

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401  
400 Chestnut Street Tower II

May 3, 1985

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BLRD-50-438/83-35  
BLRD-50-439/83-31

U.S. Nuclear Regulatory Commission  
Region II  
Attn: Dr. J. Nelson Grace, Regional Administrator  
101 Marietta Street, NW, Suite 2900  
Atlanta, Georgia 30323

Dear Dr. Grace:

BELLEFONTE NUCLEAR PLANT UNITS 1 AND 2 - B&W PLANT INTERNAL BOLT FAILURES  
- BLRD-50-438/83-35, BLRD-50-439/83-31 - FINAL REPORT

The subject deficiency was initially reported to NRC-OIE Inspector Linda Watson on May 13, 1983 in accordance with 10 CFR 50.55(e) as NCR R-30. This was followed by our interim reports dated June 13 and December 5, 1983 and August 29, 1984. NCR BLN NEB 8413 has also been generated to document this concern. TVA intends to report on both NCRs simultaneously. Enclosed is our final report. 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

*J. A. Dorman*  
for J. W. Hufham, Manager  
Licensing and Regulations

Enclosure

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

Records Center (Enclosure)  
Institute of Nuclear Power Operations  
1100 Circle 75 Parkway, Suite 1500  
Atlanta, Georgia 30339

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## ENCLOSURE

### BELLEFONTE NUCLEAR PLANT UNITS 1 AND 2 B&W PLANT INTERNAL BOLT FAILURES BLRD-50-438/83-35, BLRD-50-439/83-31 10 CFR 50.55(e) NCRs R-30 AND BLN NEB 8413 FINAL REPORT

#### Description of Deficiency

The B&W Owners Group has opened issue R-30, "Internals Bolting Failures," documenting a potential safety concern with B&W plants. Specifically, there have been failures of A286 bolts used in various reactor internals applications at Oconee 1, Rancho Seco, and Crystal River 3. B&W review of the Bellefonte Nuclear Plant (BLN) reactor internals joint design indicated that stress corrosion cracking (SCC) failures of A286 bolts like those which occurred at the above listed operating plants could also occur at BLN. The following five joints in the BLN reactor internals utilize A286 bolting material: (1) plenum lug to cover, (2) vent valve to core support assembly, (3) core support lug, (4) plenum cylinder to upper grid, and (5) column weldment to upper grid. B&W estimated peak stress levels for these joints by multiplying the sum of the preloaded and operating stresses by an estimated stress concentration factor. The resulting peak stresses for joints 1 and 2 are well below the actual yield stress. Joint 3 has low stress but the high stress concentration factor under the bolt head results in a relatively high peak stress value. The peak stresses for joints 4 and 5 are much greater than the actual yield stress. High stresses increase the potential for SCC.

The root cause of this problem was B&W's apparent failure to adequately determine stresses during the design and material selection process of the BLN reactor internals bolts. After several instances of bolt failure at operating plants, B&W reevaluated the stresses on the BLN bolts and found that some of the A286 bolts were overstressed. B&W then recommended that the overstressed bolts be replaced.

#### Safety Implications

The subject condition might result in loosened or free bolts in the reactor vessel. Loose or free bolts could result in reactor coolant flow-induced vibrations in the plenum cylinder, column weldments, and vent assemblies affected. In addition, loose parts in the reactor coolant flow stream could impact the fuel assemblies and cause cladding damage. Either of these conditions could be adverse to the safe operation of the plant.

#### Corrective Action

All of the A286 bolts in the five BLN reactor internals joints identified above are being replaced with bolts fabricated from Inconel X-750 HTH. New locking devices are also being provided with the replacement bolts. Inconel X-750 HTH has greater resistance to SCC than A286. Even though the stress levels on some of the bolts are low enough that the A286 bolts may provide satisfactory service for the life of the plant, TVA believes that replacing all of the A286 bolts with Inconel X-750 HTH bolts will minimize the potential for SCC failures.

Instructions for replacement of the A286 bolts are given in B&W field change packages (FCPs) 264 and 296 for units 1 and 2, respectively. These FCPs have been approved and transmitted to TVA's Office of Construction. Installation of the unit 1 replacement bolts is complete. All unit 2 hardware is onsite. Unit 2 installation should be completed by October 1, 1990.

Since the overstressed bolts are being replaced with bolts made from a material that is stronger and more resistant to SCC than A286, and since TVA has no other plants with B&W-supplied N3SS, there is no action required to prevent recurrence.