



MISSISSIPPI POWER & LIGHT COMPANY

Helping Build Mississippi

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JAMES P. McGAUGHY, JR.
ASSISTANT VICE PRESIDENT

August 27, 1981

Office of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, N.W.
Suite 3100
Atlanta, Georgia 30303

Attention: Mr. J. P. O'Reilly, Director

Dear Mr. O'Reilly:

SUBJECT: Grand Gulf Nuclear Station
Units 1 and 2
Docket Nos. 50-416/417
File 0260/15525/15526
PRD-81/02, Final Report,
RHR Pump Damage
AECM-81/292

Reference: AECM-81/43, 1/23/81

On January 16, 1981, Mississippi Power & Light Company notified Mr. M. Hunt, of your office, of a Potentially Reportable Deficiency (PRD) at the Grand Gulf Nuclear Station (GGNS) construction site. The deficiency concerns damage sustained by the RHR "B" Pump during construction testing.

Investigative activities into this deficiency by the constructor to determine the extensiveness of the evaluation and repair have determined that the deficiency is not reportable under the provisions of 10CFR50.55(e) or 10CFR21. The referenced letter contained one error. On page 1 of 3 of the attachment, paragraph 2 states, "Prior to restart, on 12/9/80, Pumps "A", "B", and "C" could not be turned by hand." This should have read only Pumps "B" and "C". Pump "A" could be and was turned by hand.

A final report is attached.

Yours truly,

for J. P. McGaughy, Jr.

JWY/LLA/EWC:dr
ATTACHMENT

cc: See page 2

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Mr. J. P. O'Reilly
NRC

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File

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FINAL REPORT TO PRD-81/02

I. Description of the Deficiency

The Residual Heat Removal (RHR) "B" pump had been run approximately 138 hours prior to December 8, 1980. The pump had been started numerous times with no history of problems. On December 8, 1980, the pump was started and ran under full flow for approximately 15 hours. Water was being circulated through the three (3) RHR pumps, "A", "B", and "C", to heat the water in the reactor pressure vessel to a minimum temperature of 160° F prior to the Reactor Pressure Vessel (RPV) System hydrostatic test.

On December 9, 1980, the Condensate System had been utilized to fill the reactor. The RPV was filled and the vessel isolated from the Condensate System with valves B21F065 A and B. One or both of the F065 valves were leaking, since constant flow existed from the 2" vent line at the top of the vessel head. While preparing to secure one condensate and one booster pump, the N21F003 valve was throttled in the closed direction. When valve N21F003 was throttled closed, leakage through the F065 A and B valves increased, thereby increasing pressure in the RPV. As the system became solid, the leakage from the condensate system with the pumps running resulted in a pressure spike in the reactor and RHR system of approximately 520 PSI. The pressure spike occurred at approximately 5:15 a.m. on December 9, 1981. RHR "B" pump was immediately throttled back to approximately 1300 gal/min. The minimum flow rate of this pump is 1000 gal/min. At approximately 6:00 a.m., vibration data was taken on the pump and noted to be within tolerance. At approximately 10:00 a.m., RHR "B" pump was tripped to allow verification of valve lineup. Pumps "A" & "C" tripped due to a loss of power (unrelated to the overpressurization) approximately one hour later. Prior to restart, on December 9, 1980, pumps "B" and "C" could not be turned by hand. All three pumps were bumped electrically and allowed to coast down. Pumps "A" & "C" coasted down normally. Pump "B" coasted down within a shorter period than the other pumps and came to an abrupt halt at the end of the coast down. After stopping, Pump "B" could not be rotated by hand.

The pump manufacturer's representative was contacted and arrived at Grand Gulf Nuclear Station (GGNS) on the afternoon of December 11, 1980. Attempts were made to free the pump by use of the adjusting plate. Condition Report (CR) #5126 was issued, documenting that the pump had seized with possible damage. The CR was screened as not being potentially reportable. On December 12, 1980, the pump shaft broke loose and turned 3 or 4 revolutions, by hand, then re-seized. On December 15, 1980, efforts resumed to determine cause and extent of damage. On December 16, 1980, debris, which seemed to be weld slag, was found in the suction and discharge sides of the pump.

On December 17, 1980, the mechanical seal and upper bearing were removed. Attempts to remove the throttle bushing failed. A jack was applied to the bushing, at which point it was detected that the shaft moved with the bushing. It was determined that the bushing was galled to the shaft. CR #5183 was issued to allow removal of Unit II pump parts, in the event they were

necessary to meet the schedule for system turnover. On December 18, 1980, the bushing came loose and was removed. CR #5175 was issued on December 18, 1980, which states, "Due to the nature of visible damage to the pump shaft of RHR "B" pump, internal damage to upper thrust bearing in the pump motor should be considered as a distinct possibility and an inspection of said motor should be performed." CR #5176 was also issued on December 18, 1980, to require an inspection of the interior and exterior of the pump barrel for hidden damage. These two CR's were screened as not being potentially reportable. At this time, on December 18, 1980, a decision was reached to use the Unit II shaft, since early indications were that it would take a considerable amount of time to ship the shaft to the manufacturer for the minor repairs.

On December 22, 1980, the 3rd stage of the pump was removed. On December 23, 1980, the remaining two stages were removed. All three stages showed signs of overheating in that temper films were present on the mating surfaces of the impeller and wear rings. The total damage was visible at this point. On January 6, 1981, a decision was reached to use the Unit II pump assembly and CR #5126 was supplemented to document the additional damage.

On January 15, 1981, Nonconformance Report (NCR) #5302 was issued to document the inability to insert the rebuilt "B" pump internals into the pump barrel. Inspection of the pump barrel revealed an out-of-round condition at the lower support ring.

II. Analysis of Safety Implications

Our investigation into the extent of the deficiency resulted in the identification of three basic areas of concern. These three areas and their safety implications will be discussed separately.

- A. Wear to internal pump parts, including case bearings, wearing rings, upper shaft, and throttle bushing. Although the exact cause is unknown, this condition is most likely related to the pumping of foreign debris. After detailed inspection of the worn internal pump parts, the pump manufacturer concluded that the wear was not significant enough to warrant pulling the pump out of service, and was of insufficient magnitude to have had an detrimental effect on pump performance. This conclusion was based on test data noted during developmental testing of this pump by the manufacturer. The worn parts are being replaced by the manufacturer to restore the pump components to their original as shipped condition. The wear, as noted above, was not sufficient to have degraded pump performance and would have had no adverse effect on the safe operation of the plant.
- B. Overpressurization of the pump caused by the system anomalies described in the sequence of events given in Section I. The pump manufacturer performed calculations of stress levels using the pressurization data provided. Their analysis revealed that the stresses caused by the overpressurization did not exceed the yield allowables of the materials of concern.

The NSSS Supplier at MP&L request, performed similar calculations, using a more conservative approach than that of the pump manufacturer. These calculations revealed a possible overstress condition of the suction barrel and the seal flange bolting material. The NSSS Supplier specified the following precautions to assure no damage had been caused by the overpressurization:

1. Hydrostatic test at normal operating pressure.
2. Nondestructive Test (NDT) of the barrel at the junction with the barrel flange.
3. Visual inspection of the barrel assembly to verify that mechanical damage had not occurred.
4. Replacement of the seal flange bolts.

NDT and hydrostatic test of the barrel at (ASME) Section XI pressure were performed by the pump manufacturer. The NDT was acceptable and the hydro test revealed no leakage. The barrel assembly was inspected for damage and none was found except for the seismic ring distortion as noted in Section II.C.

The seal flange bolts were removed and NDT performed to assure no stress induced cracking was present. This NDT was acceptable. The overpressurization of the pump components resulted in stresses that, by conservative analysis, could have exceeded material yield strengths within the pump assembly. Based on results of NDT and hydrotests, this condition produced no damaging effect on the pump barrel or seal flange bolts and, therefore, would have had no effects on the safe operation of the plant.

- C. Distortion of the pump barrel seismic support rings as reported on NCR 5302. The cause of this distortion is indeterminate. The barrel was distorted by unknown causes, such that the seismic support rings in their free position were out-of-round by as much as 0.200". With the pump bowl installed in the barrel, the distortion of the barrel was limited to the outer diameter of the mating bowl rings.

The pump manufacturer has investigated the effects of this deviation, to include any effects on the seismic analysis of the assembly. The only effect was that, without correction, the bowl could not be reinstalled in the barrel once it was removed and the barrel allowed to return to a free position.

Since the only effect of the barrel distortion is an inability to re-install the pump bowl after removal, the barrel distortion would have had no effect on the safe operation of the plant.

In summary, the reported damage to the RHR "B" pump has been analyzed, and it has been determined that none of the damage would have had an adverse effect on safe operations of the plant, and is therefore not reportable under 10CFR50.55(e) or 10CFR21.

III. Corrective Actions Taken

The actions taken for each area of concern have already been discussed under the applicable area of Section II. These corrective actions are complete.