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**DUKE POWER**

September 14, 1994

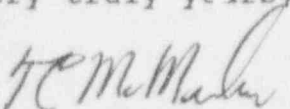
U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 20555

Subject: McGuire Nuclear Station, Unit 1  
Special Report No.: 94-004  
Problem Investigation Process No.: 1-M94-1024

Gentlemen:

Attached for your information is Special Report No. 94-004 concerning a valid failure of Diesel Generator 1A due to failure of the output voltage regulator. 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

RJD/bcb

Attachment

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DUKE POWER COMPANY  
McGUIRE NUCLEAR STATION  
SAFETY REVIEW GROUP SPECIAL REPORT

Diesel Generator Special Report Due To A Valid Failure Of Diesel  
Generator 1A On August 21, 1994, As Documented On Problem  
Investigation Process (PIP) 1-M94-1024.

Special Report No.: 94-004

Date Of Report: September 14, 1994

On August 21, 1994, Diesel Generator (DG) 1A was being run using routine surveillance test procedure PT/1/A/4350/01A, Diesel Generator 1A Operability Test. The DG was 22 hours into the 24 hour surveillance run (Start No. 980) associated with Refueling Outage 1EOC9. All systems were normal, the plant was in Mode 5 and preparing for initial drain down of the Reactor Coolant (NC) system. At 0829, the DG output voltage indication failed high. Attempts to lower the voltage from the Control Room and the local DG Control Panel were unsuccessful. Subsequently, at 0842, the DG was tripped by Operations personnel constituting a valid failure of the DG. The initiating condition that alerted Operations personnel of a problem existing was high voltage, high current, and low power factor on the DG output due to failure of the series boost exciter-regulator (voltage regulator). The Voltage Regulator is a Basler, Model 90 68100-100 Type SBSR-HV.

This was the first Valid Failure in the last 20 Valid Tests and the third Valid Failure in the last 100 Valid tests of DG 1A. On a Unit basis, this is the first Valid Failure in the last 100 Valid Tests of DGs 1A and 1B combined. Surveillance testing remains monthly per the requirements of Technical Specification 4.8-1 (Diesel Generator Test Schedule). This incident has been assigned a cause of P2h, Degraded Subcomponent contributed to failure.

During subsequent troubleshooting of the voltage regulator, Maintenance personnel examined the DG potential transformers and fuses. No problems were found with either. New fuses were installed to the isolation transformer, the power isolation transformer was checked for grounds, and the voltage regulator circuit board (SVR) was replaced to insure that an operable control board was installed. The DG was restarted (Start No. 981) and the output voltage again went high. The DG was immediately shut down.

Further troubleshooting identified a loose connection on the DG neutral grounding resistor. This loose connection was suspected as being the source of the problems. The connection was tightened, and the original SVR was reinstalled. Upon restart of the DG (Start No. 982), the output voltage was observed to overshoot and then return to rated voltage in a normal manner, with the exception of taking a slightly longer than normal time to do so. However, very shortly thereafter the voltage began to rise once more and smoke was observed to come over the top of the low voltage chassis from the high voltage chassis side of the voltage regulator cabinet. Before the DG could be shut down two distinct explosions were heard and fire was observed coming from the voltage regulator cabinet louvers. The DG subsequently tripped due to the operation of the 86 lockout relay which was initiated by the operation of the 87 differential relay.

Starts No. 981 and 982 did not constitute valid failures because the DG was removed from service for troubleshooting at those times.

Because of the extensive damage to components, the voltage regulator was later removed and taken to Basler Electric Company, the manufacturer, for in depth examination and repair. Upon examination the components which

failed the manufacturer's acceptance test were, Isolation (Control Power) Transformer T54, Current Transformer CT1, and Current Transformer CT2.

After analysis of circumstances surrounding the failure, it was concluded that the root cause of the failure of the voltage regulator on DG 1A was failure of Isolation Transformer T54. Both automatic and manual control had been lost on the DG 1A voltage regulator due to inter-winding and winding to core insulation failures in the transformer. Isolation Transformer T54 is a 4200/240V single phase encapsulated transformer which provides power to the SVR. Without this voltage, full excitation is provided to the generator field causing the generator output voltage to try to rise to ceiling with no control. The smoke, ionized gases, and molten copper resulting from the failure of Isolation Transformer T54 caused the phase to phase and phase to ground arcing/faulting within the voltage regulator cabinet.

Corrective actions as a result include inspection of the T54, CT1, CT2, and CT3 current transformers for voltage regulators on DG 1B, 2A, and 2B during the next available outage timeframe, respectively.