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DUKE POWER

July 5, 1990

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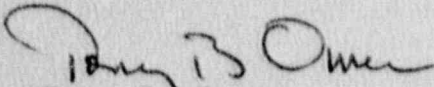
Subject: Catawba Nuclear Station
Docket No. 50-413
LER 413/90-024

Gentlemen:

Attached is Licensee Event Report 413/90-024 concerning COMPLETION OF A TECHNICAL SPECIFICATION REQUIRED SHUTDOWN DUE TO AN INOPERABLE NUCLEAR SERVICE WATER PUMP.

This event was considered to be of no significance with respect to the health and safety of the public.

Very truly yours,


Tony B. Owen
Station Manager

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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Catawba Nuclear Station, Unit 1										DOCKET NUMBER (2) 0 5 0 0 0 4 1 3				PAGE (3) 1 OF 0 8		
TITLE (4) Completion Of A Technical Specification Required Shutdown Due To An Inoperable Nuclear Service Water Pump																
EVENT DATE (5)			LER NUMBER (6)				REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)						
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES N/A				DOCKET NUMBER(S)			
0 6	0 3	9 0	9 0	0 2 4	0 0 0 7	0 5	9 0						0 5 0 0 0			
OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (Check one or more of the following) (11)														
1		20.402(b)				20.405(e)				50.73(a)(2)(iv)				73.71(b)		
POWER LEVEL (10)		20.405(a)(1)(i)				50.36(c)(1)				50.73(a)(2)(v)				73.71(c)		
1 0 1 0		20.405(a)(1)(ii)				50.36(c)(2)				50.73(a)(2)(vii)				OTHER (Specify in Abstract below and in Text, NRC Form 366A)		
		20.405(a)(1)(iii)				X 50.73(a)(2)(ii)				50.73(a)(2)(viii)(A)						
		20.405(a)(1)(iv)				50.73(a)(2)(iii)				50.73(a)(2)(viii)(B)						
		20.405(a)(1)(v)				50.73(a)(2)(iii)				50.73(a)(2)(ix)						
LICENSEE CONTACT FOR THIS LER (12)																
NAME C.L. Hartzell, Compliance Manager										TELEPHONE NUMBER AREA CODE 8 0 3 8 3 1 - 3 6 6 5						
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)																
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	
B3b	B II	M 10 1 1	W 1 1 2 10	N												
SUPPLEMENTAL REPORT EXPECTED (14)																
YES (If yes, complete EXPECTED SUBMISSION DATE)										X NO		EXPECTED SUBMISSION DATE (15)		MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single space typewritten lines) (16)

On June 3, 1990, at 0430 hours, with Units 1 and 2 in Mode 1, Power Operation, Nuclear Service Water (RN) Pump 1B was inservice and found to be experiencing vibration higher than normal. At 0448 hours, RN Pump 2B was placed inservice. At 0518 hours, RN Pump 1B was secured. On June 5 at 0300 hours, RN Pump 1B was removed from service and the motor was run uncoupled from the pump coincident with scheduled preventive maintenance. Vibration levels in the motor still indicated higher than normal. The motor was removed and disassembled. Abnormal wear was observed to have occurred in the lower bearing. Attempts were made to rebuild a spare motor and install it on the 1B pump before Unit shutdown was required. These attempts were unsuccessful and at 0922 hours, on June 9, Unit 1 entered Mode 5, Cold Shutdown, meeting all requirements of the Technical Specifications. This incident is attributed to Manufacturing Deficiency in that the motors (Pump 1B and spare) were supplied with a stator approximately 0.1 inches shorter than the original manufacture specification. The affected motors are being repaired by the manufacturer. Other RN motors have been evaluated to determine if they may be affected by similar manufacturing deficiencies; acceptable conditions were found. This report is being submitted pursuant to 10CFR 50.73, Section (a)(2)(i)(A).

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104

EXPIRES: 8/31/83

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TEXT (If more space is required, use additional NRC Form 353A's) (17)

BACKGROUND

The Nuclear Service Water [EIIS:BI] (RN) System serves as the ultimate heat sink in providing the station with a nuclear safety related cooling system. Most of the heat loads are cooled directly by heat transfer to the once-through river water. Those heat exchangers [EIIS:HX] in which a tube leak could allow radioactive fluid to enter the cooling water are cooled through the closed loop Component Cooling [EIIS:CC] (KC) System. Heat is then transferred to RN via the KC heat exchangers. The one exception is the Containment Spray [EIIS:BE] (NS) System Heat Exchangers, which returns are monitored for radioactivity before returning to the RN discharge line.

The RN System is served by two bodies of water, Lake Wylie and the Standby Nuclear Service Water Pond (SNSWP). The SNSWP serves as the nuclear safety water supply sufficient to bring the station to a cold shutdown condition following a Loss of Primary System Coolant Accident (LOCA) on one Unit. Water is supplied to the RN Pump [EIIS:P] Structure via separate intake lines from Lake Wylie and the SNSWP. The RN Pump Structure is a seismically designed concrete structure which provides protection for the RN Pumps. There are two separate pits within the structure, physically separating Train A and Train B. Two pumps in each pit (four total) provide discharge flow to a common header which supplies cooling to the related train on both Units.

The RN Pump Motors [EIIS:MO] are type LLD, manufactured by Westinghouse, Frame L6810P42. Motors are equipped with a lower sleeve bearing and a (upper) Kingsbury thrust bearing with a guide. The four motors initially installed were designed and manufactured in the Westinghouse Buffalo, New York, Assembly Plant. A spare, duplicate motor was manufactured in the Westinghouse Round Rock, Texas plant. The station Transmission section is responsible for maintaining and repairing the RN pump motors. The Maintenance Engineering Services section is responsible for the Predictive Maintenance Program which performs vibration and oil analysis of the RN pump motors.

Technical Specification 3.7.4 identifies the limiting condition for operation (LCO) for the RN System. With both Unit 1 and 2 above Mode 5, Cold Shutdown, two independent RN loops shall be operable with each loop containing two operable RN pumps and associated emergency diesel generators [EIIS:GEN] (D/G), two essential supply and return headers, and a flow path capable of being aligned to the SNSWP. With only one Unit above Mode 5, the two independent RN loops are required to be operable with each loop containing one operable RN pump and the before mentioned equipment associated with the operating Unit. If the LCO cannot be met, the required action is to restore operability within 72 hours, or place the affected Unit in Mode 3, Hot Standby, within 6 hours, and in Mode 5 within the following 30 hours.

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EVENT DESCRIPTION

During the Unit 1 End-of-Cycle (EOC) 4 refueling outage, RN Pump 1A motor was replaced with the spare motor in order to replace the upper bearing oil cooler. On April 25, 1990, excessive wear of the lower bearing housing was discovered during disassembly of the motor removed from Pump 1A (Ref. PIR 1-C90-0153). The rotor and lower bearing housing was sent to Westinghouse for evaluation and repair.

On May 7 and 8, to investigate a probable cause of the damage observed, the four RN pump motors' shaft lock nuts that secure the shaft runner to the thrust bearing were inspected and were found to be installed correctly. Also, on May 8, vibration and oil analyses were performed on all four pump motors. The vibration analysis was found to be acceptable as has been the results of all previous vibration analyses. This was the first oil analysis performed on the RN pump motors.

On May 15, the oil analysis results indicated moderate wear levels in RN Pump Motor 1B. The other pump motors showed no wear problems. From the results, the normal quarterly vibration and oil analysis surveillance was increased to monthly, with the next analysis scheduled for June 5.

On June 2 at 1621 hours, RN Pump 1B was put into service after completing repairs to the discharge strainer. RN Pump 2B, which had previously been in service, was secured at 1723 hours. During normal operator rounds on June 3 at 0430 hours, with Units 1 and 2 in Mode 1, Power Operation, RN Pump Motor 1B was observed to be experiencing high vibrations. All other operating parameters of Pump 1B were found to be normal. At 0448 hours, RN Pump 2B was returned to service. At 0518 hours, RN Pump 1B was secured and Maintenance Engineering Services (MES) was contacted to evaluate the abnormal vibration. At 1430 hours, RN Pump 1B was run for a MES Engineer to obtain vibration data, and confirmed that motor 1B was experiencing higher vibration levels than normal. It was recommended that further pump operation be restricted until the data could be further analyzed. On June 4 at 1500 hours, the MES Engineer, an MES Technical Specialist, the Transmission Station Support Engineer, and a Westinghouse Service Representative met to discuss the condition of pump motor 1B. Various inspections that could be performed with the pump in service were suggested during this meeting. Service Representative A suggested that rubbing in the oil seal area could be the cause of the moderate wear level detected in the oil analysis. MES personnel met with their management and decided to further investigate the matter during the regularly scheduled P/M activities on the following day.

On June 5 at 0300 hours, with Units 1 and 2 operating in Mode 1, RN Pump 1B was removed from service and Unit 1 entered the action statement for an inoperable RN pump. With the pump uncoupled from the motor, vibration levels still indicated abnormally high. The motor shaft runout was observed to be 0.050 inches (normally < 0.010 inches), indicating excessive wear in the bearings.

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MES, Transmission, and the Westinghouse Service Representative met and determined that an operability concern existed and that the motor should be replaced. RN Motor 1B was removed from the pump and transported to the Turbine Building. Disassembly of Motor 1B began at 1700 hours on June 6. By 2100 hours, abnormal wear was observed to have occurred in the upper bearing along with excessive wear in the lower bearing. Motor 1B could not be rebuilt on site and was transported to Westinghouse for repairs.

Rebuild of the spare motor was proceeding (rotor and lower bearing were returned from Westinghouse on May 31). On June 4, the Westinghouse Service Representative was assisting and had been requisitioned for this repair. During reassembly the axial movement of the shaft was observed to be loose. On June 5, shims were installed in the upper bearing to correct for the loose rotor. In result, axial movement was reduced to zero (.015 to .020 inches is required). A complete teardown and inspection of the spare motor was performed, and the upper guide bearing was determined to be undersized. The replacement bearings in stock were found to be out of round, and no Duke Power approved drawings existed to bring the bearing within specifications on site. Through conversation with Westinghouse it was found that supplied parts would require some machine work at the site to insure proper fit. On June 6, the guide bearing was machined using Westinghouse approved drawings. On June 7, the spare motor was rebuilt, but the shaft failed to rotate when assembly was completed. During disassembly the insulator in the upper bearing runner was believed to have been approximately 0.2 inches too thin. Westinghouse recommended using a spacer to compensate for the thin insulator. This spacer had to be machined from plate material which made it quite difficult to produce. On June 9, the spare RN pump motor was assembled. A slight excessive runout of the motor shaft was observed, which was found acceptable by the service representative.

On June 7 at 2000 hours, Unit 1 started cooldown to Mode 3 due to the inoperable RN Pump 1B. On June 8 at 0730 hours, Unit 1 entered Mode 3. On June 9 at 0922 hours, Unit 1 entered Mode 5. At 2300 hours, the spare RN pump motor was installed on pump 1B. At 0100 hours on June 10, during an uncoupled run, the spare RN motor was found to have excessively high vibration levels (12 mils). The spare motor was removed and sent to Westinghouse for repairs.

On June 11 at 1800 hours, Unit 2 entered Mode 5 for its EOC3 refueling outage. The motor of RN Pump 2A was moved to pump 1B. The axial end play and shaft runout were measured and verified to be acceptable. On June 14 at 0325 hours, RN Pump 1B was returned to operable status and the T/S action statement was exited. The motors under repair at Westinghouse are to be returned and one is to be installed on the 2A pump prior to returning Unit 2 to operation.

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CONCLUSION

This incident is attributed to Manufacturing Deficiency. During repairs of the two motors returned to Westinghouse, it was discovered that the motor stators were approximately 0.1 inch out of tolerance (-100 mils). The short stator caused the lower bearing to contact a shaft shoulder resulting in the metals found in the oil analysis, leading to accelerated bearing wear. The possibility of fixing the rotor placement relative to the bearings by shimming the stator in the field was proposed by Transmission personnel but was not approved by Westinghouse as an appropriate field fix. Therefore, the stator being short was not recognized as the root cause of the problem during repair attempts made on site. The actions taken to shim the bearings, machine the bearing guide, and add a shim to the insulator were incorrectly identified as proper solutions and these repairs were ineffective. The short stators were the result of improper manufacturing, outside of the manufacturer's original specification. This condition existed since initial startup of Unit 1. The motors will be properly modified to correct for the manufacturer deficiencies prior to their return to Catawba. A review will be performed to determine the applicability of this concern to other safety-related Westinghouse motors.

The two motors with the short stators were manufactured at the same time by Westinghouse in Buffalo, New York. Two of the other three motors available for use at Catawba were also manufactured in Buffalo under a different shop order number. The third motor (the original spare motor) was manufactured in Round Rock, Texas. Vibration analysis and oil analysis indicate no problems with the other three motors. Vibration analysis has been performed on a weekly basis and oil analysis on a monthly basis since the problem was identified. At this time, the problems appear to be confined to the two motors. The axial end play of the motor presently installed on pump 1B was inspected and found to be acceptable when it was removed from pump 2A. The RN Motor 1A Stator length has been verified to be the proper length. Work Request 2824 MES has been initiated to measure the stator length of the motor on pump 2B. Inspection results will be evaluated to determine the need for further action.

The vibration and oil analysis predictive maintenance program is controlled by guidance provided in Station Directive 3.3.15, Predictive Maintenance and Monitoring Program, which was initiated in January 1988. The initial efforts were directed toward identifying acceptable vibration limits on various plant equipment. The oil analysis program began to expand in 1989. As a result of the wear found during disassembly of the 1A motor, the RN pumps were added to the oil analysis program which were the last nuclear safety related pumps not previously included.

Prior to the increase in vibration, RN Pump 1B had been tested and verified to be capable of delivering the required flow during surveillance using PT/O/A/4400/22B, RN Pump Train B Performance Test. The last test was performed on May 8, 1990. After the vibration levels increased, MES responded by investigating further during the Preventive Maintenance (P/M) activity scheduled the next day. The RN Pump 1B was not declared inoperable at the discovery of

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the high vibration, however, it was shut down until further investigation was performed. The data taken on June 3, was not taken during an IWP test and not at IWP test conditions as all previous data had been. Although the vibration levels were elevated, they were not in the unacceptable range. RN Pump 1B was removed from service and declared inoperable in order to perform the P/M activity. The excessive shaft runout required the motor be replaced prior to returning pump 1B to service. Maintaining a reliable, operable RN System was of the utmost concern during this incident. The actions taken to investigate and repair the cause of abnormal vibration on RN Pump 1B clearly addresses those concerns, even though it resulted in a Unit shutdown.

The Transmission Station Support Engineer and the Westinghouse Service Representative were informed by MES of the abnormal vibration and oil analysis results. Additional measures to verify operability were discussed. The Service Representative did not believe the vibration data or the oil analysis results indicated an operability concern. MES then met with their management, at which time a decision was made to perform additional inspections during the P/M activity scheduled for the following day. MES, having an understanding of the operational requirements of the RN System, believed that prompt additional investigation should be made during the P/M activity. Transmission did not have the same understanding of operational requirements and with the input from Westinghouse did not share this level of concern. Transmission was not involved in the final decision made by MES to proceed with additional operability inspections during the scheduled preventive maintenance. Additionally, technical training for Transmission on systems and T/S requirements would help improve communications between groups on operability concerns.

Transmission had originally only scheduled manpower and the service representative for reassembly of the spare motor. The diagnosis of the problem with abnormal vibration, the subsequent removal from service and teardown of the 1B motor required the manpower to accomplish both the reassembly of the spare motor and the diagnostic work on 1B. The available onsite Transmission manpower was not adequate to effectively accomplish both tasks simultaneously. Additional Transmission manpower was called in from other sites and manpower was provided by the Catawba Mechanical Maintenance Section. This manpower was used as relief for the single crew that was available at the start of this incident. Likewise, the Westinghouse Service Representative received additional support from a second representative. Technical support was not available within the Transmission Department to assist in evaluating the situation as it developed. Transmission relied heavily on Westinghouse for technical assistance. This support was not sufficient to overcome the problems encountered. In addition, the procedure used to rebuild the RN pump motors does not provide specific instructions and inspections to ensure reassembly is performed correctly, primarily due to unavailability of certain information considered proprietary by the vendor, such as manufacturer prints, specifications, and tolerances. As a result of these factors, rebuilding the spare motor required an extensive amount of time. Transmission's support of station activities has been under review since January 1990 by Transmission Department Management. Improvements in

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TEXT (If more space is required, use additional NRC Form 306A's) (17)

technical support and manpower levels are expected to be completed by September 1990. Technical information needed to achieve effective repairs will be obtained from the vendor.

A search of the Operating Experience Program database reveals that within the past 24 months no completion of a Technical Specification shutdown has occurred due to a manufacturing deficiency or a deficiency in manpower or technical support availability. LER 413/89-026 does involve a Technical Specification Unit power reduction when a Westinghouse HFB 3125A breaker tripped below the minimum trip value due to manufacturing deficiencies. With the Turbine/Generator off-line and Reactor power at 6%, repairs to the breaker was completed and post-maintenance testing was satisfactorily performed, before the completion of the shutdown. Catawba's increased emphasis in both preventive and predictive maintenance activities, along with the present Technical Specification Surveillance program, will improve on identifying manufacturing deficiency that affects equipment operability. LERs 413/89-027 and 414/88-022 involved Unit shutdowns due to inoperability of a centrifugal charging pump due to (apparent) pump shaft failures. These events are attributed to equipment failure without a manufacturing deficiency identified. By the Duke Power Company definition, this incident is not considered to be a recurring problem, although the need for improvements in the manufacturing process are recognized.

CORRECTIVE ACTION

SUBSEQUENT

- 1) RN Pump 2B was returned to service.
- 2) RN Pump 1B was secured.
- 3) Vibration levels on 1B were recorded and found to be higher than normal.
- 4) Motor on 1B was inspected during a scheduled P/M activity. Found condition to be unacceptable.
- 5) Motor was removed from pump 1B, and sent to Westinghouse for repairs.
- 6) Unit 1 shutdown (Mode 5).
- 7) Spare motor was installed on pump 1B. Also experienced high vibration.
- 8) Spare motor was removed from pump 1B and sent to Westinghouse for repairs.
- 9) RN motor was moved from pump 2A to pump 1B, to return RN loop B to service.

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- 10) The motor moved from pump 2A to 1B was inspected to verify axial end play and shaft sway were acceptable.
- 11) Westinghouse is modifying the two affected pump motors to bring them within the requirements of the manufacture specifications.
- 12) Vibration analysis is being performed weekly and oil analysis is being performed monthly on the inservice motors.
- 13) Transmission support of station activities has been under review by Department Management since January, 1990.
- 14) The 1A RN motor stator length has been verified to meet the original specification.

PLANNED

- 1) The necessary information, proprietary prints, and specifications will be obtained from the vendor and incorporated into station procedures to enhance the capability to achieve effective on-site repairs in a timely manner.
- 2) An evaluation will be performed to determine the applicability of the manufacturing concern to other safety-related Westinghouse motors.
- 3) RN Motor 2B will have its stator length verified to ensure it meets the original manufacturer's specification (Work Request 2824 MRS).

SAFETY ANALYSIS

Inservice testing of RN Pump 1B was periodically conducted to ensure operability and was last performed on May 8, 1990. As the high vibration levels were observed, the pump was secured and eventually removed from service to investigate the cause of the vibration. When repairs could not be completed within the required action statement of T/S 3.7.4, Unit 1 was shutdown due to the inoperable RN pump. During this incident the Unit was maintained within the requirements of T/S 3.7.4, reaching the required conditions within the specified time frames. The health and safety of the public were not affected by this incident.