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DUKE POWER

October 9, 1992

U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 20555

Subject: McGuire Nuclear Station Unit 1  
Implant Review Report No. 92-19

Gentlemen:

This report is being submitted pursuant to Selected Licensee Commitment 16.9-7, Remedial Action c. This event concerned the Standby Shutdown System being determined past inoperable (for more than seven days) due to the Unit 1 Chemical Volume And Control System Standby Makeup Pump being declared past inoperable. This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

*T.C. McMeekin*

T.C. McMeekin

TLP/bcb

Attachment

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MCGUIRE SAFETY REVIEW GROUP

INPLANT REVIEW REPORT

1. REPORT NUMBER: 92-19
2. DATE OF REVIEW: September 10 - October 1, 1992
3. SUBJECT DESCRIPTION: This 30 day report is submitted as a special report pursuant to Selected Licensee Commitment (SLC) Section 16.9-7, Remedial Action c. The Standby Shutdown System (SSS) was determined Past Inoperable for more than 7 days due to the Unit 1 Chemical Volume and Control (NV) system Standby Makeup pump (1MNVP0046) being declared Past Inoperable when it was discovered that the pump drive shaft was rotating in the incorrect direction. This report documents the related circumstances and provides corrective actions to prevent recurrence of a similar event.
4. EVALUATION AND COMMENT:

Abstract

On August 4, 1992, Maintenance personnel were performing maintenance activities on Standby Makeup pump 1MNVP0046. During the maintenance activities, it was discovered that the drive shaft on pump 1MNVP0046 was rotating in the opposite direction than specified on the pump casing. Problem Investigation Report (PIR) 1-M92-0127 was subsequently written to evaluate the reversed shaft rotation, determine the cause of the event, and corrective actions to be taken. Unit 1 was in Mode 1 (Power Operation) at 99.9 percent power at the time of discovery. On September 9, 1992, Engineering personnel subsequently determined pump 1MNVP0046 to be Past Inoperable for the time period the pump was configured in this manner. The causes of this event are Unknown and Management Deficiency because there were inadequate requirements for ensuring correct pump rotation at the time of installation. Subsequently, the pump rotation was corrected, and the SSS returned to operable status.

### Background

The standby makeup subsystem of the NV system functions as part of the SSS to control reactor coolant volume should normal volume control be unavailable following a postulated fire or security event. The SSS serves as the last resort and is designed to be used when the preferred equipment has been rendered inoperable.

One standby makeup pump is located in the annulus of each Reactor building to supply makeup flow to the Reactor Coolant (NC) system. The pump provides a means of makeup to recover normal system leakage and NC pump seal leakage. The pump is manually started within 10 minutes of the hypothesized event to ensure the Reactor Coolant pump seals are not degraded. The pump should not be stopped until the NC system is at atmospheric pressure or until the NV system charging pumps and a source of borated water are available for seal injection. The design basis operating time for this pump is 72 hours, however, the most probable event scenarios would expect the pump to be used for no more than 30 hours.

The standby makeup pump is of the positive displacement (PD) design, reciprocating plunger type, and adds a constant quantity (26 gpm) of borated water to the NC system. The pump was manufactured by the Wheatly Gaso Company and is designated as model 5P-323. The fluid end of the pump consists of 5 reciprocating plungers sealed with packing. The power end of the pump consists of a camshaft and 5 connecting rods, cross heads, and wrist pin bushings which require oil lubrication. The pump is driven by a 3 phase 575 volt (V) 50 horsepower (HP) induction motor at a rated speed of 900 RPM.

SLC 16.9.7, SSS, requires that the SSS be operable during Modes 1, 2 (Startup), and 3 (Hot Standby). If any SSS components, such as a standby makeup pump or its associated water supply, are inoperable, the SSS shall be declared inoperable. Remedial Action paragraph c requires that with the SSS inoperable for more than 7 days, submit a special report to the NRC within the next 30 days outlining the cause of the inoperability, corrective actions being taken, and plans for restoring the system to operable status.

Description Of Event

On July 5, 1992, a routine performance test procedure PT/1/A/4209/01C, Standby Makeup Pump Flow Performance Test, was performed to verify Standby Makeup pump 1MNVP00046 would meet flow requirements. During the test, the reciprocating plunger packing on the pump was determined to be leaking. Work order 91124736 was subsequently initiated to repair the pump.

On August 4, 1992, Maintenance Technician A repaired the pump, as directed by work order 91124736, by adjusting the packing on the reciprocating plunger assembly. The pump was then started for functional verification and at approximately 1700, Maintenance Technician A observed that the pump camshaft appeared to be rotating in a direction opposite to the rotation arrow cast on the pump casing.

On the morning of August 5, 1992, Component Engineering personnel were contacted and asked to evaluate the significance of Standby Makeup pump 1MNVP00046 rotating backwards. An engineering evaluation was initiated. This evaluation took almost all day and involved discussion with Operations, site engineering, and vendor (Wheatley Gasco) engineering personnel. It was then determined that Standby Makeup pump 1MNVP00046 would meet flow and pressure requirements but probably would not receive adequate lubrication when operated with the camshaft turning backwards. Therefore, it is assumed the pump would not have been able to run for the design period of 72 hours. PIR 1-M92-0127 was generated to document the problem and ensure adequate followup action was taken. Subsequently, Standby Makeup pump 1MNVP00046 was declared inoperable and logged in the Unit 1 Technical Specification Action Item Logbook (TSAIL) on August 5, 1992, at 1740.

Work order 92059571 was initiated to change the rotation of Standby Makeup pump 1MNVP00046. The X and Y phase motor leads on Standby Makeup pump 1MNVP00046 were subsequently rolled to provide correct pump rotation.

By 1723, August 6, 1992, all repair activities were complete and Standby Makeup pump 1MNVP00046 was returned to operable status. Engineering personnel continued to evaluate past operability of the pump, and determine appropriate followup action.

On September 9, 1992, during a Safety Review Group (SRG) and site engineering review and investigation of PIR 1-M92-0127, it was determined that Standby Makeup pump 1MNVP00046 was



Past Inoperable for the time period the pump was configured to run in the reverse direction. It was also determined that a reportable event per SLC section 16.9-7, Remedial Action c had occurred.

### Conclusion

This event is assigned a cause of Unknown because it could not be determined when or why Standby Makeup pump 1MNVP00046 rotation was configured to run in the reverse direction. The pump direction of rotation is determined by the electrical lead configuration to the 3 phase pump motor. The only way to make the pump run in the reverse direction is to incorrectly wire the motor. SRG and Component Engineering personnel conducted an extensive search of work request and work order history to determine when Standby Makeup pump 1MNVP00046 was configured to run in the reverse direction. A definite time could not be established when the pump motor was wired incorrectly. The most probable time was during initial pump installation which occurred prior to 1984. No significant maintenance has been performed that would have affected the rotational direction of the pump or motor since initial installation. In 1984, Nuclear Station Modification (NSM) MG1-1674 was implemented to replace the original 8 inch motor sheave with a 9 inch sheave to increase pump output. However, the motor was not required to be disconnected to perform the NSM.

Improper rotation of this type pump is not easily detected. Since the pump is a PD plunger type, its output is not affected by improper rotation. Therefore, historical engineering analysis of performance test data did not detect any problem with the pump rotation. During vibration data collection the pump is either off and is rotated by hand, or is running at rated speed. When the pump is running at rated speed, a person viewing the drive shaft would not be able to determine which direction the shaft is turning. Normally, the area around the pump is cleared (for personnel safety reasons) prior to starting the pump. Therefore, personnel performing routine maintenance or testing activities are normally not in a position to view the pump drive shaft when the motor is started.

The direction of pump drive shaft rotation has no immediate effect on the performance of the pump. However, site engineering personnel have determined that the power end of the pump may receive inadequate lubrication while the pump is run in the reverse direction. When the pump is operated

backwards, the load is shifted to the top of the cross heads which get poorer lubrication. The pump lubrication system is designed such that oil is deposited in an oil gallery on the top of the cross head bores. Then, oil trickles down to lubricate the cross heads and wrist pin bushings. If the pump is run backwards, the process depends solely on the splash effect to lubricate all necessary parts. Wheatley Gasco has not done testing to determine how long the pump would run backwards before failure.

The pump is only operated for approximately 30 minutes, 4 times per year for the performance test as specified by procedure PT/1/A/4209/01C. The pump is not heavily loaded during the test. Historical vibration analysis has not shown any mechanical problems, therefore, the power end of the pump has not been damaged due to routine testing.

A cause of Management Deficiency is assigned because there were inadequate requirements for ensuring correct pump rotation at the time of installation. Motor maintenance requiring the power leads to be disconnected are controlled by 1 of 2 procedures. Procedure MP/C/A/2002/01, Motor Inspection and Maintenance, establishes the requirements to control the inspection, maintenance, and repair of electric motors. This procedure is normally used for motors above 600 V and 150 HP. Step 11.5.9 includes a requirement to perform a rotation verification if the motor leads are disconnected during maintenance activities. Procedure IP/0/A/3190/02, Induction Motor Preventative Maintenance, establishes the requirements to control preventative maintenance, inspections, and repair of AC induction motors 600 V and 150 HP or smaller. Since Standby Makeup pump 1MNVP00046 is less than 150 HP, maintenance activity performed on the motor would be controlled by procedure IP/0/A/3190/02. However, there is no programmatic mechanism, in place, to ensure the pump motor is wired for correct rotation if the motor leads are disconnected.

The pump motor wiring was subsequently corrected and the SSS returned to operable status. Procedure IP/0/A/3190/02 will be revised to add a requirement for rotational checks anytime motor leads are disconnected during maintenance activities.

There were no personnel injuries, radiation overexposures, or uncontrolled releases of radioactive material as a result of this event.

Corrective Actions

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|------------|--|
| Immediate  | PIR 1-M92-0127 was initiated to document and correct the reversed standby makeup pump shaft rotation.  |
| Subsequent | <ol style="list-style-type: none"><li>1. The motor leads of pump 1MNVP00046 were reconfigured to provide correct pump shaft rotation.</li><li>2. Unit 2 Standby Makeup pump 2MNVP00046 was verified with correct pump shaft rotation.</li><li>3. Appropriate Catawba Nuclear Station personnel were notified since they have identical standby makeup pumps.</li></ol> |
| Planned    | <ol style="list-style-type: none"><li>1. Procedure IP/0/A/3190/02 will be revised to add a step to require a rotational check be performed anytime motor leads are disconnected.</li></ol>   |