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DCD JE22

RLB-91-145

May 28, 1991

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

Reference: Quad Cities Nuclear Power Station
Docket Number 50-254, DPR-29, Unit One

Enclosed is Licensee Event Report (LER) 91-009, 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)(v)(D). The licensee shall report any event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident. This report is also being submitted in accordance with the requirements of Part 50.73(a)(2)(i)(A). The completion of any nuclear plant shutdown required by the plant Technical Specifications.

Respectfully,

COMMONWEALTH EDISON COMPANY
QUAD CITIES NUCLEAR POWER STATION

R.A. Kirby for
R. L. E...
Station Manager

RLB/MJB/jlg

Enclosure

cc: R. Stols
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 One
 Title (4) RCIC Inoperable From Not Meeting Tech. Spec. Requirements Due To Controller & Governor Problems.

Docket Number (2) 0151010121514
 Page (3) 1 of 08

Event Date (5) 04/27/91
 LER Number (6) 01019
 Report Date (7) 05/28/91
 Other Facilities Involved (8) Facility Names: Docket Number(s): 015101010111

Operating Mode (9) 4
 POWER LEVEL (10) 022
 THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10CFR (Check one or more of the following) (11)
 20.402(b) 20.405(c) 50.73(a)(2)(iv) 73.71(b)
 20.405(a)(1)(i) 50.36(c)(1) X 50.73(a)(2)(v) 73.71(c)
 20.405(a)(1)(ii) 50.36(c)(2) 50.73(a)(2)(vii) Other (Specify
 20.405(a)(1)(iii) 50.73(a)(2)(i) 50.73(a)(2)(viii)(A) in Abstract
 20.405(a)(1)(iv) 50.73(a)(2)(ii) 50.73(a)(2)(viii)(B) below and in
 20.405(a)(1)(v) 50.73(a)(2)(iii) 50.73(a)(2)(x) Text)

LICENSEE CONTACT FOR THIS LER (12)

Name Nick Radloff, Technical Staff Engineer, Ext. 2942
 TELEPHONE NUMBER 31096151412141

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC

SUPPLEMENTAL REPORT EXPECTED (14)

Expected Submission Date (15) X NO

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

ABSTRACT:

At 0100 hours on April 26, 1991, Unit One Reactor was operating in the RUN mode at 22 percent rated core thermal power. At this time, the Unit One Reactor Core Isolation Cooling (RCIC) system was declared inoperable due to failure to meet pump requirements.

Troubleshooting of the system continued throughout this event due to repeated failures of the RCIC controller and governor. The system was successfully tested and declared operable on May 3, 1991 at 0345 hours.

The most significant cause of this event was due to an inadequate calibration procedure which resulted in unstable responses from the controller and governor. Also, because the system control parameters changed, the result affected the operation of the flow controller.

This event is being reported according to 10CFR50.73(a)(2)(v)(D) and 10CFR50.73(a)(2)(i)(A).

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PLANT AND SYSTEM IDENTIFICATION:

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

EVENT IDENTIFICATION: RCIC Inoperable From Not Meeting Tech. Spec. Requirements Due To Controller & Governor Problems.

A. CONDITIONS PRIOR TO EVENT:

Unit: One Event Date: April 26, 1991 Event Time: 0100
Reactor Mode: 4 Mode Name: RUN Power Level: 22%

This report was initiated by Deviation Report D-4-01-91-067, D-4-01-91-069, D-4-01-074

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:

At 0100 hours on April 26, 1991, Unit One was in the RUN mode at 22 percent rated core thermal power, starting up from scheduled refueling outage Q1R11. At this time, the Unit One Nuclear Station Operator (NSO) began the Quarterly Reactor Core Isolation Cooling (RCIC) [BN] Pump [P] Operability Test, QCOS 1300-5, and the second portion of the Periodic RCIC Pump Operability Test, QCOS 1300-1. During these tests, RCIC failed to meet its Technical Specification requirements and was declared inoperable.

Technical Specification 3.5.E requires that when reactor [RCT] pressure reaches 920 psig during startup, RCIC high pressure operability testing shall be completed within the following 12 hours. This testing shall consist of developing a pump flow rate of at least 400 gpm and a discharge pressure against a system head corresponding to a reactor vessel [RPV] pressure of at least 1150 psig. If testing cannot be completed in time, the reactor is required to be shutdown within 24 hours.

During the surveillance test, RCIC was initiated and stabilized at 3000 revolutions per minute (rpm) pump speed, 300 gallon per minute (gpm) pump flow rate, and 600 pounds per square inch gage (psig) pump discharge pressure. These values were below acceptable limits. The NSO attempted to adjust system flow to within acceptable limits through manual adjustment of flow indicating controller, 1-1340-1, and motor operated (MO) test return valve, 1-1301-53. The NSO was unable to achieve an acceptable flow rate or increase the turbine [TRB] speed. He subsequently shutdown the system after recording the final pump flow rate at 300 gpm, pump discharge pressure at 600 psig, and turbine speed at 3000 rpm.

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At 0200 hours, Instrument Maintenance (IM) personnel were contacted. The RCIC controller and governor were suspected to be out of adjustment due to the actuator having been replaced during the QIR11 outage. The IM department had a work package already prepared for troubleshooting and adjusting the governor and signal controller in order to fine tune the system during testing.

Several attempts were made to adjust the RCIC turbine controller in order to achieve the pump flow requirements. The IM personnel adjusted the speed potentiometer in the signal controller in order to increase the turbine speed. This increased pump flow and discharge pressure. Operations personnel then throttled the MO-1-1301-53 valve in order to readjust the pump discharge pressure and flow rate. When the correct system parameters were established, the RCIC system was tripped and restarted in order to test the system's operability. The RCIC turbine subsequently tripped from overspeed. The NSO and IM's continued to readjust the MO-1-1301-53 valve and speed potentiometer with no success. On each startup attempt, the turbine would either trip from overspeed or fail to achieve required pump specifications.

At 0540 hours, the Shift Engineer (SE) decided to discontinue testing temporarily until notification was made due to the expiration of the 12 hour test period at 0701 hours.

At 0615 hours, the NRC was notified via the Emergency Notification System (ENS) of the impending entry into a 24 hour Limiting Condition of Operation (LCO). This notification was made in order to comply with the requirements of 10CFR50.72(b)(2)(iii)(A).

At 0701 hours, the Shift Engineer initiated Outage Report QCOS 1300-2 for Unit one RCIC testing being incomplete within 12 hours of reaching 920 psig reactor pressure. This placed Unit One into a 24 hour LCO at 0701 hours.

IM personnel continued to troubleshoot the RCIC controller and governor by performing QIP 1300-1 which details the calibration of the Ramp Generator Signal Converter (RGSC) and Woodward EG-M control box located in the RCIC controller cabinet.

At 1320 hours on April 26, 1991, RCIC was run again with the same results. The turbine came up to 3000 rpm speed, 300 gpm flow rate, and 600 psig pump discharge pressure. At this time, IM personnel decided to replace the RGSC and EG-M control box in the RCIC control cabinet and perform QIP 1300-1 again. While performing QIP 1300-1 on the new RGSC and EG-M control box prior to installation, IM noticed that the output signal to the EGR actuator was a negative voltage. This represented a signal to close the governor valve when the governor valve should have been open. As a result, IM questioned the accuracy of the calibration sequence in the procedure.

IM calibrated the RGSC and control box using QIP 1300-1 and the guidance of General Electric Service Information Letter (SIL) #351 which provided more detailed information in calibrating the RGSC and EGM control box.

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At 1820 hours, RCIC was tested again. Upon initiation, the turbine once again tripped on overspeed. IM investigated further and discovered the ramp limit switch from the MO-1-1301-61 steam inlet valve was not operating correctly when the valve was stroked open.

Electrical Maintenance (EM) identified a wiring problem as the cause. They corrected it by disconnecting the wire from the 12 and 12C contacts and connecting the wires to the 16 and 16C contacts located in the Limitor's operator of the MO-1-1301-61 valve. This enabled the contact timing to open and close correctly in order for the RGSC to operate properly.

At 1920 hours on April 26, 1991, RCIC was initiated again and achieved approximately 3000 rpm speed, 300 gpm pump flow, and 600 psig pump discharge pressure. IM checked the signals from Flow Indicating controller (FIC) [TC] 1-1340-1 and the RGSC. The signal outputs from both the controller and the RGSC were sending a close signal to the EGR actuator, which should have closed the governor valve. However, there was enough steam being supplied through the governor valve to maintain a turbine speed of 3000 rpm. Further they discovered that the jumper on the new RGSC was on the 10-50 milliamp (mA) terminals, when it should have been on the 4-20 mA terminals. RCIC was tripped and shutdown in order for IM to change the jumper on the terminals and recheck the input and output voltages from the controller. The RGSC and EG-M control box were recalibrated using SIL #351 and QIP 1300-1. RCIC was initiated again, and again it maintained a speed of 3000 rpm. The controller circuit calibrations from the EG-M control box and RGSC were rechecked successfully, however, the output voltage to the actuator was still negative. At this point, RCIC was shut down. IM decided to contact the vendor of the controller and governor in order to verify that QIP 1300-1 and SIL #351 were correct in calibrating the EG-M control box and RGSC.

At 0250 hours on April 27, 1991, the SE declared a Generating Station Emergency Plan (GSEP) unusual event due to the Technical Specification LCO requiring a reactor shutdown. The Station Manager and Assistant Superintendent of Operations (ASO) were notified. Because of the Technical Specification LCO, the SE initiated a shutdown of the reactor. A Nuclear Accident Reporting System (NARS) phone call was made at 0301 hours per GSEP procedures. Also, an Emergency Notification System (ENS) phone call was made at 0305 hours in order to comply with 10CFR50.72(b)(1)(i)(A).

At 0450 hours on April 27, 1991, the SE terminated the GSEP event due to the reactor pressure being less than 150 psig. The Station Manager and ASO were notified. At 0456 and 0503 hours, ENS and NARS notifications of the event were made, respectively.

IM discussed the QIP 1300-1 procedure and SIL #351 with the vendor of the controller, Woodward Governor. The vendor recommended information that was not provided in the Vendor Equipment Technical Information (VETI) Manual or SIL #351 where the RGSC and EGM control box had a detailed calibration sequence. IM performed the calibration on the EG-M control box and RGSC. After several adjustments, the signal outputs responded correctly. The final adjustments to the governor would be required when RCIC was running.

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At 0820 hours on April 29, 1991, the reactor was in startup mode with reactor pressure at 250 psig. At this point, Unit One entered a 12 hour LCO per Technical Specification requirements which allows RCIC operability testing at low reactor pressure per QCOS 1300-1. At 1017 hours, QCOS 1300-1 was completed successfully which ended the 12 hour LCO for RCIC.

At 1245 hours, reactor pressure reached 920 psig. At this point, Unit One entered another 12 hour LCO for RCIC high pressure operability testing per the QCOS 1300-1 procedure. Testing was completed successfully, however the response time of the controller to ramp the turbine to the correct setpoints was slow. This exceeded the requirements for the system to perform its intended function within 30 seconds of auto-initiation as described in the Updated Final Safety Analysis Report (UFSAR). IM adjusted the proportional band, time integral, time derivative, and deadband settings located on FIC 1-1340-1 in order to decrease the response time of the control process signal to and from the controller.

At 1828 hours, RCIC was initiated in order to check the response time of the system. The initiation time achieved was 26.5 seconds, thus fulfilling UFSAR requirements.

At this time, the SE declared RCIC operable and terminated the 12 hour LCO. He then began to establish conditions required by QCOS 1300-7, RCIC Manual Initiation Test. This test initiates RCIC and injects coolant into the vessel.

At 2050 hours, the NSO performed QCOS 1300-7. The turbine ramped up correctly and achieved 400 gpm within 24.5 seconds, however the FIC, pump discharge pressure, turbine steam discharge pressure, and tachometer indicators began to oscillate extensively. The NSO switched the FIC to manual control and steadied the oscillations. He then switched it back to auto and the oscillations returned.

The SE declared RCIC inoperable and initiated QCOS 1300-2, RCIC System Outage Report.

The NRC was notified of the event via the Emergency Notification System (ENS) at 0251 hours, April 30, 1991, in order to comply with the requirements of 10CFR50.72(b)(2)(iii)(D).

Several adjustments were made to the control parameters in the flow controller in order to fine tune the system response. However, when IM fine tuned the flow controller to the system response during QCOS 1300-1, the FIC and other indicators would oscillate extensively during QCOS 1300-7. When IM fine tuned the control parameters to QCOS 1300-7, the system would respond very sluggishly when QCOS 1300-1 was performed. During QCOS 1300-1, the flow controller output signal indicator would ramp down slowly until the output was zero, but flow remained at approximately 450 gpm and pump discharge pressure at 600 psig. This indicated the governor valve was either not fully closing or steam was leaking by the valve.

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IM, Technical Staff and Mechanical Maintenance (MM) investigated the problem. They discovered the valve stroke on the governor valve needed fine tuning to allow the valve disk to seat properly, thereby stopping the steam leak. This work was performed as part of the work package IM had assembled.

At 2310 hours on May 1, 1991, IM had finished the flow controller adjustments. The NSO performed and completed QCOS 1300-1 and QCOS 1300-7 successfully.

After the Nuclear Work Request packages had been completed and closed out, the SE declared RCIC operable and terminated the RCIC Outage Report at 0345 hours on May 3, 1991.

C. APPARENT CAUSE OF EVENT:

These events are being reported according to 10CFR50.73(a)(2)(v)(D): the licensee shall report any event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident. Also, 10CFR50.73(a)(2)(i)(A): The completion of any nuclear plant shutdown required by the plant Technical Specifications.

The instability of the controller and governor was due to a procedure based on the VETI Manual that did not detail a calibration sequence accurately enough. This prevented the proper calibration of the controller and governor voltages and amperages. This resulted in an unstable system response which either could not achieve pump requirements or respond correctly under automatic flow controller operation. A new EGR actuator was installed recently during the refuel outage prior to this event which may have added to an incorrect system response.

The instability of FIC 1-1340-1 was caused by the tuning control parameters of the FIC needing to be retuned due to the adjustment of the EGM controller and governor.

The RGSC also had wiring connected to the wrong contacts from the limit switch on the MO 1-1301-61 valve due to personnel error. This error was due to the electrician misreading the wiring labels on the limit switch assembly block and an inadequate post maintenance verification procedure. The contact was set to initiate the RGSC when the MO-1-1301-61 valve was in the full close or intermediate position. The RGSC should initiate when the valve is in the intermediate or full open position. EM performed the work under Nuclear Work Request (WR) #Q87508 during the recent Unit One Outage and corrected the wiring under WR #Q92249.

Also, the governor valve stroke was fine tuned to prevent steam from leaking past the governor valve disk. The valve stem was adjusted in order to fine tune the governor valve's operation during RCIC testing.

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D. SAFETY ANALYSIS OF EVENT:

The safety of the plant and personnel was not affected during this event. The RCIC system automatically initiates on low-low water level (-59 inches) and is designed to provide core cooling water in the event the reactor becomes isolated from the main condenser simultaneously with a loss of the reactor feedwater system. The RCIC system is not part of the station Emergency Core Cooling Systems (ECCS) and is therefore not required for a Loss of Coolant Accident (LOCA).

The causes of this event developed during maintenance activities conducted throughout the QIR11 refuel outage. Therefore, they did not exist undiscovered for any time period in which RCIC was required to be operable.

The instability of the RCIC controller and governor would not have prevented automatic system initiation during low reactor pressure testing (250-325 psig reactor pressure). The system achieved Technical Specification requirements and therefore was determined operable. During the high reactor pressure testing (920-1005 psig reactor pressure), the instability of the system affected operability of the system only for a short period of time while the station was in an LCO for RCIC testing. Once IM personnel had calibrated the controller and governor to the correct system responses, the instability of the RCIC flow controller would have prevented turbine operation in the automatic mode, however it would not have prevented automatic system initiation. Once the system had initiated, the operator could have taken manual control to provide flow to the reactor.

Per Technical Specification 3.5.E, if RCIC is found to be inoperable when the reactor is in the RUN mode, continued reactor operation is permissible provided the High Pressure Coolant Injection (HPCI) system is operable. In addition to HPCI providing backup to RCIC, the Safe Shutdown Makeup Pump (SSMP) is a motor driven pump designed as a backup to RCIC as part of the station safe shutdown system. The SSMP and HPCI were available throughout this event.

E. CORRECTIVE ACTIONS:

The immediate corrective actions consisted of switching the flow controller to manual to control pump flow. After it was determined the required flow was unattainable, the turbine was manually tripped and IM was called in to investigate the problem.

After several attempts to correct the problem, IM personnel determined the problem was due to the EGM controller and governor being out of calibration. The EGM controller and governor were calibrated which changed the system parameters. The flow controller was then changed in order to respond to the new control parameters programmed in the governor and EGM controller itself.

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The flow controller was reprogrammed in order to respond to different system characteristics when the system injected into the reactor vessel as opposed to testing the system using the test return line, which utilizes a throttle valve.

Investigation by EM personnel determined the MO-1-1301-61 ramp limit switch was wired to a set of contacts that caused an improper timing sequence. The contacts are located in the Limitorque operator of the valve where the ramp limit switch wiring was changed to the contacts with the correct timing sequence. EM performed the work under nuclear work request #Q87508 during the recent Unit One Outage and corrected the wiring under WR #Q92249. The individual involved in this error has been counselled by the EM Department Head. To prevent this from occurring again, the EM Department has incorporated a procedure (QCEM 700-14) which provides wire lead documentation and double verification of each wire. In addition, the post maintenance verification matrix which functionally tests this valve has been revised.

The steam leakage through the governor valve was due to the valve stroke needing to be fine tuned in order to have the valve disk seat properly. IM and MM performed this adjustment, however this was minor and would not affect the operation of the RCIC turbine during initiation.

In order to prevent further occurrences, the QIP 1300-1 calibration procedure for the EGM control box and RGSC is being revised where it will accurately detail a calibration sequence and will be performed every outage to ensure proper system response before reactor startup. This procedure will also include verification of the 4-20 mA setting on the ramp generator. (NTS #2542009106701)

F. PREVIOUS EVENTS:

There is one similar previous event of an instability problem with the RCIC and HPCI pump flow controllers. The event is documented in License Event Report 90-006 which involves unstable oscillations due to the flow controller. No search of the Nuclear Plant Reliability Data System (NPRDS) was performed as there was no component failure identified in this event.

G. COMPONENT FAILURE DATA:

There was no component failure associated with this event.