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Exelon Nuclear

10 CFR 50.73

October 15, 2010
BW100109

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

Braidwood Station, Unit 2
Facility Operating License No. NPF-77
NRC Docket No. STN 50-457

Subject: Licensee Event Report 2010-003-00 – Unit 2 Reactor Trip Caused by Phase to Ground Fault of a Failed Crossover Damper/Deionizer Assembly Due to an Inadequate Inspection Acceptance Criteria and Preventive Maintenance Inspection Frequency

The enclosed Licensee Event Report (LER) is being submitted in accordance with 10 CFR 50.73, "Licensee event report system", paragraph (a)(2)(iv)(A), as an event that resulted in a valid actuation of the reactor protection system and auxiliary feedwater system. On August 16, 2010, Braidwood Station Unit 2 received an actuation of the reactor protection system (reactor trip) and the auxiliary feedwater system due to a phase to ground fault of a failed crossover damper/ deionizer assembly. 10 CFR 50.73(a) requires an LER to be submitted within 60 days following discovery of the event. Therefore, this report is being submitted by October 15, 2010.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this submittal, please contact Mr. Ronald Gaston, Regulatory Assurance Manager, at (815) 417-2800.

Respectfully,

Amir Shahkarami
Site Vice President
Braidwood Station

Enclosure: LER 2010-003-00
cc: NRR Project Manager – Braidwood Station
Illinois Emergency Management Agency – Division of Nuclear Safety
US NRC Regional Administrator, Region III
US NRC Senior Resident Inspector (Braidwood Station)

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

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

LICENSEE EVENT REPORT (LER)

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

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.

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4. TITLE
Reactor Trip Caused by Phase to Ground Fault of a Failed Crossover Damper/Deionizer Assembly Due to an Inadequate Inspection Acceptance Criteria and Preventive Maintenance Inspection Frequency

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
08	16	2010	2010	- 003 -	00	10	15	2010	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)	☐ 20.2203(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

FACILITY NAME	TELEPHONE NUMBER *(Include Area Code)*
Ronald Gaston, Regulatory Assurance Manager	(815) 417-2800

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
E	EL	DMP	P295	Y	N/A	N/A	N/A	N/A	N/A

14. SUPPLEMENTAL REPORT EXPECTED		15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)*	☒ NO		N/A	N/A	N/A

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

On August 16, 2010 at 0206, Unit 2 main generator received generator lockout relay trips, which caused the Unit 2 reactor to trip on a turbine trip above 30 percent power. Following the reactor trip, the auxiliary feedwater pumps automatically started on low-low steam generator water levels.

The root cause of the Unit 2 reactor trip was determined to be an inadequate damper inspection acceptance criteria and preventive maintenance (PM) frequency that did not account for the more turbulent flow characteristics that the crossover damper is subjected to.

Corrective actions to prevent recurrence include revising the PM schedules to ensure the crossover damper assembly is inspected and/or replaced prior to failure, and revising the maintenance procedure for isophase bus duct PM to include additional inspection criteria for the crossover damper assembly.

There were no actual safety consequences impacting plant or public safety as a result of the event.

This event is being reported pursuant to 10 CFR 50.73(a)(2)(iv)(A) due to actuation of the reactor protection system (reactor trip) and the auxiliary feedwater system.

NARRATIVE

A. Plant Operating Conditions Before The Event:

Event Date: August 16, 2010 Event Time: 0206 CDT

Unit: 2 MODE: 1 Reactor Power: 100 percent

Unit 2 Reactor Coolant System (RC) [AB]: Normal operating temperature and pressure

B. Description of Event:

No structures, systems, or components were inoperable at the start of this event that contributed to the event.

On August 16, 2010 at 0206, Unit 2 main generator received generator lockout relay trips (86G2B and 86G1B relays), which caused the Unit 2 reactor to trip on a turbine trip above 30 percent power.

Following the reactor trip, the auxiliary feedwater (AF) [BA] pumps automatically started on low-low steam generator water [SJ] levels and the steam dumps opened to control pressure, all of which are expected responses to a trip from full reactor power. Flow control valve 2AF005H to the 2D steam generator failed open and isolation valve 2AF013H was throttled to control flow.

Following the Unit 2 reactor trip, condensate water was automatically rejected to the condensate storage tank (CST) to prevent hot well overfill. An AF vent riser standpipe is connected to the CST header, and the influx of condensate filled the standpipe and resulted in an overflow of the standpipe onto the turbine deck. The overflow spread to openings in the turbine building floor and flowed down to the elevation below; entered a 4160V/480V substation cabinet located in Unit 1; caused a ground over-current on breaker 1435VU; and caused a trip of buses 133V and 133U. Loss of bus 133 caused the 1A and 1C circulating water pumps to trip, and at 0219 resulted in a trip of Unit 1 on loss of condenser vacuum. This Unit 1 event is addressed under Unit 1 LER 2010-001-00.

Operator response to the trip was proper and all safety related systems, structures, and components operated normally during this event except as noted above.

This event is reportable under 10 CFR 50.73(a)(2)(iv)(A), any event or condition that resulted in manual or automatic actuation of any of the systems listed in 10 CFR 50.73(a)(2)(iv)(B) including any event or condition that results in actuation of the reactor protection system (RPS) when the reactor is critical, and actuation of the PWR auxiliary feedwater system.

C. Cause of Event

The cause of the Unit 2 generator lockout relay trip was a phase-to-ground fault in the isolated phase (isophase) bus duct.

A root cause evaluation was performed to determine the cause of the trip. Inspections of the crossover dampers and deionizer grid assemblies (henceforth referred to as crossover damper assemblies) inside the isophase bus duct identified excessive wear and degraded flow damper blades. Additionally, deionizer grid fins were found detached from the damper outlet. Analysis of the failed components determined that a failed deionizer fin section of the damper assembly caused the Unit 2 isophase bus duct ground.

The cause of the crossover damper assembly failure was investigated. Based on the analysis performed, the cause for the increased degradation of the crossover damper assemblies is the more turbulent air flow characteristics that

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the dampers are subjected to. The rate of normal degradation for the crossover damper assemblies is accelerated when compared to the similar model bypass damper assemblies. The analysis noted that the inspection acceptance criteria for the damper assemblies was not detailed enough to account for this turbulent condition on the sub-components of the assembly. Therefore, the root cause for this event was determined to be an inadequate damper assembly inspection acceptance criteria and preventive maintenance frequency that did not account for the more turbulent flow characteristics that the crossover damper assemblies are subjected to.

A contributing cause for this event is that historic changes in operating conditions (i.e., two bus duct fan operation) have also increased the rate of degradation for the crossover damper assemblies. The station had not adequately evaluated the air flow characteristics for this change to understand how these factors affected the degradation.

D. Safety Consequences:

There were no actual or potential safety consequences impacting plant or public safety as a result of this event. Flow control valve 2AF005H to the 2D steam generator failed open, and isolation valve to 2AF013H was throttled to control flow.

All other safety related systems, structures, and components operated normally during this event.

This event did not result in a safety system functional failure.

E. Corrective Actions:

The corrective actions to prevent recurrence include:

- Revise the preventive maintenance schedule to ensure the crossover damper assemblies are inspected and/or replaced prior to failure, with the periodicity to be set through engineering analysis. The engineering analysis will determine the air flow characteristics for bus duct fan configurations and the impact of these configurations on internal isolated phase bus components and degradation rates.
- Revise the maintenance procedure for isophase bus duct preventive maintenance to include inspection criteria for the crossover damper assembly, including the requirement to remove the assemblies for inspection (to preclude over-reliance on robotic inspections), a detailed inspection of sub-components, dimensional tolerances for the sub-components (where possible), and a hold point for As Found inspection.

Other corrective actions include:

- Replacement of Unit 1 and Unit 2 crossover damper assemblies with a more robust design.
- Identify systems where the station has changed operating conditions that could increase degradation of internal components and determine if the evaluations were performed adequately (addressed the degradation rate of the components).
- Complete a case study for this event with all Engineering personnel, to focus on the organizational weaknesses associated with the oversight and monitoring for the isophase components.

F. Previous Occurrences:

There have been no previous, similar events identified at the Braidwood Station in the past three years.

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G. **Component Failure Data:**

Manufacturer	Nomenclature	Model	Mfg. Part Number
H. K. Porter Company, Inc.	Crossover Damper/Deionizer Grid Assembly	L-98021X11 Rev. A with 52412X5 deionizer grid	L-98021X11 Rev. A with 52412X5 deionizer grid