complete a review of the design for cable tray supports which use expansion-anchored plates to determine if baseplate flexibility and construction tolerances were adequately considered in the design. Perform review based on the anchorage allowables in effect for the original design. If errors are found, identify a condition adverse to quality (CAQ) document unless the deficiency is covered by an existing CAQ document.
3. Initiate new or revised design change control documentation on the embedded plates which referenced the wrong plate number.
4. Complete a review of the documentation for the embedded plates which were identified in the sampling program which should have had an FCR. Determine if existing CAQ documents cover the deficiencies. Initiate additional CAQ documents if required.
5. Based on a complete drawing review, identify embedded plates that have one or both of these deficiencies. Based on the size of the population, determine if a sampling program or a complete review should be performed for evaluation of the adjacent embedded plate or concrete edge deficiency.
6. Complete a review of the calculations for the embedded plate FCRs which were determined to contain errors. Review the error for the embedded plate FCRs to determine if the error is likely to have occurred for other calculations. If additional errors are likely, initiate a CAQ document unless the deficiency is covered by an existing CAQ document.
7. Identify calculations for embedded plate FCRs in the sample which used the standard review form and review/revise as required. If any of the calculations misused the review form, determine if the error is likely to have occurred for other calculations.
8. TVA will complete corrective actions for this deficiency by fuel load for each unit.