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WILLIAM O. PARKER, JR.
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December 16, 1981

Mr. J. P. O'Reilly, Director
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

Re: McGuire Nuclear Station Unit 1
Docket No. 50-369

Dear Mr. O'Reilly:

Please find attached Reportable Occurrence Report RO-369/81-183. This report concerns T.S.6.9.1.12(g), "Conditions arising from natural or man-made events that, as a direct result of the event require unit shutdown, operation of safety systems, or other protective measures required by technical specifications." This incident was considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

William O. Parker, Jr.

PBN/jfw
Attachments

cc: Director
Office of Management and Program Analysis
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Mr. P. R. Bemis
Senior Resident Inspector-NRC
McGuire Nuclear Station

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DUKE POWER COMPANY
McGUIRE NUCLEAR STATION
REPORTABLE OCCURRENCE REPORT NO. 81-183

REPORT DATE: December 16, 1981

FACILITY: McGuire Unit 1, Cornelius, NC

IDENTIFICATION: Inadvertent Station Blackout during Loss of Offsite Power Test

DISCUSSION: At 2136 on December 2, 1981 the Unit 1 reactor and turbine tripped on low reactor coolant (NC) pump frequency while a Loss of Offsite Power Test was being attempted. The test was initiated by opening the switchyard power circuit breakers (PCB) and isolating Unit 1 from the power grid. The turbine generator was expected to "run back" from its operating load of 30% (315 MWe) to the unit's auxiliary load of 46 MWe while maintaining generating frequency within the reactor and turbine trip setpoints. Immediately following the trip of the last PCB, generator frequency increased to 62 Hz as speed control took over and closed the governor and intercept valves. Frequency then dropped to 60 Hz and the intercept valves opened to maintain speed. Governor valves remained closed and the frequency again began to drop after hovering at 60 Hz for a short period. Frequency dropped to 58 Hz and then slowly drifted to 56 Hz. The governor valves never opened more than a crack before the reactor and all four NC pumps tripped on under frequency signals from 2 out of 4 NC pump motor busses. The NC system went into natural circulation cooling and the safety systems responded as designed. Operators immediately began recovering offsite power and the 6900 volt busses were charged after verifying that major pump motor breakers on the busses were tripped. Power was restored to all four 6900 volt busses about two minutes after the blackout started. NC pump B was started at 2140 and forced circulation of the primary system was reestablished. Within twenty minutes, NC pumps A and C were started; but, efforts to start NC pump D were unsuccessful because its number 1 seal was apparently cocked. No significant transient resulted from the trip.

Operators continued to recover the secondary side of the plant. The condensate (CM) system was started up using the appropriate Condensate and Feedwater System procedure. Hotwell pump (HWP) A was started about 2212, but the strainer differential pressure rose rapidly so B HWP was started and A was tripped. About ten or fifteen minutes later, a seal oil (LG) system trouble alarm was received. While investigating this problem, water was noticed coming from the turbine end of the main generator. Operations staff personnel attempted to keep the generator sealed by running the back up seal oil pump and controlling the system manually. Other Operations personnel isolated the hydrogen cooler from the CM system and vented hydrogen to atmosphere. The LG system maintains an operating pressure 12 psig higher than the hydrogen pressure in the generator. When the operators reached the LG skid, the local gauge was pegged high (100 psig) due to the high hydrogen pressure. A large volume of water had leaked from the hydrogen cooler into the generator.

EVALUATION: The loss of Offsite Power Test was the first test of the turbine control system in which turbine speed was controlled with a load on the generator. A severe drop in electrical load, from 315 MWe to 46 MWE, added to the difficulty of the test.

The turbine speed transient that ended in a reactor trip was the result of an improperly set up turbine control system. Damage to the generator hydrogen cooler was apparently caused by starting A HWP with a flow path through polisher demineralizer cells A, C, and D.

As the CM system is currently designed, seven flow paths exist between the HWP discharge header and the generator hydrogen cooler. Four of the paths are through polishing demineralizer cells A, B, C and D. Two demineralizer bypass paths are controlled by valves 1CM-422 and 1CM-423. The seventh path is a line which connects the HWP discharge directly to the condensate booster pump suction and is controlled by valve 1CM-420. Valve 1CM-420 is normally closed and opens only when a turbine runback is in progress. Valves 1CM-422 and 1CM-423 operate from a single controller to limit differential pressure across the demineralizers when the controller is in automatic. When the controller is in manual the valves may be positioned as necessary by a manual loader in the control room. Of the four valves involved with isolation of each demineralizer cell, 2 inlet and 2 outlet, 2 are operated by the demineralizer control logic and 2 may be positioned manually. If a cell is in service and flow drops below a preset limit, the corresponding "hold" pump starts and a "hold" valve opens to allow recirculation flow through the cell. This prevents loss of the filter coating material which covers the screens. The demineralizer outlet valves do not automatically close on loss of flow through a cell in service, but maintain their operating positions unless repositioned by the cell control system. Cells may be isolated by selecting the "hold" mode on the local control panel. Each cell has its own set of control switches and indication lights on the local panel. A set of switch modules is also located in the control room for controlling the operating modes of the cells. Each module, one for each cell, has a "hold" pushbutton and light, and a "filter" pushbutton and light. These switches are redundant to the switches on the local panel and are not normally used because station Chemistry personnel have responsibility for operating the cells. During the event the control room operator called the chemistry technician on duty and asked the status of the polisher demineralizer cells. Based on the information he received he assumed all the cells were isolated, but in fact cells A, C and D were not isolated. Some of the misunderstanding between Operations and Chemistry personnel might be attributable to what is meant by a cell being in "hold". A cell might be said to be in "hold" when the flow has dropped on a cell that was in service. The hold pump would be running and the water would be recirculating to protect the filter. This condition differs from the "hold" mode because the cell is not isolated and the "filter" status light is illuminated.

None of the seven flow paths valves have status lights in the control room. The demineralizer cell valves have status lights on the local panel. Valve 1CM-420 has a computer status point.

There are three interlocks which prevent starting the first HWP when all three pumps are tripped. If 1CM-420 or 1CM-422 is not closed, HWP starts are prevented (1CM-423 closes before 1CM-422). Pump start is also prevented if the controller for 1CM-422 and 1CM-423 is in automatic mode. No interlocks are installed on the demineralizer cell isolation valves to prevent HWP starts.

Inspection of the generator determined that no permanent damage had occurred other than damage to tubes at the exciter end of the cooler.

CORRECTIVE ACTION: The speed controls on the turbine generator will be readjusted by Westinghouse personnel to respond more quickly.

Work is underway to replace the damaged hydrogen cooler with the cooler coil from Unit 2.

The stator and rotor of the generator have been heated and dried out using fans, heaters, and specially constructed housing structures. Electrical leakage tests were conducted on the insulation to determine the residual moisture present during the drying process.

A task force has been formed to review this incident and to determine whether procedural or design changes are required.

SAFETY ANALYSIS: The reactor trip and ensuing transient presented no danger to the NC system. Development of the capability for a unit to withstand a separation from its electrical load and offsite power and yet continue to supply auxiliary loads will increase the safety and reliability of the station. The health and safety of the public was not affected by this incident.