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ComEd

LWP-95-104

November 14, 1995

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

Reference: Quad Cities Nuclear Power Station
Docket Number 50-254, DPR-29, Unit 1

Enclosed is Licensee Event Report (LER) 95-007, 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)(i)(B). The licensee shall report any operation or condition prohibited by the Plant's Technical Specifications.

This report is also submitted in accordance with the requirements of the Code of Federal Regulations, Title 10, Part 50.73(a)(2)(ii)(B). The licensee shall report any event or condition that resulted in the condition of the nuclear power plant, including its principal safety barriers, being seriously degraded, or that resulted in the nuclear plant being in a condition that was outside the design basis of the plant.

The following commitments are being made by this letter:

1. The corrective actions identified by the level 2 investigation will be completed.

2. Modifications M04-1(2)-95-006 will be installed. The modification for Unit 1 will be installed during Q1R14. The modification for Unit 2 will be installed prior to Start Up from the current forced outage (Q2F38).

STMGR\10495.LWP

JE22 /1

If there are any questions or comments concerning this letter, please refer them to Nick Chrissotimos, Regulatory Assurance Administrator at 309-654-2241, ext. 3100.

Respectfully,

COMMONWEALTH EDISON COMPANY
QUAD CITIES NUCLEAR POWER STATION

L. W. Pearce
Station Manager

LWP/NC/plm

Enclosure

cc: J. Schrage
C. Miller
INPO Records Center
NRC Region III

Licensee Event Report
Reviewer Assignment Form

Revised 12/01/94

LER # 2541809500700 **Date:** October 20, 1995

Subject: The Control Rod Drive Scram Discharge Volume's Control Logic Fails to Meet the Single Failure Criteria Due to Design Deficiency.

Signatures of reviewers indicating review and approval of item:

Systems Eng. Supv:	[signature] / 11-14-95 Date	[signature] / 11/14/95 Date
Operating Eng.:	[signature] / 11-14-95 Date	/ Date
	/ Date	/ Date
	/ Date	/ Date

Approved: [signature] / 11/14/95
Station Manager/PORC Chairman Date

J.G.N. 11/14/95.

LER254\95\007.WPF

LICENSEE EVENT REPORT (LER)			Form Rev. 2.0
Facility Name (1) Quad Cities Units One and Two	Docket Number (2) 0 5 0 0 0 2 5 4		Page (3) 1 of 0 6

Title (4)

The Control Rod Drive Scram Discharge Volume's Control Logic Fails To Meet the Single Failure Criteria Due to Design Deficiency

Event Date (5) Month	Day	Year	LER Number (6) Year	Sequential Number	Revision Number	Report Date (7) Month	Day	Year	Other Facilities Involved (8) Facility Names	Docket Number(s)
									Quad Cities Unit Two	0 5 0 0 0 2 6 5
1 0	2 0	9 5	9 5	0 0 7	0 0	1 1	1 4	9 5		0 5 0 0 0

OPERATING MODE (9): 4

POWER LEVEL (10): 1 0 0

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)	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)
20.405(a)(1)(iii)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
20.405(a)(1)(iv)	X 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
Nick Chrissotimos, Regulatory Assurance, Ext. 3100	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
B									

SUPPLEMENTAL REPORT EXPECTED (14)

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

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

ABSTRACT:

On October 21, 1995, at approximately 2140 hours, while Units 1 and 2 were in the Run mode, it was determined that the Control Rod Drive (CRD) [AA] Scram Discharge Volume's (SDV) control logic did not meet the single failure criterion specified in the UFSAR. The SDV was declared inoperable and an ENS phone call was made.

Quad Cities Station entered Technical Specification 3.1 Table 3.1-3 which requires the insertion of all operable rods within 4 hours. Based on the determination that the SDV level input to RPS did not meet the single failure criteria specified in the Updated Final Safety Analysis Report (UFSAR), both Units were shutdown. Unit 2 had all rods inserted at 2159 hours on October 21, 1995, and Unit 1 had all rods inserted at 0026 hours on October 22, 1995.

The root cause has been determined to be Design Error.

PLANT AND SYSTEM IDENTIFICATION:

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

EVENT IDENTIFICATION:

The Control Rod Drive Scram Discharge Volume's Reactor Protection System Control Logic Fails to meet the Single Failure Criteria due to Design Deficiency.

A. CONDITIONS PRIOR TO EVENT:

Unit: One	Event Date: October 21, 1995	Event Time: 2140
Reactor Mode: 4	Mode Name: Run	Power Level: 100%
Unit: Two	Event Date: October 21, 1995	Event Time: 2140
Reactor Mode: 4	Mode Name: Run	Power Level: 25%

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

B. DESCRIPTION OF EVENTS:

On October 21, 1995, at approximately 2140 hours, while Units 1 and 2 were in the Run Mode, it was determined that the Control Rod Drive [AA] Scram Discharge Volume's (SDV) control logic did not meet the single failure criterion specified in the UFSAR. The SDV was declared inoperable and an ENS phone call was made.

On October 20, 1995, Dresden made a four hour phone call to the NRC due to the Unit 2 Reactor Protection System (RPS) Scram Discharge Volume Logic circuitry, as implemented, does not fulfill the single failure criteria as required per IEEE 279 (1968). The Dresden Unit 2 RPS SDV logic is designed with four level switches per SDV. Two level switches from each SDV, electrically connect in series, feed into an RPS subchannel (i.e. A1, A2, B1, B2) with subchannels A1 and B1 fed from one SDV, and, A2 and B2 fed from the other SDV. Each subchannel is capable of providing a 1/2 SCRAM signal upon initiation; a combination of any A and any B subchannel would provide a full SCRAM signal.

Dresden's concern was that if there is an event in which only one of the SDV is at the SCRAM level and a single component failure of an auxiliary relay to drop out (failed ENERGIZED) associated with any one of the subchannel relays (2-590-100 A/B/C/D) occurred, then only a 1/2 SCRAM initiation will result instead of the required full SCRAM. This is outside of the single failure criteria design requirement as described in the Dresden Technical Specifications and the Updated Final Safety Analysis Report (UFSAR).

At Quad Cities Station, on October 20, at approximately 1100 hours, notification from Dresden Station was received regarding the design deficiency.

A review of the Quad Cities Station RPS SDV logic circuitry was performed. This included a review of drawings, Technical Specifications, UFSAR, Design Basis Document, the original installation of the SDV level scram instrumentation modifications M04-1(2)-81-021, and M04-1(2)-80-023, and a field walkdown. Both Quad Cities Units 1 and 2 RPS SDV logic circuitry are designed and configured similar to Dresden Unit 2. As a result of this initial review, Problem Identification Form (PIF) #95-2685 was written on October 20, 1995 at 1845 hours.

The Issue Screening Form (QCAP 230-7, Attachment A) was completed on October 21, 1995 at approximately 2140 hours. This concluded the required design functions were not met and that a one hour ENS phone call was required.

At 2145 hours on October 21, 1995, while Unit 1 was in the Run Mode at 100% power and Unit 2 was in the Run Mode at 25% power, Quad Cities Station entered Technical Specification 3.1 Table 3.1-3 which requires the insertion of all operable rods within 4 hours. Based on the determination that the SDV level input to RPS does not meet the single failure criteria specified in the UFSAR, the ENS phone call was made on October 21, 1995 at 2233 hours and both Units were shutdown. Unit 2 had all rods inserted at 2159 hours on October 21, 1995, and Unit 1 had all rods inserted at 0026 hours on October 22, 1995.

On October 30, 1995, a joint Corporate and Station (Dresden and Quad Cities) root cause team was assembled for event investigation.

C. **CAUSE OF THE EVENT:**

Investigation results have identified that a modification installed on Unit 1 in 1984 and Unit 2 in 1985 provided an incorrect design for the SDV control logic and cable routing for Unit 2.

D. **SAFETY ANALYSIS:**

The SDVs are designed to receive and contain the water exhausted from all of the CRDs during a Reactor scram. Upon receipt of a scram actuation, each control rod will displace approximately 2.5 gallons of water from the drive's over piston area to the SDV. This water input occurs in less than 7 seconds. The drives then continue to input a smaller flow rate into the SDV as leakage from the drive's mechanical seals allows a small, continued input until the SDV piping is filled "solid" with discharge water from the CRD. At the point where the SDV is "solid", further drive motion inward will be significantly limited to that allowed by drive seal leakage into the reactor pressure vessel. The volume (capacity) of the SDV is established to ensure that all CRDs can achieve their required scrams without impairment of the required 7 second insertion time, i.e. they will be fully inserted before the SDV fills "solid". This sizing and volume capacity is sufficient to ensure that the first rods that move do not fill up the SDV before the slower or later rods can be inserted. In order to enforce this SDV capacity requirement, the SDV high level sensors are designed to initiate a RPS scram initiation prior to the SDV level needed to accommodate the discharge water for a full reactor scram.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

Form Rev. 2.0

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) Year		Sequential Number		Revision Number	PAGE (3)
Quad Cities Units One and Two	0 5 0 0 0 2 5 4	9 5	-	0 0 7	-	0 0	4 OF 0 6

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

This SDV high level trip is therefore, a pre-emptive trip that ensures that should a protective trip from one of the sensed reactor processes be needed, that the Control Rod Drive system is capable of executing the needed reactor shutdown. The SDV high level is not itself a condition that poses a challenge to the reactor or fuel integrity.

With the as-found design configuration of the SDV level sensors and RPS logic, the SDV RPS control logic would have provided the necessary actuation and scram signals if the SDV level reached an unacceptable level as verified by the previous surveillance testing. The maintenance history for the initiation relays (590-100A, B, C and D) show that there have been no relay failures since the SDV RPS control logic was modified.

However, if a single failure of the initiation relay would have occurred along with a high level in one of the SDVs, the required pre-emptive full scram signal would not have been initiated. This possibility is discussed below, however it is extremely unlikely and no mechanism has been identified which could reasonably lead to having a full SDV without the needed full scram having been taken, either manually or automatically.

had 1/2

A "1/2 scram" WOULD be generated, along with the alarms indicating high SDV level for the affected SDV. If, while in this condition, a valid reactor process signal was sensed that required a reactor scram, only the CRDs controlled by the bank of Hydraulic Control Units (HCU) unaffected by the single failure scenario would have fully inserted into the reactor core. This would be 50% of the control rods on one side of the reactor core. During this scenario, a significant power reduction would occur, but one side of the reactor core could still be critical, and generating power at a reduced rate. Manual Operator action would complete the reactor shutdown, which could include the use of the Stand By Liquid Control (SBLC) system or draining the SDV. The consequences of this are bounded by full power ATWS.

The effects of this condition on the execution of the Emergency Operating Procedures (EOP) was reviewed, and it was concluded that the symptom based procedures for the ATWS condition would be effective. In this scenario, the rod position indication is not affected by the postulated failure, and APRM power indication would not be significantly affected, since the APRM inputs are axially and radially distributed throughout the reactor core, to achieve spatial averaging that is not primarily dependent on control rod symmetry. During the EOP performance, the steps that allow Bypass and Reset of the SCRAM would allow the SDV to be drained, and (possibly multiple) SCRAM inputs would achieve the needed rod insertion.

The ComEd Probabilistic Risk Assessment (PRA) Group performed a bounding quantitative analysis using the current Quad Cities PRA model with guidance on failure-to-scram quantification from the industry BWR IPE methodology. Further qualitative evaluation shows that the undetected filling of one of the SDVs without the expected full scram is highly unlikely because of the Quad Cities Unit 1 and Unit 2 SDV modifications installed in the 1980's. The evaluation also shows that, during an ATWS scenario involving the single failure of concern, a power reduction would be expected from scramming the CRDs controlled by the bank of HCUs unaffected by the single failure scenario. The review of the equipment history showed no challenge to the system, no single failure occurred nor was there a history of single failure for the initiation relays, and there is a low probability of occurrence involving the single failure of concern.

Quad Cities considers this event to be a significant design control issue. Based on the bounding quantitative analysis and the qualitative evaluation, the ComEd PRA Group concluded that the impact of the Quad Cities SDV level switch RPS logic failing to meet the single failure criterion is Non-Risk-Significant.

E. CORRECTIVE ACTIONS:

Corrective Actions Completed:

1. PIF 95-2685 was written to investigate the cause of the design deficiency. The level 2 investigation for PIF 95-2685 will identify the root cause of the incorrect logic design.

2. Senior Station Management was notified of the incorrect logic.

3. The SDV RPS logic has been corrected for Quad Cities Unit 1 (Temporary alteration 95-1-28).

4. Being a design error from the 1980's, more controls have been added to the process for modifications.

Corrective actions to be completed:

1. The corrective actions identified by the level 2 investigation will be completed. (NTS # 2541809500701)

2. Modifications M04-1(2)-95-006 will be installed. The modification for Unit 1 will be installed during Q1R14. The modification for Unit 2 will be installed prior to Start Up from the current forced outage (Q2F38).(NTS # 2541809500702)

F. **PREVIOUS OCCURRENCE:**

LER/Docket Number	Title
LER 91-014/2542009110100	DVR 04-01-91-101; (Voluntary) Standby Gas Train Heater logic circuitry missing due to an inadequate review of the SAR (See DVR 04-01-91-029)
LER 92-013/2542009206100	DVR 04-01-92-061; Inability of the "A" Standby Gas Train to autostart on an ESF signal if "A" is in Primary & "B" is in standby and power is lost to Bus 19 due to a design deficiency (LCO)

G. **COMPONENT FAILURE DATA:**

There were no component failures associated with this LER.