TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

400 Chestnut Street Tower II

'84 AUG 10 A10:06 January 24, 1984

WBRD-50-390/83-41
WBRD-50-391/83-41

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:

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2 - DIESEL GENERATOR REAR BEARING PROBLEM - WBRD-50-390/83-41, WBRD-50-391/83-41 - THIRD REPORT

The subject deficiency was initially reported to NRC-OIE Inspector Linda Watson on June 27, 1983 in accordance with 10 CFR 50.55(e) as NCR W-125-P. Interim reports were submitted on July 21 and September 30, 1983. On December 14, 1983 NRC Region II Inspector Paul Fredrickson was notified that nonconformance reports (NCRs) W-151-P, W-152-P, W-153-P, and W-154-P would be included with W-125-P. Enclosed is our third interim report. We expect to submit our next report on or about March 2, 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

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

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2
DIESEL GENERATOR REAR BEARING PROBLEM
NCR W-125-P, W-151-P, W-152-P, W-153-P, AND W-154-P
WBRD-50-390/83-41, WBRD-50-391/83-41
10 CFR 50.55(e)
THIRD INTERIM REPORT

Description of Deficiency

During performance of test MI-82.1 on June 10, 1983, sparks were observed coming from the rear generator bearing of emergency diesel generator 2B-B (S/N 17401228-200). The cause of the sparks was apparently the shaft striking the outer oil seal. As a result of this concern, the other diesel generators were inspected for mismatch alignment of the inner and outer race assemblies. The results are given in "Interim Progress" below.

The generators are manufactured by Parsons-Peebles Electric Products, Incorporated of Cleveland, Ohio. Each generator is rated at 4400 kW at 0.8 power factor and has a tapered roller bearing on one end and a cylindrical roller bearing on the other to accommodate a thermal shaft growth of approximately 0.040" to 0.045".

Interim Progress

The failure was found to be wearing of the generator shaft insulation material under the inner race of the cylindrical roller bearing. The wear allowed the shaft to drop down and rub the bearing inner and outer oil seals (bearing cover). The insulation wear was caused by the turning of the inner bearing race on the shaft.

The turning of the inner race on the shaft was caused by misalignment of the inner and outer bearing races to the extent that in the cold condition the outer race contacted the lockwasher retaining the nut which holds the inner race on the shaft. This contact caused the outer race to spin imparting torque to the inner race turning it on the shaft. The cause of the misalignment was found to be a combination of design tolerances, deformation of the generator bearing bracket and housing that occurred during handling, and the addition of shims to correct what was thought to be a pinched outer race.

The generator, (which has been replaced by a spare) was repaired at TVA's Power Service Shops located at Muscle Shoals, Alabama. The repairs consisted of rebuilding the oil seals; polishing the shaft under the oil seals; replacing the shaft insulation material under the bearing; machining the bearing housing cap to the correct the alignment; adding a shim to restrain the outer race; and installing new bearings. The repaired generator will be used as a spare at WBN.

Disassembly of the other emergency diesel generators at WBN revealed the following deficiencies which were corrected as indicated (NCRs were written in order to track the deficiencies and corrective actions).

Generator No. 18003480-200 (NCR W-151-P):

This generator was found to have a mismatch in alignment of the inner and outer race assemblies of 0.091 inch on the connection end of the generator. A further investigation revealed that although no contact as in generator No. 17401228-200 was possible, the outer race assembly was not restrained sufficiently to prevent a possible increase in the mismatch of the inner and outer bearing races to the point that in the cold condition, the rollers would not be riding on the flat surface of the inner race, potentially causing early bearing failure. The bearing housing cap was machined and a shim was added to restrain the outer race within acceptable alignment limits. Bearings on both ends of the generator were replaced as a precautionary step.

Generator No. 18003481-200 (NCR W-152-P):

This generator was found to have a mismatch in alignment of the inner and outer race assemblies of 0.099 inch on the connection end of the generator. A further investigation revealed that although no contact as in generator No. 17401228-200 was possible, the outer race assembly was not restrained sufficiently to prevent a possible increase in the mismatch of the inner and outer bearing races to the point that in the cold condition, the rollers would not be riding on the flat surface of the inner race, potentially causing early bearing failure. The bearing housing cap was machined and a shim was added to restrain the outer race within acceptable alignment limits. The bearing on the connection end was replaced as a precautionary step.

Generator No. 17401226-200 (W-153-P):

This generator was found to have a mismatch in alignment of the inner and outer race assemblies of 0.0485 inch on the connection end of the generator. This small misalignment will not allow any of the problems above. However, a shim is being added to limit the travel of the outer race and the bearing on the connection end will be replaced as a precautionary step.

Generator No. 17401227-200 (W-154-P):

This generator was found to have a mismatch in alignment of the inner and outer race assemblies of 0.203 inch on the connection end of the generator. A further investigation revealed a gross machining error on the inner oil slinger which could have allowed the outer race and the locking washer to come into contact causing a grounding of the rotor to stator and bearing failure similar to generator No. 17401228-200. The bearing housing cap was machined and a shim was added to correct the misalignment caused by the mismachined inner oil slinger. A shim was added to limit the travel of the outer race and the bearing on the connection end was replaced as a precautionary step.

Summary

As discussed above, the cause of the failure of generator 17401228-200 was found to be a combination of initial misalignment to accommodate thermal expansion, machining tolerances, damage to the generator housing, and the

addition of shims to correct what was previously determined to be a pinched outer race. The only other generator found to have the potential for this failure was 17401227-200. The root cause of the deficiency on this machine was a grossly mismachined part. The potential for shortened bearing life discussed above for generators 18003480-200 and 18003481-200 is of a limited significance since the generators were designed for a 40-year life and the deficiency would have only been possible when the generators were started from the cold condition with the outer race at its maximum misaligned position.

TVA is still investigating the actions to prevent recurrence and will provide this information in our final report.