LICENSEE EVENT REPORT (LER) Form Rev. 2.0

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Title (4)

Unit Two Reactor Scram Due To Low Level Signal

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)	X 50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)	20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
	20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	Other (Specify in Abstract below and in Text)
9 7	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)
Dennis Cook, Ext. 2077	3 0 9 6 5 4 - 2 2 4 1

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)

A. ABSTRACT

On December 2, 1993, two Instrument Maintenance (IM) Technicians were performing Quad Cities Instrument Surveillance (QCIS) 200-1, Quarterly Reactor (Rx) High Pressure SCRAM Calibration and Functional Test on Unit 2 High Rx pressure switch (PS) [63] 2-263-55A. The Control Room received a Unit 2 Rx Low Level SCRAM. It was believed at that time that the SCRAM was caused due to a leaky isolation valve [ISV].

The valve was removed and disassembled for inspection. The inspection revealed stainless steel particles inside the valve. These particles are assumed to have wedged in between the valve seat and disc which caused the valve to remain partially open when the valve was initially closed. The SCRAM appears to have been due to pressure wave propagation in the common tapped instrument sensing lines.

Immediate corrective actions taken were as follows:
The Unit 2 Rx was brought to a cold shutdown condition. The Operations Department withheld the performance of this surveillance test on the rest of the pressure switches on both units, until the preliminary investigation was completed. The IM Department along with the Operations Department developed a method for performing surveillances, involving pre-pressurization valves, to determine if the instrument isolation valve was leaking by. This method was documented in IM memorandum #25. The IM Department is also backflushing all instrument lines on both units that have the same valve design configuration.

Recommended corrective actions include the review and possible re-design of the isolation valve configuration and the review and possible inclusion of these valves into a preventive maintenance schedule for backflushing.

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PLANT AND SYSTEM IDENTIFICATION:

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

EVENT IDENTIFICATION: Unit 2 Reactor Scram Due to Low Level Signal.

A. CONDITIONS PRIOR TO EVENT:

Unit: Two Event Date: December 2, 1993 Event Time: 1619
Reactor Mode: 4 Mode Name: RUN Power Level: 97

This report was initiated by Licensee Report 265\93-024.

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. DESCRIPTION OF EVENT

On December 2, 1993, Unit 2 was in the RUN mode of operation at approximately 97 percent of rated core thermal power. At approximately 1617 hours, a Control System Technician (CST) and a "B" Technician from the Instrument Maintenance (IM) Department were performing Quad Cities Instrument Surveillance (QCIS) 200-1, QUARTERLY REACTOR HIGH PRESSURE SCRAM CALIBRATION AND FUNCTIONAL TEST on Unit 2, high reactor pressure switch 2-263-55A located at the 2202-5 instrument rack. The CST was working at the 2202-5 instrument rack and the "B" Technician was located in the Control Room in head phone contact with the CST. The CST isolated the pressure switch and connected test equipment in accordance with the instructions of QCIS 200-1 step H.5. Step H.5.d states "Open pre-pressurization valve".

At 1619 hours, the CST opened the pre-pressurization valve and was immediately notified by the "B" Technician that the Control Room received a Unit 2 Rx trip. The CST then closed the pre-pressurization valve, opened the pressure switch isolation valve and returned to the IM shop. It was assumed at that time that the unit trip was caused by a pressure spike in the common tapped sensing line due to a leaky isolation valve.

An explanation of this condition is as follows:
The High Rx pressure switch, 2-263-55A, instrument configuration is as follows: the instrument sensing line is a 1/2 inch common tap line from the reactor vessel level chamber reference leg. The common line splits at the top side of the instrument rack. The sensing line then routes to the rack stop isolation valve, is reduced to a 3/8 inch line, to the instrument isolation valve and on to the pressure switch. The line from the instrument isolation valve to the pressure switch has a 3/8 inch tubing tee installed for a test tap connection point. The test tap is made up of a ball type isolation valve and a tubing cap. The ball type valve is used in pre-pressurizing the small volume of tubing between the isolation valve and the pressure switch after performance of surveillance tests. Pre-pressurization is performed to limit the pressure shock in the system when the instrument isolation valve is opened after surveillance performance.

The sensing lines are normally pressurized in range from 900 to 1010 psi. The surveillance test sequence is to, close the instrument isolation valve, connect the test pressure source/instrumentation and open the pre-pressurization valve. With the instrument isolation valve partially open, as is suspected in this case due to foreign material intrusion, and when the pre-pressurization valve was opened, a sudden pressure spike was induced in the sensing line. The spike was a result of the rapid depressurization transient. This depressurization led to a pressure wave being propagated in the common tapped sensing lines.

The theory of the pressure wave propagation is the same as that described in engineering literature for waterhammer pressure wave propagation. The pressure wave was propagated through the instrument sensing line to the 2-263-57A and 2-263-57B Reactor Low Level Differential Pressure Transmitters [PDT]. These transmitters provide the Channel A and Channel B reactor low water level reactor trip signals respectively. The high side cells of these transmitters are virtually the dead end points for the wave propagation. When the wave reaches the transmitters, the waves are then reflected and travel in the opposite direction. This reflection changes the positive wave to a negative wave at the transmitters but does not reduce the magnitude of the wave. Other partial wave reflections will occur at changes in pipe area, branches and tees. The initial output from the transmitter would be expected to be a high reactor level due to the depressurization of the reference leg, however, the transmitter output would rapidly indicate a low level due to the combined effect of the wave reflections. There was no increase in level detected during this event. This can be explained as follows: Wave propagation can travel at the speed of sound (approximately 5000 ft/sec). The short lengths of tubing in this configuration coupled with the rate of speed of wave propagation and the transmitter response time (0.2 sec), would lead to the reasoning that the analog equipment used for monitoring changes in level may not react fast enough to see the high level condition prior to the wave reflection or prior to the reactor trip. This would be due to the slow response time of the analog monitoring devices (indicators, recorders, the one minute computer update). The wave propagates and reflects through the system until the energy of the wave is dissipated. Dissipation of the wave happens very rapidly. Dissipation occurs as the wave travels through differences in tube diameters and at elbow junctions within the system.

The significant event log identified the first hit as that of the Rx Low Level Channel A trip followed immediately by the Rx Low Level Channel B trip.

At 1808 hours, a 4 hour Event Notification System (ENS) phone call was made in accordance with the reporting requirements of 10CFR50.72(b)(2)(ii). This Licensee Event Report is being submitted in accordance with the reporting requirements of 10CFR50.73(a)(2)(iv). The unit was brought to a cold shutdown condition in preparation for a maintenance outage previously scheduled to begin December 4, 1993.

On December 3, 1993, a static pressure test was performed on the High Rx pressure switch, 2-263-55A, instrument isolation valve. The isolation valve was closed and test pressure of 900 psi was applied to one side of the valve with no significant leakage identified. The process was then repeated from the opposite side of the valve, again with no significant leakage identified. Swabs were taken of the valve internals. These swabs were then analyzed and a hardened particle was retrieved. On December 7, 1993, the particle was sent to System Materials and Analysis Department (SMAD) for testing. The results showed that the particle was a series 300 stainless steel material.

A review of Total Job Management (TJM) and Instrument kardex history was performed. The review did not show any record of this valve ever being replaced. It is therefore assumed that this valve is an original installation. On December 16, 1993, the instrument isolation valve was removed and root cause examination was started. The valve was disassembled and the internals inspected. The internal valve stem and seating surface are a machined, highly polished stainless steel. There were three score marks evidenced on the valve disc. Other than that the disc was in good condition. The seating surface appeared to be in good condition as well. There was some foreign material extracted from the valve. This material was viewed and was found to be similar to the material removed earlier (particles of stainless steel). The source of these particles is indeterminate due to the age of the valve and because the piping and tubing of this system is made up of series 300 stainless steel.

Immediate corrective actions taken were as follows:
The Unit 2 Rx was brought to a cold shutdown condition. The Operations Department withheld the performance of QCIS 200-1 surveillance test on both units until the preliminary investigation was completed.

Additional corrective actions taken were as follows: The IM Department along with the Operations Department developed a method for performing surviellances, involving pre-pressurization valves, to determine if the instrument isolation valve was leaking by. This method was documented in IM Memorandum #25. The IM Department is also backflushing all instrument lines that have the same valve design configuration. Due to an unrelated shutdown of Unit 1, this work will be performed on both units. The work is being performed under Nuclear Work Requests (NWR) Q12891 and Q12892. This work is to be completed prior to a Rx startup.

C. APPARENT CAUSE

The root cause of this event is indeterminate. The proximate root cause is believed to be due to foreign material (stainless steel particles) in the isolation valve coupled with an inadequate design configuration. The design configuration of the instrument puts the isolation valve in the low point of the instrument sensing line. In this configuration, the valve becomes the collection point for foreign material.

D. SAFETY ANALYSIS OF EVENT

The Safety consequences of this event were minimal. The High P_A pressure switch 2-263-55A shares a common tapped instrument sensing line with Reactor Low Water Level Differential Pressure Transmitters 2-263-57 A and B. The 2-263-57 A and B transmitters provide input signals to the Reactor Protection System. The effect of the leaking isolation was propagation of a pressure wave in the sensing line. The reactor low level transmitters detected the line perturbation and provided the SCRAM function of the RPS system to shutdown the reactor. The reactor was then brought to a cold shutdown condition.

E. CORRECTIVE ACTIONS

Corrective actions are for System Engineering, Site Engineering and the IM Department to review all instrument isolation valve installations similar to the design configuration as the 2-263-55A and determine a course of action which may include the following:
(NTS# 2651809302401)

1) Change the design configuration such that the isolation valve is not the low point in the sensing line

2) Leave the design "as is" and develop a prentive maintenance schedule for flushing the isolation valves and associated tubing

3) Replace the isolation valves at some pre-determined frequency and clean out the associated tubing

4) A combination of items above

Additional corrective actions will include the following:

The System Engineer with IM Department assistance will determine the industry practice and vendor recommendations for maintenance of isolation valves (NTS# 2651809302405).

The IM Department will incorporate the basic function of testing for leaky isolation valves, on instrumentation that employs the pre-pressurization valve configuration, into the IM surveillance procedures. (NTS #2651809302402)

In addition to the proposed corrective actions above, the details of pressure wave propagation, explained earlier in this report, will be incorporated into Operations (NTS #2651809302403) and IM (NTS #2651809302404) continuing training.

F. PREVIOUS EVENTS

A search of the Nuclear Tracking System Database revealed no previous events identified similar to this event.

G. COMPONENT FAILURE DATA

There was no component failure associated with this event.

The isolation valve was a Whitey valve 1SV 6 series.

Commonwealth Edison
Quad Cities Nuclear Power Station
22710 206 Avenue North
Cordova, Illinois 61242
Telephone 309/654-2241

GGC-93-045

December 28, 1993

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

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

Enclosed is Licensee Event Report (LER) 93-024, Revision 00, for Quad Cities Nuclear Power Plant 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 and event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature.

Respectfully,

COMMONWEALTH EDISON COMPANY
QUAD CITIES NUCLEAR POWER STATION

Guy G Campbell

G. G. Campbell
Station Manager

GGC/TB/plm

Enclosure

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

Post-it™ brand fax transmittal memo 7671	# of pages ▶ 13
To Roland Wood	From Terry Barber
Co. Doc. Control	Co. CECO
Dept. NRC	Phone # 654-2241 Ext 3103
Fax # (301) 504-1137	Fax #

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