Exelon Generation®

Mark Flaherty
Plant Manager

Calvert Cliffs Nuclear Power Plant
1650 Calvert Cliffs Parkway
Lusby, MD 20657

410 495 5205 Office
443-534-5475 Mobile
www.exeloncorp.com

mark.flaherty@exeloncorp.com

10 CFR 50.73

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

Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2
Renewed Facility Operating License Nos. DPR-53 and DPR-69
NRC Docket Nos. 50-317 and 50-318

Subject: Licensee Event Report 2015-002, Revision 00
Calvert Cliffs Unit 1 and Unit 2 Automatic Reactor Trips Due to Transmission System Disturbance

The attached report is being sent to you as required by 10 CFR 50.73.

There are no regulatory commitments contained in this correspondence.

Should you have questions regarding this report, please contact Mr. Larry D. Smith at (410) 495-5219.

Respectfully,

Mark D. Flaherty
Plant Manager

MDF/SMR/bjd

Attachment: As stated

cc: NRC Project Manager, Calvert Cliffs
NRC Regional Administrator, Region I
NRC Resident Inspector, Calvert Cliffs
S. Gray, MD-DNR

IE22
NRR

NRC FORM 366 (02-2014) | U.S. NUCLEAR REGULATORY COMMISSION | APPROVED BY OMB: NO. 3150-0104 | EXPIRES: 01/31/2017

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 and Information Collections Branch (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 Page 2 for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE

Calvert Cliffs Unit 1 and Unit 2 Automatic Reactor Trips Due to Transmission System Disturbance

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	
04	07	2015	2015	- 002 -	00	06	05	2015	Calvert Cliffs Unit 2	05000 318
									FACILITY NAME	

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*			
1	☐ 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)
10. POWER LEVEL	☐ 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)
100	☐ 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)	☐ 50.73(a)(2)(vii)
	☐ 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)
S.M. Reichard, Regulatory Specialist	410-495-3648

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	EK	SS	S519	Y	X	JE	44	V124	N

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

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

On April 7, 2015 at 1239 Calvert Cliffs experienced a dual unit trip due to an off-site grid disturbance resulting in an undervoltage condition that caused all four Engineered Safety Features (ESF) Buses to trip. Due to this condition, all of the emergency diesel generators (EDGs) started and loaded with the exception of 2B EDG which started but tripped due to a failed electronic speed switch in the startup circuitry. The associated 4 kV ESF bus was repowered from the normal power source. Additionally, while 2A EDG energized its respective 4 kV ESF bus, the associated shutdown sequencer failed to start 21 Saltwater pump which was subsequently manually started. Unit 1 tripped on loss of all power to generator excitation and all required safety systems responded as designed. Unit 2 tripped due to generator loss of load and is classified as an unplanned scram with complications as 24 4 kV ESF bus was de-energized for greater than 10 minutes. The failed 2B EDG speed switch and 2A EDG shutdown sequencer were replaced and tested satisfactorily. Future corrective actions include to design and implement a speed switch modification to eliminate the single-point failure risk, and to procure and install a newly manufactured sequencer in each channel.

I. DESCRIPTION OF EVENT:

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

A. INITIAL CONDITIONS:

Both Unit 1 and Unit 2 were operating at 100 percent power in Mode 1 on April 7, 2015 prior to the event.

B. EVENT:

On April 7, 2015 at 1239, Unit 1 and Unit 2 reactors [RCT] tripped during a degraded grid event. The Unit 1 Main Turbine Generator [TG] lost field excitation thus causing a turbine trip on loss of load and subsequent reactor trip. The Steam Generator Feed Pumps (SGFP) [SB P] tripped due to loss of power effects and Auxiliary Feedwater (AFW) [SA] was manually actuated.

Unit 2 also experienced a loss of load causing the Unit 2 reactor to trip. The Unit 2 trip was complicated by the 2B Emergency Diesel Generator (EDG) [EK] failing to energize the 24 4 kV Engineered Safety Features (ESF) Bus [BU] following loss of power to the bus due to the under voltage condition. The 2B EDG started but tripped due to a failed electronic speed switch [SS] in the startup circuitry. Normal power was manually restored to the 24 4 kV ESF bus. Additionally, the shutdown sequencer [JE 44] for the 2A EDG did not perform its safety function to automatically restart selected equipment. Most significantly, the shutdown sequencer failure resulted in a failure of the 21 Saltwater (SW) [BS] pump to be automatically restarted following loss of power to 21 4 kV ESF bus. This failure, combined with the loss of power to 24 4 kV ESF bus, resulted in the loss of flow in both SW trains for 12 minutes until 21 SW pump was subsequently restarted manually. The SGFPs tripped due to loss of power effects and an Auxiliary Feedwater Actuation Signal (AFAS) [BA] started the AFW pumps.

Operator actions were appropriate and in accordance with procedures and proper stabilizing actions were taken to successfully manage a dual unit trip.

C. INOPERABLE STRUCTURES, COMPONENTS, OR SYSTEMS THAT CONTRIBUTED TO THE EVENT:

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

D. DATES AND APPROXIMATE TIMES OF MAJOR OCCURRENCES:

April 7, 2015 (1239) Units 1 and 2 experienced reactor trips due to degraded grid voltage condition.

April 7, 2015 (1239) Units 1 and 2 - ESF bus undervoltage

April 7, 2015 (1239) Unit 2 - 2A EDG started and the shutdown sequencer failed

April 7, 2015 (1239) Unit 2 - 21 SW pump doesn't start due to failed shutdown sequencer

April 7, 2015 (1239) Unit 2 - 2B EDG started but failed to energize 24 4 kV ESF bus

April 7, 2015 (1251) Unit 2 - 21 SW pump manually started

April 7, 2015 (1259) Unit 2 – Normal power restored to the 24 4 kV ESF bus

April 7, 2015 (1545) Event Notification Report # 50961 made to the Nuclear Regulatory Commission (NRC) due to automatic system actuations on Units 1and 2

April 8, 2015 (1730) Unit 2 - 2B EDG restored

April 9, 2015 (0336) Update to ENS Report #50961 to add the subsequent determination that a loss of safety function and an unanalyzed condition had occurred on Unit 2.

April 9, 2015 (0433) Unit 2 - 2A EDG shutdown sequencer restored

April 9, 2015 (0631) Unit 1 paralleled to the grid

April 9, 2015 (1432) Unit 2 paralleled to the grid

E. FAILURE MODES:

The 2B EDG started but failed to energize the 24 4 kV ESF bus following the Unit 2 trip. The cause of the failure was a failed speed switch due to a failed integrated circuit (IC) chip. A new speed switch was installed and tested satisfactorily prior to its return to operation. The 2B EDG was inoperable for approximately 29 hours.

The shutdown sequencer failed to load some equipment onto the 21 4 kV ESF bus due to a failed IC chip in step 1 of the sequencer. A replacement shutdown sequencer was installed and tested satisfactorily prior to its return to operation. The shutdown sequencer was returned to service following 2B EDG return to service. The shutdown sequencer was inoperable for approximately 40 hours.

F. METHOD OF DISCOVERY:

The event was self-revealing. The reactor trip event is documented in station Issue Report number 02481527. The 2B EDG failure to start and the shutdown sequencer failure are documented in station Issue Report number 02484165.

II. CAUSE OF EVENT

The root cause of the reactor trip event was determined to be an off-site grid disturbance resulting in an undervoltage condition (transient under voltage relays actuated) on the 4 kV ESF buses.

The root cause of the 2B EDG failure to load was due to a failure of the input transistors on an IC chip in the speed switch. The cause of the shutdown sequencer failure was due to a failure of the U-8 IC chip in the step 1 portion of the sequencer.

A. SAFETY CONSEQUENCES:

The Reactor Protection System (RPS) [JC] on both Unit 1 and Unit 2 automatically actuated on loss of load and tripped the Units.

The 2B EDG failed to energize 24 4 kV ESF bus following 24 4 kV ESF bus loss of power due to the undervoltage condition. Normal power was manually restored to the 24 4 kV ESF bus. The shutdown sequencer for the 2A EDG did not automatically load the 21 SW pump onto the 21 4 kV ESF bus. The 21 SW pump was manually started. The Unit 2 SGFP's tripped due to loss of power effects and an AFAS started the AFW pumps.

This event did not result in any actual nuclear safety consequences. The safety significance of this event was that Calvert Cliffs experienced an undervoltage condition on each unit's safety-related 4 kV ESF buses that resulted in automatic actuation of the reactor protection system and the emergency diesel generators to safely shutdown each unit. While Unit 1 equipment performed their required safety functions, the failure of 2B EDG to energize 24 4 kV ESF bus and the failure of 21 4 kV ESF bus shutdown sequencer resulted in the trip on Unit 2 being classified as an unplanned scram with complications. Despite these failures, Operations was able to effectively perform a safe shutdown of both units.

This event was reviewed for probable risk assessment impact. For Unit 1 the estimated conditional core damage probability was 1E-6 while the Unit 2 estimated conditional core damage probability damage was 2 E-5. These conditional core damage probability damage values fall into a range which triggered a NRC special inspection team investigation. There were no NRC identified findings from the inspection.

This event is reportable against several criteria in NUREG-1022, Revision 3. Both Unit 1 and 2 tripped on loss of load (RPS actuation), therefore the event meets the criteria of 10 CFR 50.73 (a)(2)(iv)(B)(1). For Unit 1 the EDGs were automatically actuated which is reportable under 10 CFR 50.73(a)(2)(iv)(B)(8). On Unit 2, the EDGs and AFW were automatically actuated, which is reportable under 10 CFR 50.73(a)(2)(iv)(B), sections (6) and (8). Since both Unit 2 EDGs were inoperable at the same time, this event is also reportable as an unanalyzed condition 50.73(a)(2)(ii)(B), and a condition that could have prevented the fulfilment of a safety function 50.73(a)(2)(v)(D). The event was reported in ENS report 50961.

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NARRATIVE

B. CORRECTIVE ACTIONS:

The failed 2B EDG speed switch and the 2A EDG shutdown sequencer were replaced and tested satisfactorily prior to restart of Unit 2.

Future corrective actions are:

- Evaluate, design, approve, and implement a speed switch modification to eliminate it as a single-point failure risk.
- Procure and install a newly manufactured shutdown sequencer in each channel.

III. PREVIOUS SIMILAR EVENTS:

There was a dual unit trip in 2010 (LER 317/318-2010-001) and 2014 (317/318-2014-001). There were no common initiating events amongst all these events. The commonality between those two trips and the 2015 event is that due to various equipment issues each Unit 2 trip met the criteria for being an unplanned scram with complications. In 2010 the 2B EDG tripped on low lube oil pressure due to a failed Agastat relay; in 2015 the 2B EDG started but tripped due to a failed speed switch. The previous dual unit trip investigations and resulting corrective actions to prevent recurrence would not have prevented this event.

A. COMPONENT INFORMATION:

- The 2A/2B EDGs are manufactured by Fairbanks Morse (F010).
- The LOCI/SDS Sequencer is manufactured by Vitro Labs Division Automation Indication Incorporated (V124), part number 1628-1076.
- The EDG Speed Switch is manufactured by Synchro-Start Products (S519), Model ESSB-2AT, part number SA-1905.