

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA TENNESSEE 37401
400 Chestnut Street Tower II

84 MAR 5 P12: February 29, 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 - FINAL 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. A combined interim report was submitted on January 24, 1984. Enclosed is our final report. We consider 10 CFR Part 21 applicable to this deficiency.

Please note that TVA no longer considers 10 CFR 50.55(e) applicable to NCRs W-151-P, W-153-P, and W-154-P.

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

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)
FINAL 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 "Corrective Action" 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".

Safety Implications

The emergency diesel generators are required for safe shutdown of the plant, and therefore, must remain functional. Had the condition remained undetected and uncorrected, it could have resulted in significant damage to the generator. In the event of loss of offsite power, this condition could have adversely affected the safe operation and shutdown of the plant.

Corrective Action

The failure was found to be wearing of the generator shaft insulation material under the inner race of the cylindrical-roller bearing (2B-B engine end of the generator). 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 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 Watts Bar Nuclear Plant (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 outer race to lockwasher 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 up to 0.194 inch in the cold condition. In this position, the rollers would not be riding entirely on the flat surface of the inner race, potentially causing reduced bearing life. The bearing housing cap was machined and a shim was added to restrain the outer race within vendor-recommended alignment limits. Bearings on both ends of the generator were replaced as a precautionary step.

Generator No. 17401227-200 (W-152-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 (of 0.203 inch) on the inner oil slinger which could have allowed the outer race and the lock washer to come into contact causing a grounding of the rotor to starter and bearing failure similar to generator No. 17401228-200 (NCR W-125-P). 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 per the vendor's recommendations to limit the travel of the outer race and the bearing on the connection end was replaced as precautionary steps.

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 was added per vendor recommendations to limit the travel of the outer race and the bearing on the connection end was replaced as precautionary steps.

Generator No. 18003481-200 (NCR W-154-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 outer race to lockwasher contact as in generator No. 17401228-200 (NCR W-125-P) 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 up to 0.196 inch in the cold condition. In this position, the rollers would not be riding entirely on the flat surface of the inner race, potentially causing reduced bearing life. The bearing housing cap was machined and a shim was added to restrain the outer race within acceptable alignment limits. The bearing was replaced as a precautionary step.

Summary

As discussed above, the cause of the failure of generator 17401228-200 (NCR W-125-P) 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 (NCR W-152-P). 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 (NCR W-151-P) and 18003481-200 (NCR W-154-P) 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 and when the outer race is at its maximum misaligned position.

As stated above, the misalignment in generator 17401226-200 (NCR W-153-P) was insufficient to have caused any problems of this nature.

TVA, therefore, believes that NCRs W-151-P, W-153-P, and W-154-P would have had no safety implications and can thus be downgraded to nonreportable. The misalignments identified on these NCRs are within acceptable tolerances.

NCRs W-125-P and W-152-P are attributable to isolated occurrences and as such no separate action required to prevent recurrence is necessary.