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RLB-93-022

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U.S. Nuclear Regulatory Commission
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Washington, DC 20555

Reference: Quad Cities Nuclear Power Station
Docket Number 50-265, DPR-30, Unit Two

Enclosed is Licensee Event Report (LER) 93-001, Revision 00, for Quad Cities Nuclear Power Station.

This report is submitted in accordance with the requirements of the Code of Federal Regulations, Title 10, Part 50.73(a)(2)(iv). The licensee shall report any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature.

Respectfully,

COMMONWEALTH EDISON COMPANY
QUAD CITIES NUCLEAR POWER STATION

R. L. Bax
Station Manager

RLB/TB/plm

Enclosure

cc: J. Schrage
T. Taylor
INPO Records Center
NRC Region III

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LICENSEE EVENT REPORT (LER)

Form Rev 2.0

Facility Name (1) Quad Cities Unit Two										Docket Number (2) 0 5 0 0 0 2 6 5										Page (3) 1 of 0 5																													
Title (4) Reactor Flux Scram While Transferring "B" RPS To Dirty Power From 2-203-2A Main Steam Isolation Valve Closure																																																	
Event Date (5) Month Day Year 0 1 0 7 5 3 9 3										LER Number (6) Sequential Number Revision Number 0 0 1 0 0										Report Date (7) Month Day Year 0 2 0 4 9 3										Other Facilities Involved (8) Facility Names Docket Number(s) 0 5 0 0 0 1 1																			
OPERATING MODE (9) POWER LEVEL (10) 1 0 0										THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10CFR (Check one or more of the following) (11)																																							
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LICENSEE CONTACT FOR THIS LER (12)																																																	
Name Randy Charneski, Tech Staff Engineer, Ext. 2175																				TELEPHONE NUMBER AREA CODE 3 0 9 6 5 4 - 2 2 4 1																													
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)																																																	
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ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)																																																	

ABSTRACT:

On January 7, 1993, Quad Cities Unit Two was in the Run mode at 100 percent of rated core thermal power. At 1008 hours, Reactor Protection System (RPS) Bus B was being transferred to its alternate power supply in preparation for the semi-annual testing of the RPS Electrical Protection assemblies (EPA) units. When the breaker for the RPS Bus B was opened the 2-203-2A Main Steam Isolation Valve (MSIV) closed causing the reactor flux and pressure to exceed the scram setpoints. All safety feature actuations occurred as designed. An Emergency Notification System (ENS) notification was completed at 1205 hours on January 7, 1993.

The cause of the 2-203-2A MSIV closing during the transfer of the B RPS Bus is attributed to the failure of the DC solenoid coil on the MSIV manifold assembly. Corrective actions will include proposed changes to the Technical Specifications and changes to QOP 7000-1, Reactor Protection System MG Sets.

This report is being submitted to comply with 10CFR50.73(a)(2)(iv).

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TEXT Energy Industry Identification System (EIIIS) codes are identified in the text as [XX]

PLANT AND SYSTEM IDENTIFICATION:

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

EVENT IDENTIFICATION: Reactor flux scram while transferring "B" RPS to dirty power from 2-203-2A main steam isolation valve closure.

A. CONDITIONS PRIOR TO EVENT:

Unit: Two Event Date: January 7, 1993 Event Time: 1008
Reactor Mode: 4 Mode Name: RUN Power Level: 100%

This report was initiated by Deviation Report D-4-2-93-002.

RUN Mode (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. DESCRIPTION OF EVENT:

On January 7, 1993, at 1008 hours, Unit 2 was in the Run mode at 100 percent of rated core thermal power. Reactor Protection System (RPS) [JC] Bus [BU] B was being transferred to its alternate power supply (Motor Control Center [MCC] 25-2) in preparation for the semi-annual functional testing of the RPS Electrical Protection Assemblies (EPA) in accordance with Technical Specifications Section 4.9.F. Since this transfer is a dead bus transfer, the B RPS Bus and its associated relays lose power and trip during the transfer. During the dead bus transfer, all outboard Main Steam Line Isolation Valve (MSIV) [ISV] AC solenoids lose power. The MSIVs have an AC and DC solenoid valve [PSV], both solenoids must de-energize and reposition to allow the MSIV to close. When the breaker [BRK] for the RPS B Bus was opened, the 2-203-2A outboard MSIV closed causing the reactor flux and pressure to rapidly increase.

At 10:08:36 this increase resulted in an Average Power Range Monitor (APRM) channel 1 trip, which provided a trip of RPS Bus A, completing the logic for the full reactor scram 17 milliseconds later. A reactor vessel high high pressure trip occurred 320 milliseconds after the APRM scram. The rapid reduction in voids resulted in increased flow through the core and a reduction of water inventory in the shroud area. This resulted in vessel level control logic increasing the A and B Reactor Feedwater Pump (RFP) [P] flows. This additional flow through the pumps decreased RFP suction pressure. The 2B Condensate/Condensate Booster Pump was out-of-service and did not auto-start and the B Feedwater Regulating Valve (FWRV) [FCV] locked up. This resulted in the tripping of the A and B RFPs on low suction pressure. Group II and III Primary Containment Isolations (PCIs) occurred. The trip of the A and B RFPs returned the feedwater suction pressure to normal and the C RFP auto-started. At this time the extra NSO noticed a rapid rise in vessel water level. He identified that the B Feedwater Regulating Valve was locked up near full open. He manually reset the lockup, closed and isolated the valve. During this evolution, the C RFP increased vessel level and tripped at +48 inches. The pump coast down and vessel swell increased vessel level to just over +60 inches in the following minutes.

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At 1031 hours, the scram was reset and a systematic reactor pressure vessel [RPV] cooldown was initiated.

In addition, the following problems were identified during the reactor scram:

1. The A Reactor Recirculation Motor Generator [MG] Set ran back extremely slow.
2. The 2B3 Extraction Bypass Valve [FCV] AO-2-31-2C did not open.
3. Source Range Monitors (SRMs)/Intermediate Range Monitors (IRMs) did not automatically insert after the scram.
4. B Feedwater Regulating Valve locked-up.

An Emergency Notification System (ENS) notification of this event was completed at 1205 hours on January 7, 1993, to comply with the requirements of 10CFR50.72(b)(2)(ii).

During the RPS Bus swap, no other activities were being performed that could have contributed to this event. An investigation was initiated to determine the cause of the MSIV closure.

C. APPARENT CAUSE OF EVENT:

This Licensee Event Report is being submitted in accordance with 10CFR50.73(a)(2)(iv), which requires the reporting of any event or condition that results in manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS) [JC].

The root cause of this event is attributed to the failure of the DC pilot solenoid on outboard MSIV 2-203-2A. Each MSIV is equipped with an AC and DC solenoid. De-energization of both solenoids is required to cause MSIV closure. Investigation revealed that the DC solenoid on the outboard MSIV 2-203-2A had failed due to an open coil, and that the MSIV was being held in the open position by the AC solenoid, as designed. However, during the RPS Bus B transfer, a normal expected loss of AC power was experienced at the bus. Since the AC solenoids for all the outboard MSIVs are fed from the RPS Bus, the solenoids experienced a momentary loss of AC power as expected. This allowed for closure of the 2-203-2A outboard MSIV upon de-energization of the AC solenoid because the DC solenoid was already repositioned. The remaining three outboard MSIVs were held in the open position during the RPS Bus B transfer by their corresponding DC solenoids, as designed. The DC solenoid coil was sent to the CECO System Material Analysis Department (SMAD) for failure analysis. The SMAD failure analysis revealed that the DC coil failed due to an open between the external lead and the coil connection. This open was caused by turn to turn shorts within the coil which caused increased current to flow in the coil.

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The cause for the slow runback of the A Recirculation MG Set is unknown at this time.

The cause of the 2B3 Extraction Bypass Valve AO-3102C failing to open was attributed to the spring tension adjustment on the valve being set at the lowest possible setting thereby not providing any lift on the valve.

The cause of the SRMs/IRMs failing to insert following the scram attributed to a resistance problem in the pushbutton contacts.

The cause for the lock-up of the 2B FWRV is unknown. The Unit Two NSO was able to reset the lock-up and isolate the valve immediately following the scram.

D. SAFETY ANALYSIS OF EVENT:

The safety significance of this event is minimal. All expected Engineered Safety Features (ESF) occurred as designed to bring the reactor to a safe shutdown condition. Closure of the 2-203-2A outboard MSIV occurred properly upon temporary loss of AC power concurrent with failure of the DC solenoid. Valve closure is designed to occur upon de-energization of both the AC and DC solenoids. As such, the MSIV failed in the conservative (isolated) position. Quad Cities Updated Final Safety Analysis Report (UFSAR) section 5.2 provides the analytical basis for evaluation of this event. This section discusses the overpressurization analysis of the vessel assuming all MSIVs close and the reactor scrams on high neutron flux. This scram is bounded by this analysis in the UFSAR. Only one MSIV closed which provided the rapid pressurization event. This increased the moderator density which increased the neutron flux and resulted in an APRM high high scram on the A RPS Bus.

The level transient that occurred after the scram is explained by the equipment that was out-of-service at the time of the event and the B Feedwater Regulating Valve that locked up during the transient.

E. CORRECTIVE ACTIONS:

Nuclear Work Request (NWR) Q05112 was initiated to replace the MSIV Manifold Assembly for the outboard MSIV 2-203-2A. The manifold assembly was replaced and successfully tested by the Electrical Maintenance Department (EMD), with the 2-203-2A MSIV returned to service on January 8, 1993, at 2020 hours.

On January 9, 1993, at 0445 hours, the B RPS Bus was transferred to its normal power feed. During the power transfer, all four outboard MSIVs remained open, further verifying operability of the DC solenoids.

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The Technical Specification Improvement Program is revising sections 3.9/4.9 of the Tech Specs. As part of the revision the surveillance requirements for the testing of the RPS EPAs is being changed to require testing each time the unit is in Cold Shutdown for a period of more than 24 hours, unless performed in the previous six months. The changes to section 3.9/4.9 are pending submittal to the NRC for approval. This change, when approved, will prevent the transfer of the RPS Buses to their alternate power sources to test the EPAs when the unit is operating (NTS# 2652009300201).

The Technical Staff System Engineer will submit a procedure change to QOP 7000-1, Reactor Protection System MG Sets to recommend that the procedure be performed when the reactor power is less than 75% (approximately 600 MWe) (NTS# 2652009300202).

Nuclear Work Request (NWR) Q05116 was initiated for the Instrument Maintenance Department to investigate the cause for the slow runback of the A Recirculation MG Set during the scram. It is planned to check the transformer that feeds the scoop tube and control circuitry (NTS# 2652009300203).

The spring tension on 2B3 Extraction Bypass Valve AO-3102C was adjusted to allow the valve to fully stroke open.

The SRMs/IRMs pushbutton switch was replaced under NWR Q05114 and successfully tested by the Electrical Maintenance Department.

F. PREVIOUS EVENTS:

An extensive search was conducted of coil failures/reactor scrams at Quad Cities Station. There were no previous documented events involving open coils.

A nationwide Nuclear Plant Reliability Data System search was conducted on solenoid failures. Two events were identified at Dresden Station involving failures of Automatic Valve Company (AVCO) DC solenoids.

G. COMPONENT FAILURE DATA:

The DC solenoid coil which failed was an AVCO model number 6910-020.