

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

5N 157B Lookout Place

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WBRD-50-390/86-64

NOV 12 1986

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

Dear Dr. Grace:

WATTS BAR NUCLEAR PLANT UNIT 1 - FAILED MOTOR PINION KEY AND MOTOR SHAFT IN
LIMITORQUE OPERATOR - WBRD-50-390/86-64 - INTERIM REPORT

The subject deficiency was initially reported to NRC-Region II Inspector
Morris Branch on October 9, 1986 in accordance with 10 CFR 50.55(e) as NCR
W-477-P. Enclosed is our interim report. We expect to submit our final
report on or about February 14, 1987. We consider 10 CFR Part 21 applicable
to this deficiency.

If there are any questions, please get in touch with J. A. McDonald at
(615) 365-8527.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

R. Gridley
R. Gridley, Director
Nuclear Safety and Licensing

Enclosure

cc (Enclosure):

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

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ENCLOSURE
WATTS BAR NUCLEAR PLANT UNIT 1
FAILED MOTOR PINION KEY AND MOTOR
SHAFT IN LIMITORQUE OPERATOR
WBRD-50-390/86-64
NRC W-477-P
10 CFR 50.55(e)
INTERIM REPORT

Description of Deficiency

During preventive maintenance for the actuator for valve 1-FCV-63-72A (residual heat removal (RHR) pump suction to containment sump isolation valve), the motor shaft-pinion gear key connection was found to be damaged. The key was found deformed and approximately one third of the way out of its slot. The motor shaft was found to be cracked in two places. The redundant train valve actuator (1-FCV-63-73B) was then examined, which revealed a similarly deformed key, but no motor shaft cracking. The failed actuators are model SB-3, manufactured by Limitorque Corporation, Lynchburg, Virginia, equipped with 100 ft-lb motors. These were provided to TVA by Westinghouse Corporation, Pittsburgh, Pennsylvania, under the NSSS contract (54114-1).

Safety Implications

The damage identified could result in a sudden failure of the key and/or motor shaft, rendering the valves inoperable. Failure of these valves to operate could result in loss of the ability to recirculate water from containment following a loss-of-coolant accident (LOCA). Therefore, this deficiency could have adversely affected the safety of operations of the plant.

Interim Progress

The failed motor shaft and both motor pinion keys were submitted to TVA's Central Laboratory for a metallurgical failure analysis. This recently completed analysis revealed both keys to be mild steel (type 1018 or 1022) and the motor shaft to be free machining carbon steel (AISI type 1144 material).

The metallurgical analysis identified the damage to the keys as plastic deformation and outer-case cracking resulting from compressive overloading in two directions. The damage to the shaft was identified as impact overloading that initiated in the keyway.

These failures appear to be related to the condition identified in March 1981 in OIE Information Notice 81-08 which addressed failure of motor pinion keys in Limitorque SMB-4 actuators with motor torque in excess of 100 ft-lbs. Subsequently, Limitorque Corporation issued a letter (June 3, 1981) to affected nuclear sites clarifying and expanding the information provided in the IE Notice. Limitorque recommended that the original mild steel keys be replaced with high strength keys on actuator sizes three and four utilizing motors of 150 ft-lbs or greater. In early 1984 Westinghouse issued Field Change Notice (FCN) WATM-10706 to replace the motor pinion keys in NSSS Limitorque actuators meeting the above criteria.

The subject valves utilize 100 ft-lb motors and, therefore, did not meet the 150 ft-lb criteria and thus, the keys were not inspected or replaced. It should be noted that although no shaft cracking was found, the mild steel keys removed for the FCN exhibited similar deformation to that found on the subject valves.

Component data research revealed that the two referenced valves are the only safety-related Limitorque size three or four actuators that have not previously had keys replaced as a result of IE Information Notice 81-08 and the Limitorque recommendation.

It appears that the shaft failure was due to increased impact loading as a result of the key deformation and reduced engagement length. A shaft failure of this type has not previously been associated with the mild steel key material. For this reason, the failure and metallurgical analysis is being reviewed with Limitorque to determine if additional design deficiencies may be present in the shaft/keyway material or configuration.

During the next routine maintenance on all size three and four actuators with the previously installed high strength keys, the keys and motor shafts will be inspected for any cracking or deformation.

The results of Limitorque's investigation of the failure are needed to finalize corrective actions to be taken. TVA is evaluating the deficiency for unit 2. This will be addressed in our final report which will be provided to NRC on or about February 14, 1987.