

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

400 Chestnut Street Tower II

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November 19, 1984

BLRD-50-438/83-42

U.S. Nuclear Regulatory Commission  
Region II  
Attn: Mr. James P. O'Reilly, Regional Administrator  
101 Marietta Street, NW, Suite 2900  
Atlanta, Georgia 30323

Dear Mr. O'Reilly:

BELLEFONTE NUCLEAR PLANT UNIT 1 - MAKEUP/HIGH PRESSURE INJECTION PUMP  
VIBRATION -BLRD-50-438/83-42- FINAL REPORT

The subject deficiency was initially reported to NRC-OIE Inspector Linda Watson on June 22, 1983 in accordance with 10 CFR 50.55(e) as NCR 2393. This was followed by our interim reports dated July 20, and November 30, 1983 and March 12 and July 20, 1984. 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. Damer*  
for J. W. Hufham, Manager  
Licensing and Regulations

Enclosure

cc: Mr. Richard C. DeYoung, 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  
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## ENCLOSURE

BELLEFONTE NUCLEAR PLANT UNIT 1  
MAKEUP/HIGH PRESSURE INJECTION PUMP VIBRATION  
BLRD-50-438/83-42  
NCR 2393  
10 CFR 50.55(e)  
FINAL REPORT

### Description of Deficiency

Measured vibration levels on one of the three makeup/high pressure injection (MU/HPI) pumps provided by Babcock & Wilcox (B&W) for Bellefonte (BLN) unit 1 are not consistently below the established high level limit of 0.75 mils. After the high vibration problem was noted, an attempt by B&W was made to balance the rotating assembly in November 1982. The effort was not successful. It was noted at that time that the vibration level on the pump varied with the temperature of the pump.

Since the attempt to balance the rotating assembly on site was not successful, the inner casing and rotating assembly were removed and shipped to the manufacturer, Bingham-Willamette in Portland, Oregon. The shaft and rotating assembly were examined by Bingham and returned to BLN in March 1983. The pump was reassembled and further vibration testing was completed. The initial vibration levels of the reassembled pump were high (2.5 to 3.0 mils displacement). B&W again attempted to balance the pump rotating assembly. Vibration levels were reduced to a level below the 0.75 mils limit for approximately 70 percent of the measurements, with the remainder of the measurements at or greater than the 0.75 mils limit.

During October 1983, a shaft straightness check and a "rap" test (to determine the resonant frequency of the shaft) were conducted by B&W. These tests were made under both hot and cold conditions to determine the effect of the thermal transient on the results of the tests. The shaft straightness test detected no bowing of the shaft under both hot and cold conditions. The "rap" test data indicated that the shaft resonant frequencies did not contribute to the vibration problem and did not change as a result of the imposed thermal transient.

### Safety Implications

Failure of the subject pump due to excessive wear caused by uncorrected high vibration could adversely affect the ability of the MU/HPI system to mitigate the effects of a loss of coolant accident (LOCA) or safe shutdown earthquake (SSE).

### Corrective Action

During April 16-30, 1984, representatives from B&W were at BLN to install a permanent balance ring and perform a final, two plane, balance of the subject pump. The results of B&W's balancing effort were submitted to TVA in B&W report No. 1151454A-00, "TVA Bellefonte Plant Makeup Pump 1B Vibration Investigation." The report indicated

that the vibration on the pump bearing housing had been reduced to the 0.5 to 0.6 mils p-p range. Based on these results, B&W concluded that future operation of the pump would be satisfactory.

TVA reviewed the subject report and had the following comments:

1. TVA concurred that the measurements included in B&W's report indicated that the pump vibration on the bearing housing is now within the 0.75 mils p-p limit. However, it was noted that the measurements taken by B&W were filtered readings and that during plant operation vibration measurements would be made using unfiltered instruments. Since the error margin for unfiltered instruments is greater than that for filtered instruments, the 0.75 mils p-p limit may not be appropriate for use with these instruments.
2. TVA noted that B&W had reported only the pump bearing housing vibration measurements in their report. The pump was also instrumented to measure shaft vibration levels during the April balancing operation. The shaft vibration data is of interest to TVA due to TVA experience with a pump of similar design at the atmospheric fluidized bed combustion (AFBC) demonstration plant in Paducah, Kentucky. The AFBC pump is the same design as the BLN pump except that it has 9 stages rather than 11. The AFBC pump also experienced high vibration levels on the pump bearing housing. It was found on the AFBC pump that the vibration on the pump bearing housing could be reduced to the 0.2 to 0.3 mils p-p range while the pump shaft vibration remained high. Pump shaft vibration levels above 3.0 mils p-p caused failure (destaging) of the pump seals. B&W was requested to submit the shaft vibration data on the BLN pumps for TVA review.

On September 27, 1984, a meeting was held in Knoxville between TVA and B&W to discuss B&W's report and resolve the above comments. The meeting resulted in the following agreements:

1. B&W agreed to review the appropriate codes and regulations and consult the pump manufacturer to recommend a vibration limit for unfiltered measurements on the pump bearing housing. This limit will be incorporated into the B&W plant limits and precautions document.
2. B&W submitted the shaft vibration data to TVA. The data indicates that shaft vibration was in the 1.0 to 1.5 mils p-p range. This was found to be an acceptable vibration level by TVA. It was noted that no limit has been established for shaft vibration. B&W indicated that they would review the matter and make a recommendation for pump shaft vibration limits to be incorporated into the plant limits and precautions document.

In summary, TVA agreed with B&W that the pump can now be "used-as-is". Nonconformance report (NCR) 2393 has been dispositioned accordingly. In order to aid TVA in the long-term operation of the pumps, B&W will establish a vibration limit for unfiltered bearing housing measurements and shaft measurements by February 15, 1985.

TVA believes this vibration problem is a unique situation which does not require any action to prevent recurrence.