



DUKE POWER

October 30, 1989

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

Subject: **McGuire Nuclear Station, Unit 2**
Docket No. 50-370
Diesel Generator Special Report

Gentlemen:

Pursuant to Technical Specification (T.S.) 6.9.2 as specified by T.S. 4.8.1.1.3, find attached a special report concerning two valid failures on Diesel Generator 2B.

If you have any questions, please contact S.E. LeRoy at (704) 373-6233.

Very truly yours,

Hal B. Tucker
Hal B. Tucker

SEL/469

Attachment

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Duke Power Company
McGuire Nuclear Station
Diesel Generator 2B Special Report

On September 28, 1989 at 0947, Diesel Generator (DG) 2B was started (start attempt no. 747) per the normal surveillance procedure (PT/2/A/4350/02B). This start attempt was made but the engine did not rotate. The ventilation fans started but the DG starting air did not actuate. The start attempt ended after 20 seconds when 50% speed had not been achieved. This start attempt is considered a Valid Failure. Investigation revealed that an indication of a ground on the DG control power was noted at the time of the start attempt. (This ground was thought to be in the monitoring circuit and not the cause of the start failure.) The contact status in the start circuit was checked with no problems found.

A decision was made to try another start at 1153, to monitor relay RVG1 which must energize to pick up all four starting air valve solenoids (valves 2VG-65, 2VG-66, 2VG-67, and 2VG-68). Before this start attempt (no. 748), Instrument and Electrical (IAE) personnel made preparations to monitor contacts 1 and 1A on relays 2TRA and 2TRB, and to watch relays RVG1 and S1A1X to detect any problem that would prevent the starting air solenoids from energizing. This start was successful with all relays and contacts operating as expected, and was classified as a Valid Success.

Another start was attempted at 1840, (start attempt no. 749). Prior to this start, IAE performed several checks on contacts 1 and 1A, and 3 and 3A on relay RVG1. Both of these contacts showed intermittent high resistance, and looked burned. Relay RVG1 was then replaced. Failure of either of these contacts would prevent any of the four starting air solenoid valves from opening and would explain the failure to roll the engine on starting air during the previous failed attempt. This start attempt (no. 749) verified proper operation of the new relay. This start attempt was satisfactory and classified as a Valid Success. PT/2/A/4350/02B was then completed.

On September 29, 1989 at 0541, another start attempt (no. 750) was made so IAE could check for a ground. The start was an invalid test due to troubleshooting. The ground monitoring system was replaced. The DG was declared operable with the completion of the work.

SUMMARY:

The cause of the start attempt failure was intermittent failure of one of the two RVG1 contacts in series with the starting air solenoids. The root cause of the problem was an inadequate circuit design that placed all four starting air solenoids in series with the RVG1 contacts. The large current surge across the contacts to supply the solenoids burned the contacts and

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eventually caused the resistance to be too high to allow sufficient current to pass to pick up the solenoids, preventing the DG from starting due to no starting air supply. The design deficiency had previously been discovered during a Self Initiated Technical Audit (SITA). Station Problem Report (SPR) No. 2403 had been written as to address the problem. IAE personnel wrote work requests to replace the RVG1 contacts on the other McGuire DGs. The priority for completing SPP No. 2403 will be increased.

This failure was the third Valid Failure in the last 20 valid tests and the sixth Valid Failure in the last 100 valid tests on DG 2B. The DG 2B tests frequency is weekly. On a unit basis, this failure was the fourth Valid Failure in the last 100 valid tests.

On October 5, 1989 at 0930, DG 2B was started for the normal surveillance test (PT/2/A/4350/02B). The engine rotated slowly but apparently did not get any fuel, and was turning on starting air. The operator intentionally stopped the start attempt after 15 seconds. The DG would have tripped after 20 seconds due to not achieving 50% speed in 20 seconds. A ground on the diesel batteries was detected during the start attempt. This start attempt is considered a Valid Failure (start attempt no. 751).

A work request was submitted and Instrument and Electrical (IAE) personnel began troubleshooting the ground and the failure to get fuel to the engine. Solenoid valves 2VGSV-5170 and 2VGSV-5172 were suspect because they must open on a DG start to allow fuel flow to the engine. The solenoid coils and wiring to the control panel were checked for grounds; however, none were found. Relays RVG2, RVG3, 2TRA, 2TRB, and their respective contacts to the solenoids valves were checked but no problems were found. Each motor capable of being started from the DG control panel was started individually while being monitored for grounds. It was discovered that each time the crankcase vacuum blower was tripped, a ground was picked up on the diesel batteries. A decision was made to attempt another start with personnel monitoring ground and relay status.

At 1700, the DG started successfully, (start attempt no. 752), and a positive leg ground was noted on the batteries about six seconds after starting the DG. The ground remained in and switched to a negative leg ground when the DG was stopped. It went away after the DG auxiliaries (oil pump, water pump, and vacuum blower) timed out 20 seconds after stopping the DG. This start was classified as an Invalid Test due to troubleshooting.

Two start simulations were attempted with the starting air manually isolated to prevent the DG from rolling and trying to start. It was discovered that air was blowing out of a vent solenoid valve (2VGSV-5173). This leak meant that the supply solenoid valve, 2VGSV-5172, had failed to close. The valve was replaced.

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The crankcase vacuum blower and motor were removed, cleaned, and checked for a ground in the wiring from the breaker to the motor. No problem was found. While cleaning the blower, a decision was made to check the crankcase vacuum and cooling water pressure switches 2KDPS-5011 and 1KDPS-5051 for grounds. A ground was discovered internal to 2KDPS-5051. This discovery explained the ground indication that had periodically occurred. The cooling water pressure switch was replaced. The vacuum blower/motor was replaced.

A decision was made to try three starts and check for a battery ground and to monitor starting operation for consistent start times. If operation was successful, then the operability test would be performed. The following start attempts were made on October 7, 1989:

Start Attempt No. 753 at 0815, start time to 95% speed - 8.5 seconds;
Start Attempt No. 754 at 0822, start time to 95% speed - 8.4 seconds; and,
Start Attempt No. 753 at 0832, start time to 95% speed - 8.4 seconds.

All three starts were good with consistent start times, and were classified Invalid Tests due to troubleshooting.

SUMMARY:

The root cause of the DG battery ground was determined to be the ground on pressure switch 2KDPS-5051. However, this ground does not explain the original failure of the DG to get fuel during start attempt no. 751.

Failure of solenoid valve 2VGSV-5172 to open would explain the failure during start attempt no. 751; however, the failure mode discovered was that the valve failed to close. Upon disassembly of the valve, it was noted that a small piece of metal was in a hole beneath the seat area on the inlet side of the valve. The metal appeared to have originated from outside the valve. Markings on the surface of the foreign metal piece indicated the metal may have been pinched in the valve seat preventing closure. It was not obvious how the piece of metal could have prevented the valve from opening as would be the case necessary to explain a start attempt failure due to lack of fuel.

DG 2B will be closely monitored during the next start for any signs of grounds or solenoid problems. The control air line filter and the solenoid valve 2VGSV-5170 will be checked for foreign metal at the next opportunity.

This failure was the fourth Valid Failure in the last 20 valid tests and the seventh Valid Failure in the last 100 valid tests on DG 2B. Surveillance test frequency is weekly. On a unit basis, this was the fifth Valid Failure in the last valid 100 tests.