TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

November 30, 1983

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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 30303

Dear Mr. O'Reilly:

BELLEFONTE NUCLEAR PLANT UNIT 1 - MAKEUP/HIGH PRESSURE INJECTION PUMP VIBRATION -BLRD-50-438/83-42- SECOND INTERIM 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 report dated July 20, 1983. Enclosed is our second interim report. We expect to submit our next report by March 14, 1984. 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

D S Kammer

for 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

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 UNIT 1
MAKEUP/HIGH PRESSURE INJECTION PUMP VIBRATION
BLRD-50-438/83-42
NCR 2393
10 CFR 50.55(e)
SECOND INTERIM 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 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 Bellefonte 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. The pump to date has failed to operate within the vibration limit on a consistent basis and still shows a significant variation of the vibration level with temperature.

Interim Progress

In response to NCR 2393, B&W performed several tests on the pump to determine if a bowed shaft was causing the high vibration levels or if changes in the resonant frequency caused by thermal transients resulted in the high vibration levels. The tests consisted of the following:

(1) The rotating element was removed from the pump.

(2) A shaft straightness check was made with the rotating element at room temperature.

(3) The rotating element was placed in a 145°-150°F water bath and allowed to stabilize at that temperature.

(4) The element was removed from the bath and a second shaft straightness test was performed.

(5) The element was allowed to stabilize at ambient conditions and a final shaft straightness test was performed.

(6) A "rap" test on the rotating assembly was performed to determine the resonant frequency at each thermal condition.

In each case, the shaft straightness test detected no bowing in the shaft. The results did not show any susceptibility to the thermal transient imposed on it. B&W's conclusion was that a bowed shaft was not producing the vibration pattern observed.

The "rap" test data was obtained using accelerometers mounted on the shaft and resulted from impacts in both the horizontal and vertical directions at two locations. The data indicated that the vertical first resonant frequency was unchanged from the hot to cold condition. B&W indicated that, since this is the most reliable test configuration, the absence of frequency changes indicates no shaft stiffness change. There were measured changes in the horizontal direction for the first, second, and third resonant frequencies. B&W believes that these changes were due to the lack of control over the horizontal support boundary conditions and should not be of concern. B&W concluded from the frequency tests that the vibration problem was not the result of a thermally induced rotor characteristic change.

Based on the above results, B&W has concluded that continued operation of the pump is acceptable for the following reasons:

Operation within Acceptance Criteria - Recorded data indicates vibration, as measured at the bearing housings, is within criteria as established in the B&W Plant Limits and Precautions Document (OS-1101, B&W No. 67-1003781-01). The limits of 0.785 mil (design flow) and 1.0 mil (off-design flow) were not exceeded, as the observed vibration level was 0.6 mil.

The last six runs of the pump during May 1983 consumed approximately 7.5 hours with the maximum vibrations as given above (0.6 mil). B&W submits that this demonstrates consistency, considering the total time this pump has operated.

Experience Base - Operating requirements reflect accepted industry standards. B&W's experience base supports the judgment that adherence to such criteria will result in acceptable operation. Furthermore, numerous contacts with the manufacturer of these pumps (Bingham-Willamette) have been made concerning the mechanical performance. Their assessment is that the current levels of vibration are not injurious to the pump.

Balancing - During reassembly, field balancing and permanent attachment of balance weights where necessary will be required. B&W will coordinate with TVA site personnel to schedule this balancing effort. Documentation of the method for permanent attachment will be accomplished by revising the instruction manual.

Additionally, during near term operations, B&W recommends that periodic data collection be made. This would include broad band vibration readings in addition to pump and system parameters (temperature, pressure, flow, oil temperature, etc.). B&W recommends that this be continued during hot functional testing to ensure that degradation of the pump vibration characteristics will not occur over long-term operation.

TVA is currently reviewing the results of the B&W tests and B&W's recomendations described above.