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Exelon Nuclear

March 10, 2011

10 CFR 50.73

SVP-11-015

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Quad Cities Nuclear Power Station, Unit 2
Renewed Facility Operating License No. DPR-30
NRC Docket No. 50-265

Subject: Licensee Event Report 265/2011-001-00, Loss of Unit 2 Essential Service 480V Bus

Enclosed is Licensee Event Report (LER) 265/2011-001-00, Loss of Unit 2 Essential Service 480V Bus, for Quad Cities Nuclear Power Station, Unit 2.

This report is submitted in accordance with 10 CFR 50.73(a)(2)(v)(D), which requires the reporting of any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

There are no regulatory commitments contained in this letter.

Should you have any questions concerning this report, please contact Mr. W. J. Beck at (309) 227-2800.

Respectfully,

William R. Gideon
Site Vice President
Quad Cities Nuclear Power Station

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Quad Cities Nuclear Power Station

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NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2013

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Quad Cities Nuclear Power Station Unit 2	05000265	1 OF 6

4. TITLE

Loss of Unit 2 Essential Service 480V Bus

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									N/A	N/A
01	12	2011	2011	- 001 -	00	03	10	2011	FACILITY NAME: N/A	DOCKET NUMBER: N/A

9. OPERATING MODE

1

10. POWER LEVEL

100%

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☐ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☐ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ■ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER *(Include Area Code)*
Tom Petersen – Regulatory Assurance	(309) 227-2825

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
X	ED	CNTR	G080	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ■ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
N/A	N/A	N/A

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On January 12, 2011, at 1020 hours, the Unit 2 Essential Service (ESS) 480V Bus 29 [BU] was inadvertently de-energized. The cause of this bus trip was due to inadvertent contact with the bus feed breaker local trip pushbutton [JS] by a station employee during unrelated work activities in the bus feed breaker area. While Bus 29 was de-energized, Division II core and containment cooling systems [BO] were unavailable and inoperable; however, normal power to Bus 29 was restored within 6 minutes.

The plant responded as designed to the loss of Bus 29, with the exception that the normally supplied reactor building ESS 480V Bus Motor Control Center (MCC) 28/29-5 did not receive the auto transfer of supplied power from its reserve feed 480V Bus 28. Since either 480V Bus 29 or Bus 28 can feed Bus 28/29-5, this condition resulted in a loss of power to Bus 28/29-5 and rendered both divisions of the Low Pressure Coolant Injection (LPCI) [BO] mode of the Residual Heat Removal (RHR) [BO] system inoperable. Therefore, Technical Specification 3.5.1.E was entered, requiring restoration of LPCI within 72 hours. It was subsequently determined that the "M" auxiliary contactor [CNTR] from Bus 29 had failed which caused the auto transfer logic from Bus 29 to Bus 28 to fail.

Bus 28/29-5 was manually reenergized from Bus 28 at 1213 hours; however, LPCI remained inoperable pending investigations. Restoration of Bus 28/29-5 auto-transfer function occurred at 2151 hours, allowing LPCI to be returned to operable status and TS 3.5.1.E to be exited.

This report is submitted in accordance with the requirements of 10 CFR 50.73(a)(2)(v)(D), which requires the reporting of any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REV NO.	
Quad Cities Nuclear Power Station Unit 2	05000265	2011	- 001 -	00	2 OF 6

NARRATIVE

PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor, 2957 Megawatts Thermal Rated Core Power

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

EVENT IDENTIFICATION

Loss of Unit 2 Essential Service 480V Bus

A. CONDITION PRIOR TO EVENT

Unit: 2 Event Date: January 12, 2011 Event Time: 1020 hours
Reactor Mode: 1 Mode Name: Power Operation Power Level: 100%

B. DESCRIPTION OF EVENT

On January 12, 2011 at 1020 hours, a worker fell off a ladder while performing the annual fire protection deluge [KP] system functional test on the 2B Reactor Recirculation [AD] Motor Generator (RRMG) [MG]. This work was located in the vicinity of the safety related (SR) Essential Service (ESS) Bus 24-1. The worker was not injured, but during the fall had inadvertently bumped the local trip pushbutton for the supply breaker to ESS Bus 29 at Bus 24-1 which caused a loss of power to Bus 29. This caused a loss of power to Unit 2 Division II Emergency Core Cooling System (ECCS) [BO], Unit 2 Emergency Diesel Generator Cooling Water Pump (EDGCWP) [LB], 1/2 A Standby Gas Treatment (SBGT), and Reactor Protection System (RPS) B [JD] which caused a half scram, half Group 1 and 2 isolation, reactor building vent [VA] isolation, Reactor Water Clean-Up (RWCU) [CE] isolation (Group 3 isolation). All systems responded as required with the exception of reactor building ESS 480V Bus Motor Control Center (MCC) 28/29-5 which failed to transfer to Bus 28. The worker who had fallen immediately called the main control room to inform them of the situation. Unit 2 entered Technical Specification (TS) Limiting Condition for Operation (LCO) 3.0.3 and Unit 1 entered a 7 day TS LCO for 1/2 A SBGT. The 1/2 B SBGT train auto started.

At 1026 hours, Bus 29 was manually re-energized from its normal power source (Bus 24-1) allowing the Unit to exit TS 3.0.3. The most limiting LCO at that time became a 72-hour shutdown LCO under TS 3.5.1.E due to MCC 28/29-5 still being de-energized which caused both LPCI sub-systems to be inoperable. The 2B Reactor Building Closed Cooling Water (RBCCW) [CC] pump was verified to be running and the previously running Drywell (DW) coolers [VB] on Unit 2 were restarted. Prior to this event, the 1/2 Emergency Diesel Generator (EDG) [EK] had been running unloaded in preparation for a 24-hour endurance run, however, it was secured at 1041 hours. Since it was unloaded, it was operable and available to both units at all times. The RPS Bus 2B was restored to its normal power feed, and the RPS B channel half scram, half group 1 and 2 isolations, and full group 3 isolations were reset.

Troubleshooting was quickly initiated following the failure of MCC 28/29-5 to auto transfer to Bus 28. MCC 28/29-5 is located in the reactor building on a separate floor level, away from Bus 24-1 and Bus 29 which are located in the turbine building, so no interactions from the worker falling could have caused the failure to transfer power. During troubleshooting, maintenance personnel found the M29 5/6 auxiliary contacts on the MCC 28/29-5 (cubicle 2-7800-28295-D2) power supply contactor coming from Bus 29 were open. The contacts should have been closed to allow bus power transfer to Bus 28. These auxiliary contacts are General Electric (GE) Model CR105X300.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REV NO.	
Quad Cities Nuclear Power Station Unit 2	05000265	2011	- 001 -	00	3 OF 6

NARRATIVE

At 1213 hours, Operations directed Maintenance to actuate the M contactor in order to allow the transfer to Bus 28. The M contactor actuation caused the MCC 28/29-5 to re-energize from Bus 28 when the 5/6 auxiliary contacts closed. Both A and B loops of LPCI became available at that time, but remained inoperable pending repairs and testing.

All internal notifications were completed per procedures at 1130 hours and a prompt investigation was initiated. ENS notification #46535 was made to notify the NRC of the loss of Bus MCC 28/29-5 due to failure to transfer.

At approximately 1600 hours, maintenance initiated repair activities to replace the auxiliary contact on the power supply contactor in MCC 28/29-5 for Bus 28 and Bus 29 using applicable portions of procedure QCEMS 0250-11, "480/208 VAC Motor Control Center Maintenance and Surveillance." The removed auxiliary contacts were retained for further investigation. The main contactor, a GE CR106 containing a NEMA size 5 coil, remains in place. Maintenance personnel observed no loose connections or misaligned mountings during troubleshooting activities.

At 2028 hours, Operations restored the normal power feed to MCC 28/29-5 from Bus 29.

At 2151 hours, after replacement of the auxiliary contacts, procedure QCOS 6700-02, "MCC 28/29-5 Auto Transfer Logic Operability Surveillance," was completed satisfactorily and LPCI was declared fully operable. The 72-hour LCO per TS 3.5.1.E was exited.

This event is reportable in accordance with the requirements of 10 CFR 50.73(a)(2)(v)(D), which requires the reporting of any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

C. CAUSE OF EVENT

The cause of the trip of Bus 29 was inadvertent contact with the Bus 29 feed breaker on Bus 24-1 by a falling worker. A root cause was performed for this portion of the sequence of events which identified a gap to excellence in the standard for hazard awareness and assessment of risk to personnel and plant equipment. Two contributing causes were also identified for this portion of the sequence of events, 1) a lack of communicating a risk insight identified at the job site prior to the event, and 2) a lack of a sufficient barrier to protect components that could result in an inadvertent breaker trip.

The cause of the failure of MCC 28/29-5 to auto transfer to the alternate power supply, which is the subject event of this LER, was separately investigated by an equipment apparent cause evaluation. The apparent cause for the inability to auto transfer power for MCC 28/29-5 from Bus 29 to Bus 28 was determined to be an intermittent mechanical binding of the plunger [8] in the 5/6 auxiliary contacts on the M29 main contactor, which prevented closure of the 5/6 electrical auxiliary contacts. This determination is based on the initial troubleshooting on January 12, 2011, in which the plunger of the 5/6 auxiliary contact at the M29 main contactor in Cubicle D2 of MCC 28/29-5 was found to be binding in the midway position. The plunger was freed at that time by placing light pressure against it, which released the plunger and allowed the 5/6 contacts to close. Also at that time, the electricians reported no loose connections, loose mounting screws, or misaligned hardware. Although like for like replacement work that installed new auxiliary contacts in 2006 did not specify the mounting screw tightness, it is not likely that binding of the plunger was caused by over-tightened mounting screws, since past annual surveillance results were successful. The current maintenance procedure, QCEMS 0250-11, "480/208 VAC Motor Control Center Maintenance and Surveillance," Revision 57, contains torque values for the tightening of the mounting screws used to install the auxiliary contacts.

In addition, Exelon Power Labs analysis reported that the removed component (the failed GE CR105X300 auxiliary contact) did not have any noticeable deficiencies. During testing and analysis of the failed GE CR105X300 auxiliary contact, the switch functioned properly. The contact plunger showed no evidence of sticking or binding. CR105X300 auxiliary contacts do not use lubrication which could lead to sticking if contaminated. No foreign material was found in the case, on the contact surfaces, or lodged in the auxiliary contact plunger. Movable and fixed contacts showed no indication of degradation from arcing. Furthermore, the auxiliary contact had no signs of degradation when it was analyzed, and it performed acceptably when electrically tested.

D. SAFETY ANALYSIS

Safety Impact

The loss of Bus 29 caused a loss of Unit 2 Division II ECCS, Unit 2 EDGCWP, and RPS B, which caused a half scram, half Group 1 and 2 isolation, reactor building vent isolation, and RWCU isolation (Group 3 isolation). All systems responded as required with the exception of MCC 28/29-5 which failed to transfer to Bus 28. Although the 1/2 EDG had been running unloaded in preparation for a 24-hour endurance run, it was operable and available to both units at all times.

The failure of MCC 28/29-5 to transfer to the alternate power supply event had no impact on the torus cooling function of Residual Heat Removal (RHR). The RHR pumps and valves required to perform this function are powered from divisional power supplies and not MCC 28/29-5. Therefore, the torus cooling function remained available.

However, the failure of MCC 28/29-5 to transfer to the alternate power supply event did result in a potential loss of the LPCI function. In the scenario of a design basis accident (Loss of Coolant Accident (LOCA) concurrent with Loss of Off-site Power (LOOP)) coupled with a single failure of the unit diesel, power would not have been available to Bus 29. Had MCC 28/29-5 then failed to transfer power to Bus 28 while under these conditions, no power would have been available to MCC 28/29-5 to allow repositioning of the inboard and outboard LPCI injection valves, nor allow repositioning of the reactor recirculation pump discharge valves. Consequently, LPCI would not have been available to mitigate a pipe break in either reactor recirculation loop, unless Bus 28 was manually transferred to supply power to Bus MCC 28/29-5. The other low pressure ECCS system (Core Spray (CS)) [BM] and High Pressure Coolant Injection (HPCI) [BJ] remained operable and available to inject at all times. This loss of LCPI event does represent a safety system functional failure (SSFF) for Unit 2, and hence this LER is issued based on 10 CFR 50.73(a)(2)(v)(D), which requires the reporting of any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

Although the required LPCI function was not operable for a short period of time, this did not create any actual plant or safety consequences since the Unit was not in an accident or transient condition requiring use of LPCI during this period of time.

Risk Insights

The risk evaluation included the following key inputs:

- The failure of MCC 28/29-5 Auto Transfer Logic (1ACTIRHBS19B-F--) is modeled in the current Probabilistic Risk Assessment (PRA) model.

- The auxiliary contact failure (intermittent mechanical binding of the plunger in the 5/6 auxiliary contacts on the M29 main contactor) is a random event. This is because the auxiliary contact failure cannot be attributed to the inadvertent bumping of the local trip pushbutton for the supply breaker to Bus 29 at Bus 24-1, since the auxiliary contact and the local trip pushbutton are physically separated by distance. That is, MCC 28/29-5 (auxiliary contact location) is located in the reactor building on a separate floor level, away from Bus 24-1 and Bus 29 which are located in the turbine building, so no interactions from the worker falling could have caused the failure to transfer power.

- A random event allows a T/2 assumption for the unavailability period which may be determined from the last known successful performance of the MCC 28/29-5 Auto Transfer Logic Operability Surveillance (QCOS 6700-02), which was on February 4, 2010. T/2 would result in an unavailability interval of 11 months/2 or 5.5 months.

The risk evaluation results are as follows:

- The T/2 interval is bounded by a 1 year (12 month) time period for unavailability of the MCC 28/29-5 Auto Transfer Logic. A bounding 1 year period for unavailability results in: 1.9 E-8 Delta Core Damage Frequency (CDF). This change in CDF is conservative and negligible.

In conclusion, the increase in risk due to the unavailability of the MCC 28/29-5 Auto Transfer Logic was negligible, therefore, the overall safety significance of this event is minimal.

E. CORRECTIVE ACTIONS

Immediate:

1. Bus 29 was re-energized from its normal power source, Bus 24-1. (This action did not re-energize MCC 28/29-5 due the bus interlock feature.)
2. The MCC 28/29-5 power supply contactor was manually actuated, which then allowed the transfer of supplied power from Bus 28.
3. Replaced the M29 5/6 auxiliary contacts (which were found open), and to address extent of condition, replaced the M28 5/6 auxiliary contacts.

Follow-up:

1. Determine need for increasing the frequency of the MCC 28/29-5 auto-transfer logic operability surveillance.
2. Replace the M29 main contactor during refueling outage, Q2R21.
3. Send the replaced M29 main contactor to Exelon Power Labs for analysis, and based on results, update corrective actions as necessary.

F. PREVIOUS OCCURRENCES

The station events database, LERs, EPIX, and NPRDS were reviewed for similar events at Quad Cities. Specifically, this event was the failure to auto transfer power for MCC 28/29-5 from Bus 29 to Bus 28 which was determined to be caused by an intermittent mechanical binding of the plunger in the 5/6 auxiliary contacts on the M29 main contactor, which prevented closure of the 5/6 electrical auxiliary contacts. Based on the causes of this event and associated corrective actions, the events listed below, although similar in topic, are not considered significant station experiences that would have directly contributed to preventing this event.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REV NO.	
Quad Cities Nuclear Power Station Unit 2	05000265	2011	- 001 -	00	6 OF 6

NARRATIVE

- Station Events Database – On 01/01/06, MO 2-3206A failed to open from the Control Room when Operations attempted to place the 2A Feedwater Regulating Valve (2-0642-A) online during unit start-up from the Q2R61 outage. The failure of MO 2-3206A to open was confirmed to be due to a binding auxiliary contact. The plunger in the auxiliary contact was binding midway in the channel primarily because the mounting screws that attach the auxiliary contact to the contactor were over-tightened. When one of the mounting screws was loosened during troubleshooting, the plunger's spring immediately returned the plunger to the reset position. Because the subject contact had been lubricated it was not a GE Model CR105X300 auxiliary contact design. Since dried grease was considered to have contributed to the contact binding, the apparent mode of the 01/01/06 failure is not applicable to this LER event since the GE Model CR105X300 auxiliary contact is not lubricated.

- Station Events Database – On 01/09/06, the 1/2B HVAC Chilled Water Pump would not stop through operation from the Control Room during initial attempts. Troubleshooting discovered a binding auxiliary contact at MCC 16/26-6 Cubicle C1. Examination of the auxiliary contact removed from Cubicle C1 at MCC 16/26-6 revealed a heavy amount of white residue from dried Aero Shell 7 grease inside the channel where the plunger moves to change states for the on/off operation of the 1/2B HVAC Chilled Water Pump. The dried residue from the grease can cause resistance to movement of the plunger. Since the contact was lubricated, it was not a GE Model CR105X300 auxiliary contact. Therefore, the apparent mode of the 01/09/06 failure is not applicable to this LER event since the GE Model CR105X300 auxiliary contact is not lubricated.

- LER 254-2010-002-00, Unit 1 Reactor Scram Due to Turbine Trip from Low Condenser Vacuum During Main Condenser Flow Reversal – On 08/12/10, Quad Cities Unit 1 performed a scheduled reversal of the direction of flow through the main condenser when two motor operated valves failed to operate, resulting in a loss of condenser vacuum. The root cause for this event was determined to be foreign material from the manufacturing process identified in a sealed auxiliary contact unit, GE Model CR305X100C, for the breaker for one of the motor operated valves involved in the main condenser flow reversal process which caused the valve to remain closed and not reposition as expected. The apparent mode of the 08/12/10 failure is not applicable to this LER event since the sealed GE Model CR305X100C auxiliary contact units are not of the same design as the GE Model CR105X300 auxiliary contacts of this LER. In addition the GE Model CR105X300 auxiliary contacts of this LER were checked for foreign material and none was found.

- EPIX/NPRDS – No similar events indentified for Quad Cities

G. COMPONENT FAILURE DATA

The component that failed was a GE Model CR105X300 auxiliary contact unit.

This event has been reported to EPIX as Failure Report No. 1080.