LICENSEE EVENT REPORT (LER) Form Rev. 2.0

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Title (4)

Failure to Start of the HPCI Turning Gear Motor due to Unknown Cause.

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	Docket Number(s)
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OPERATING MODE (9)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10CFR (Check one or more of the following) (11)					
4	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)		
POWER LEVEL (10)	20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)	73.71(c)		
8 7	20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	Other (Specify in Abstract below and in Text)		
	20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)			
	20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)			
	20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)			

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
	AREA CODE
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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)		Expected Submission Date (15)	Month	Day	Year
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

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

On October 4, 1995, surveillance test QCOS 2300-1, High Pressure Coolant Injection (HPCI) [BJ] Periodic Test, was in progress. The HPCI system was tripped to secure the system. When the turbine had coasted to rest, the turning gear motor did not auto-start and engage. At 0230 hours, the system was declared inoperable due to the inability to put the turning gear into operation. The actual root cause of this event is unknown. Troubleshooting indicates the most probable cause of the turning gear motor failure to start was associated with the turning gear motor logic. One of the contacts may not have changed state, thus creating an open circuit and not providing power to the turning gear motor. All contacts in the logic circuit were inspected and resistance checks performed. The turning gear logic was tested multiple times and the turning gear motor has started reliably. A chart recorder has been installed to monitor several points in the turning gear logic. The HPCI system was returned to service and tested. The system was declared operable at 2222 hours on October 7, 1995. The system will be tested weekly for a total of 4 consecutive weeks to assure system reliability.

PLANT AND SYSTEM IDENTIFICATION:

General Electric - Boiling Water Reactor - 2511 MWt rated core thermal power.

EVENT IDENTIFICATION: Failure to start of the HPCI Turning Gear Motor due to unknown cause.

A. CONDITIONS PRIOR TO EVENT:

Unit: Two Event Date: October 4, 1995 Event Time: 0230
Reactor Mode: 4 Mode Name: Run Power Level: 87

This report was initiated by Licensee Event Report 265\95-007.

RUN (4) - In this position the reactor system pressure is at or above 825 psig, and the reactor protection system is energized, with APRM protection and RBM interlocks in service (excluding the 15% high flux scram).

B. EVENT DESCRIPTION:

On October 4, 1995, surveillance test QCOS 2300-1, High Pressure Coolant Injection (HPCI) [BJ] Periodic Test, was in progress. At 0153 hours, the Motor Control Center (MCC) 29-2 Feed Breaker tripped on overload. See License Event Report (LER) 265-95-006 for details of this event. During the course of recovery from the loss of MCC 29-2, it was decided to terminate the HPCI test that was in progress and the HPCI system was tripped to secure the system. When the HPCI turbine had coasted to rest, the turning gear motor did not auto-start and engage. The Nuclear Station Operator (NSO) proceeded to manually start and engage the turning gear logic in accordance with QCOA 2300-8, "HPCI Turning Gear Fails to Start or Engage Automatically on a Coastdown". At 0230 hours, the system was declared inoperable due to the inability to put the turning gear into operation. At 1124 hours, the system was locked out in the tripped condition to prevent system operation. At 1730 hours, the turning gear motor was taken out of service to perform megger/milliohm checks. At 0535 hours on October 5, 1995, the turning gear motor was returned to service and at 0545 hours, the turning gear was successfully placed into operation. At 1536 hours on October 5, 1995, the HPCI system lock out was removed and the system was made available. On October 7, 1995, at 1348 hours, the turning gear was again placed in operation in preparation to test HPCI. HPCI was placed in operation at 1754 hours and shutdown normally at 1825 hours. At 2222 hours, on October 7, 1995, the HPCI Limiting Condition for Operation (LCO) was exited and HPCI was declared operable.

C. CAUSE OF EVENT:

This License Event Report (LER) is being submitted due to the requirements of 10CFR50.73.(a)(2)(v).

The actual root cause of this event is unknown. Troubleshooting indicates the most probable cause of the turning gear motor failure to start was associated with the turning gear motor logic. One of the contacts may not have changed state, thus creating an open circuit and not providing power to the turning gear motor. This was based on the following reasons:

Under normal operating conditions, power to the turning gear motor requires the following: (1) the 1-2 contacts of relay 2330-122 to be closed ('B' contacts needing relay 2330-122 de-energized); (2) the auxiliary oil pump running in order to pick up contacts 1-2 from pressures switches 2-2341-7 and 2-2341-20; (3) the turning gear motor control switch in "Normal, Start, or Engage" positions picking up switch contacts 1-1C and 2-2C; (4) the turbine at zero speed picking up contacts 3-4 on relay 2330-120 and; (5) the turning gear timer relay "TA" energized picking up contacts 3-14. The attached figure shows a simplified schematic of the interlocks that are required for the start of the turning gear motor.

Prior to this event, the turning gear motor had successfully and reliably been started per QCOS 2300-1. The turbine was placed on the turning gear approximately 3 hours prior to starting the turbine, demonstrating the turning gear logic was working as designed.

The NSO reported that, after the turbine was started, the turning gear lever "disengaged" light was energized, the auxiliary oil pump was still running, and no abnormal indications or annunciators were received on the 902-3 panel. In this condition, when the system was tripped, the turning gear motor would not have started due to relay 2330-122 being sealed-in. This occurs during the disengagement of the turning gear lever arm. The turning gear lever arm was also verified fully disengaged by the Equipment Attendant (EA) that was present locally at the HPCI system. With the turning gear disengaged, relay 2330-122 energizes and seals itself in. The NSO entered abnormal procedure QCOA 2300-8, "HPCI Turning Gear Fails to Start or Engage Automatically on a Coastdown". The NSO reset the relay 2330-122 seal-in logic, which should have started the turning gear motor at that time. As the NSO proceeded through the steps of QCOA 2300-8, it was observed that the turning gear motor run indicating light was never energized, indicating that the motor never received power to run. The motor overload indicating light also never energized. The turning gear motor run indicating light bulb was inspected and found to be acceptable.

D. SAFETY ANALYSIS:

The safety significance of this event was mitigated by the fact that Reactor Core Isolation Cooling (RCIC) [BN] and the Safe Shutdown Makeup Pump (SSMP) systems were available to provide high pressure water to the reactor. These systems would be available even in the event of the loss of off-site power. In addition, if off-site power were to remain available during a postulated loss of coolant event, all three Reactor Feed Pumps [SJ] were available to inject high pressure water. In the event of the loss of all high pressure water to the reactor, the Automatic Depressurization System (ADS) was fully available to depressurize the reactor so that the Low Pressure Coolant Injection (LPCI) [BO] and Core Spray (CS) [BM] systems would be available.

Had HPCI been immediately required, the system would have been able to restart and inject into the vessel as long as the turbine hadn't cooled down in this condition. The turning gear is required to allow for the cooldown of the turbine and prevent a temporary bow or sag. The system was declared inoperable because, after a cooldown with no turning gear operation, it is possible that the turbine shaft could have temporarily bowed. Subsequent operation of the turning gear would remove the bow. In this event, HPCI hadn't been running long enough to cause a bow or eccentricity. Later operation of the turning gear showed good condition of turbine shaft and that no eccentricity existed.

HPCI was administratively declared inoperable from 0235 hours on October 4, 1995, to 2222 hours on October 7, 1995, a total of 91.78 hours. The system was actually unavailable to perform its function due to troubleshooting activities and concern for possible temporary shaft bowing from 1124 hours on October 4 to 1536 hours on October 5, a total 28.2 hours.

E. CORRECTIVE ACTIONS:

Actions Completed:

After HPCI was declared inoperable due to the inability to put the turning gear into operation, troubleshooting was begun to determine the cause. The turning gear motor start logic was examined. All contacts in the logic were found to be operating properly.

1. The thermal overload and circuit breakers were verified after failure of the turning gear motor. Neither the thermal overload nor circuit breaker had tripped. This was verified locally at MCC 2A, at panel 902-39, on panel 902-3, and on the sequence of events recorder.

2. The turning gear motor was megger/milliohm tested to determine if failure of the motor had occurred. The testing determined the motor was acceptable. After the turning gear motor was returned to service, the auxiliary oil pump was started and the turning gear logic worked as designed.

3. Wiring and terminal points were inspected in panel 902-39, panel 902-3, and the terminal strips at the local cabinet. All wiring was acceptable.

4. The turning gear motor logic has been tested multiple times since this event. The turning gear motor has started reliably every time without discrepancies.

5. Contact resistance checks were made in the logic during the investigation. The contacts were all found to be acceptable.

6. Oil pressure switches 2-2341-7 and 20 that monitor lubricating oil for turning gear operation were calibrated and the contacts tested for repeatability. The pressure switches and contacts were found acceptable.

7. The affects from the trip of MCC 29-2 were examined for any impact that could have contributed to the lock out of the turning gear motor. The HPCI turning gear and logic is fed by 250 VDC and 125 VDC. The only affect of the tripping of Bus 29-2 on these power supplies was the loss of the battery chargers. The loss of the battery chargers could cause some power spikes during the time that they were off. The battery chargers were restored to both the 125 VDC and 250 VDC systems at approximately 0230 hours on October 4, 1995. Even though the DC systems were restored to full capacity, the problems with the turning gear and motor persisted. The conclusion drawn was that the two events (the loss of Bus 29-2 and the inability to start the turning gear) were independent and unrelated. During a subsequent HPCI run, voltages and currents were monitored at MCC 18-2 and at the 1/2 250 VDC Battery Charger to monitor for any possible electrical disturbances within the distribution system.

The turning gear logic was tested multiple times and the turning gear motor reliably started each time. A chart recorder has been installed to monitor several points in the turning gear logic. The HPCI system was returned to service and tested. The system was declared operable at 2222 hours on October 7, 1995.

Actions to be Completed:

The Unit 2 HPCI System will be tested on an increased testing frequency with a chart recorder monitoring the turning gear logic. Engineering will evaluate the data after each run to ensure the logic is responding as designed. Engineering will also monitor the AC input and the DC output of the 250 VDC in-service battery charger during the surveillance to monitor for any possible electrical disturbances within the distribution system. The system will be tested on an increased frequency to assure system reliability. This will be continued until adequate confidence is obtained (NTS #2651809500701, Operations).

F. PREVIOUS OCCURRENCES:

The Problem Identification Form (PIF) system was searched for previous occurrences of the failure of the turbine turning gear resulting in declaring HPCI inoperable. Since the start of this database (August 1993), no events were identified. Nuclear Work Request history was searched and no occurance of the turning gear motor failing to start was observed.

A Nuclear Plant Reliability Data System (NPRDS) search has been performed on components of "Turbines" in HPCI with General Electric as the manufacturer and with the word "turning gear" in the narrative. Six events were reported, three at Dresden and three at Quad Cities. Quad Cities and Dresden are the only units in the world with General Electric HPCI turbines used in an Emergency Core Cooling System application. Five of the events were failures of the turning gear to engage and one event was a fault in the turning gear motor. The failure to engage events are not applicable to this event as the start of the turning gear motor should have occurred regardless of the engage status of the lever arm with the reset of relay 2330-122.

G. COMPONENT FAILURE DATA:

No components were determined to have failed during this event.