Exelon Nuclear

10CFR50.73

February 2, 2009

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Limerick Generating Station, Unit 2
Facility Operating License No. NPF-85
NRC Docket No. 50-353

Subject: LER 2008-001-01, Valid Actuation of the D23 Emergency Diesel Generator Bus Undervoltage Logic

This Licensee Event Report (LER) addresses an event that resulted in a valid actuation of the D23 Emergency Diesel Generator bus undervoltage minimum actuation logic following manual operator action to mitigate a D23 Division 3 4kV Safeguard Bus overvoltage condition during the emergency diesel generator post maintenance testing. This revision includes additional information due to completion of a failure analysis on the degraded rectifier.

This LER is being submitted pursuant to the requirements of 10CFR50.73(a)(2)(iv)(A).

There are no commitments contained in this letter.

If you have any questions or require additional information, please do not hesitate to contact us.

Sincerely,

Original signed by Christopher H. Mudrick

Christopher H. Mudrick
Vice President – Limerick Generating Station
Exelon Generation Company, LLC

cc: S. J. Collins, Administrator Region I, USNRC
E. M. DiPaolo, USNRC Senior Resident Inspector, LGS

NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 08/31/2010

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 Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@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)

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4. TITLE:
Valid Actuation of the D23 Emergency Diesel Generator Bus Undervoltage Logic

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
										05000
01	12	2008	2008	- 001 -	01	02	02	2009	FACILITY NAME	DOCKET NUMBER
										05000

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)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER *(Include Area Code)*
Robert E. Kreider, Manager – Regulatory Assurance	610-718-3400

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
B	EK	DG	384C	Y					

14. SUPPLEMENTAL REPORT EXPECTED

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

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

A valid actuation of the D23 Emergency Diesel Generator bus undervoltage minimum actuation logic occurred following manual operator action to mitigate a bus overvoltage condition during emergency diesel generator post maintenance testing. The event was caused by a failure of the emergency diesel generator voltage regulator due to an intermittent failure of the #1 rectifier bank. The emergency diesel generator voltage regulator was swapped to the #2 rectifier bank and the emergency diesel generator governor tuning was successfully completed. The #1 rectifier bank was replaced and a failure analysis was performed. The failure was primarily caused by looseness at a bolted connection and corrosion at the rectifier flyback diode.

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NARRATIVE *(If more space is required, use additional copies of NRC Form 366A) (17)*

Unit Conditions Prior to the Event

Unit 2 was in Operational Condition (OPCON) 1 (Power Operation) at approximately 100% power. Post maintenance testing was being performed on D23 Emergency Diesel Generator (EDG) (EIIS:DG) (EIIS:EK), which was inoperable since January 6, 2008 to conduct a planned inspection. There were no other structures, systems or components out of service that contributed to this event.

Description of the Event

On Saturday, January 12, 2008, D23 Emergency Diesel Generator (EDG) governor tuning per RT-6-092-503-2 "D23 Diesel Generator Governor Tuning Response Test" was in progress during post maintenance testing of the inoperable D23 EDG. At 0904 hours the EDG was supplying the bus in isochronous mode when the test directed starting the 2C Residual Heat Removal (RHR) pump. Following the pump start the bus voltage increased above the test limit of 4900 V for greater than 5 seconds. The Plant Reactor Operator opened the EDG output breaker and then secured the EDG engine as directed by a contingency step in the test.

The bus undervoltage condition actuated the D23 Division 3 4kV Safeguard Bus undervoltage relay, which initiated the automatic start logic (0.5 second time-delay) for D23 EDG followed by an automatic close signal (1.0 second time-delay) to the D23-201 offsite source feeder breaker, which re-energized the bus. The EDG continued to run per design after the EDG output breaker was manually opened until the operator secured the EDG engine. It was during this time period that the automatic start logic was initiated and therefore, with the diesel already running, no actual EDG start occurred.

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NARRATIVE *(If more space is required, use additional copies of NRC Form 366A) (17)*

The investigation determined that the failure of the emergency diesel generator voltage regulator (EIIS:RG) was due to an intermittent failure of the #1 rectifier bank. The #2 rectifier bank was placed in service and the #1 rectifier bank was removed from service. D23 EDG post maintenance testing was successfully completed and D23 EDG was restored to operable status on January 14, 2008 at 1645 hours.

The loads on the affected bus were de-energized for approximately one second. The most significant effects on plant equipment were a trip of the 2A Reactor Water Cleanup Pump, a trip of the 2C RHR pump, and a trip of the 2A Instrument Air Compressor. The Containment Leak Detector Radiation Monitor primary containment isolation valves (PCIVs) closed due to loss of power.

This event resulted in a valid actuation of emergency A.C. electrical power. The 8-hour ENS notification required by 10CFR50.72(b)(3)(iv)(A) was performed on Saturday, January 12, 2008 at 1909 hours (#43898). Since the EDG automatic start minimum actuation logic for the bus undervoltage condition actuated, this event is being reported as an automatic actuation of emergency A.C. electrical power. Therefore, this LER is being submitted pursuant to the requirements of 10CFR50.73(a)(2)(iv)(A).

Analysis of the Event

There were no actual safety consequences associated with this event. The potential safety consequences of this event were minimal. The 4kV safeguard bus was de-energized for approximately 1.0 second, per design, between the time the EDG output breaker was manually opened and the time the offsite source breaker automatically closed.

The D23 EDG governors (EG-A and EG-B) were replaced during the EDG 24-month inspection; therefore, governor tuning was required during the post maintenance testing. The governor tuning test placed the EDG in service supplying the bus loads in isochronous mode with the offsite source breakers open. A load was applied to the EDG by starting the 2C RHR pump.

The engineering evaluation of the overvoltage condition determined that the EDG, motors, and transformer were not adversely affected by the short duration overvoltage condition. Instruments powered from the bus were walked down to ensure no undetected failures occurred.

The vendor failure analysis consistently duplicated the failure during as-found testing of the rectifier chassis. A voltage drop was identified at a bolted connection where torque was less than expected on the flyback diode anode heatsink. Corrosion induced voltage drops were also identified at several locations. The voltage drops combined to cause a silicon controlled rectifier (SCR) to fail to return to the "off" state which is also known as a "latch on" condition.

Cause of the Event

The actuation was caused by a failure of the D23 EDG voltage regulator that was due to an intermittent failure of the #1 rectifier bank. The failure was primarily caused by looseness at a bolted connection and corrosion at the rectifier flyback diode.

Corrective Action Completed

The D23 EDG voltage regulator was swapped to the #2 rectifier bank and the D23 EDG governor tuning was successfully completed.

LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET

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NARRATIVE *(If more space is required, use additional copies of NRC Form 366A) (17)*

The #1 rectifier was replaced.

Failure analysis was completed on the degraded rectifier.

Corrective Action Planned

Preventive maintenance (PM) on EDG voltage regulators will be performed during each upcoming EDG overhaul.

The voltage regulator PMs and maintenance procedure will be revised to include visual inspection and tightness checks of the silicon controlled rectifier (SCR) bolted connections.

Previous Similar Occurrences

There were no previous similar occurrences of emergency diesel generator voltage regulator failures that resulted in bus overvoltage conditions in the last five years.

Component data:
Equipment: D23 Emergency Diesel Generator
Component Number: 2C-G501
Manufacturer: 384C Fairbanks Morse Engine Division
Model Number: 00884777