Exelon.
Nuclear

Clinton Power Station
8401 Power Road
Clinton, IL 61727

U-604005 SRRS 5A.108
February 21, 2011

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

Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket No. 50-461

Subject: Licensee Event Report 2010-003-01

Enclosed is Licensee Event Report (LER) No. 2010-003-01: Unexpected Component Actuations Due To Self Test System Design Deficiencies. This report is being submitted in accordance with 10 CFR 50.73.

The enclosed report has been revised to correct an editorial error.

There are no regulatory commitments contained in this letter.

Should you have any questions concerning this report, please contact Mr. A. Khanifar at (217) 937-3800.

Respectfully,

F. A. Kearney
Site Vice President
Clinton Power Station

RSF/awh

Enclosures: Licensee Event Report 2010-003-01

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Clinton Power Station
Office of Nuclear Facility Safety – IEMA Division of Nuclear Safety

IE22
NRR

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
Clinton Power Station, Unit 1	05000461	1 OF 5

4. TITLE
Unexpected Component Actuations Due To Self Test System Design Deficiencies

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
03	15	2010	2010	- 003 -	01	02	21	2011	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE: 1

10. POWER LEVEL: 96.9

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)*
A. Khanifar, Site Engineering Director	(217) 937-3800

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	JG	RJX	K078	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 3/15/10, during full power operations, Division 2 Drywell Ventilation and Drywell Cooling Primary Containment Isolation Valves (PCIVs) closed for isolation Groups 11 and 17 and shunt trip devices for the breakers of several components were tripped. The actuations were a result of a Division 2 load driver card that spuriously actuated its loads without a valid Loss of Coolant Accident signal or a manual initiation signal present. This event was reported to the NRC by Event Notification 45901 on 5/5/10. The cause of the card failure could not be determined at the time; however during a recent investigation performed following further spurious actuations of Division 1 that occurred between 8/24/10 and 8/26/10, it was determined that the 3/15/10 event was most likely caused by degradation of the Division 2 Self Test System (STS) power supply, resulting in the misoperation of the Nuclear Systems Protection System (NSPS) load driver card. The cause of this event is that the STS has a design deficiency related to its power supplies and NSPS has a design deficiency related to its load driver cards which do not allow the STS to meet its design specification when a power supply is degraded. Corrective action for this event includes replacing STS power supplies with low voltage protection and presenting options for the STS issues to the Plant Health Committee for approval.

NARRATIVE

PLANT AND SYSTEM IDENTIFICATION

General Electric – Boiling Water Reactor, 3473 Megawatts Thermal Rated Core Power

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

EVENT IDENTIFICATION

Unexpected Component Actuations Due To Self Test System Design Deficiencies

A. CONDITION PRIOR TO EVENT

Unit: 1	Event Date: March 15, 2010	Event Time: 0138 hours CDT
Reactor Mode: 1	Mode Name: Power Operation	Power Level: 96.9 percent

B. DESCRIPTION OF EVENT

On 8/23/10, the plant was in Mode 1 (Power Operation) operating at about 97 percent reactor power.

Multiple out of service annunciators [ALM] in the Division 1 Self Test System (STS) [JG] alarmed in the Main Control Room (MCR) from 1026 hours on 8/23/10 through 1524 hours on 8/24/10. Most of the alarms reset immediately, other alarms took a few minutes to reset.

On 8/24/10 at 1844 hours, Division 1 STS power was turned off to support replacement of its Central Processing Unit [CPU] and at 2154 hours, the Division 1 STS power supply was turned back on to support maintenance troubleshooting after replacement of the CPU. Maintenance installed a new Division 1 STS CPU memory card.

On 8/24/10 at 2300 hours, the Reactor Water Cleanup system (RT) [CE] Return Line Outboard Primary Containment Isolation Valve (PCIV) 1G33F039 [ISV] went closed unexpectedly resulting in an isolation of the RT system. No group isolation signal was present and no other containment isolation valves changed position. Valve 1G33F039 was restored to operable status at 2355 hours on 8/26/2010.

On 8/25/10 at 0121 hours, Reactor Core Isolation Cooling (RCIC) [BN] Pump suction pressure was identified as high on Transient Test System and the computer point showed the RCIC minimum flow valve 1E51F019 (a PCIV) cycled with no operator action. At 0134 hours, the MCR received a RCIC Pump Suction Pressure High alarm. The alarm was caused by the RCIC minimum flow valve 1E51F019 cycling open and back to close.

On 8/26/10 at 0827 hours, Maintenance attempted to adjust the Division 1 STS power supply voltages, but was unsuccessful. The output power supply was only able to be adjusted from 3.1 Volts Direct Current (VDC) to 3.6 VDC (expected to be 5 VDC). The Alternating Current (AC) noise on the power supply increased by a similar amount from 1.1 Volts Alternating Current (VAC) to 1.5 VAC RMS (Root Mean Square). The decision was made to install a temporary 5 VDC power supply [RJX] for Division 1 STS.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REV NO.	
Clinton Power Station, Unit 1	05000461	2010	- 003 -	01	3 OF 5

NARRATIVE

On 8/26/10 at 1223 hours, the alarm for RCIC Pump Suction Pressure High, activated in the MCR. RCIC Pump suction pressure was observed to be at 68 pounds per square inch gage (psig) and steady, whereas normal pressure is 55 to 60 psig. After approximately 5 minutes the pressure lowered to 55 psig and the alarm reset. This change in pressure was caused by the RCIC minimum flow valve 1E51F019 cycling open and back to close.

On 8/26/2010 at 1225 hours, Operations identified that RCIC pump suction pressure was high at the same time the Division 1 Direct Current (DC) Bus [BU] Voltage was spiking low. This anomaly was caused by the RCIC minimum flow valve 1E51F019 cycling open and back to close.

On 8/26/10 at 1550 hours, Operators turned off the Division 1 STS power supply and no further unexpected valve operations occurred.

On 8/27/10 at 0251 hours, while performing the Safety System Status Report, operators discovered that the Low Pressure Coolant Injection (LPCI) [BO] A valve 1E12F042A (a PCIV) was unexpectedly in the open position. A computer point shows that the 1E12F042A valve automatically opened on 8/26/10 at 1144 hours. The LPCI A injection valve is normally closed, and cannot be manually opened with Reactor Pressure Vessel pressure greater than 472 psig. The 1E12F042A automatically opens if reactor pressure is less than 472 psig with a LPCI initiation signal present; neither of these conditions was present. Operators restored 1E12F042A to its normal closed position at 0251 hours on 8/27/10.

Troubleshooting was performed to determine the cause of the unexpected valve operations. The troubleshooting consisted of replacing the load driver (LDDR) card for the 1G33F039 valve, STS power supply voltage monitoring, inspections, data trending, and other methods to eliminate potential causes. When the Division 1 STS power supply was turned off no further unexpected valve operations occurred. Troubleshooting identified degradation of the Division 1 STS power supply.

During the investigation of these unexpected component actuations an analysis of a spurious automatic isolation of Division 2 PCIVs and shunt trip that occurred on 3/15/10 identified that the 3/15/10 event could be related to the unexpected valve operations on 8/24/10, 8/25/10, and 8/26/10.

Clinton Power Station initiated Event Notification 45901 on 5/5/10 at 1404 Eastern Daylight Time under the provisions of 10 CFR 50.73(a)(1) for an invalid actuation on 3/15/10 that was reportable under the provisions of 10 CFR 50.73 (a)(2)(iv)(A). The notification satisfied the 60-day telephone notification to the NRC Operations Center in lieu of a written licensee event report.

The event notification reported that on 3/15/10 at 0138 hours, with the plant in Mode 1 at about 96.9 percent reactor power, PCIVs automatically closed for isolation Groups 11 and 17, Division 2 Drywell Ventilation (VP) [VB] and Drywell Cooling (WO) [KM] valves. The valves that automatically closed were inboard PCIVs 1VP005A, 1VP005B, 1VP014A, 1VP014B, 1WO001B, 1WO002B, 1WO551B and 1WO552B. In addition, the shunt trip devices for the breakers [BKR] of the following components tripped: Drywell cooling fan [FAN] 1B (1VP01CB), Drywell cooling fan 1D (1VP01CD), Drywell chiller [CHU] 1B oil pump [P], DC Motor Control Center [MCC] 1B ground detection, DC MCC 1D ground detection, Drywell chiller 1B (IVP04CB), and Drywell chiller control panel [PL] 1B. The actuation of primary containment isolation Groups 11 and 17 was complete and the actuation was limited to these two containment isolation valve groups.

Event Notification 45901 reported that the cause of the isolation was a Division 2 load driver card spuriously actuated all of its loads without a valid loss of coolant accident (LOCA) signal or a manual initiation signal

NARRATIVE

being present. The isolation was reset at 0208 hours, the shunt trips were reset at 0215 hours, and Drywell Cooling was restored by 0259 hours on March 15. The load driver circuit remained in service until a replacement load driver card could be installed on March 19, 2010. An apparent cause evaluation of this issue was unable to identify the cause of the event but concluded that the most probable cause was either an intermittent failure of the card or an intermittent short of the output connectors. Re-evaluation of this cause on 10/12/10 concludes that based on laboratory testing there was no failure of the Load Driver card. The Load Driver card tested satisfactory per original equipment manufacturer and was capable of performing its design function. The re-evaluation further concluded that based on the results of the unexpected valve operations for RT, RCIC, and RHR systems on 8/24/10, 8/25/10, and 8/26/10, the most likely cause of the VP/WO containment isolation valve automatic isolation is the degradation of the Division 2 STS power supply resulting in the misoperation of the NSPS Load Driver card.

The Division 2 STS power supply voltage was measured on 8/27/10 and found to have higher than expected ripples/noise. A decision was then made to turn off the Division 2 STS power supply and replace it with a temporary power supply.

The power supplies for the Divisions 1 and 2 STS have been replaced with temporary power supplies.

This licensee event report constitutes a revision to Event Notification 45901.

The STS is designed to automatically test Nuclear System Protection System (NSPS) [JG] logic with a primary purpose to improve the availability of the Safety Systems Instrumentation by minimizing the time to detect and determine the failure location. The STS is designed to perform automatic testing of NSPS circuitry which includes logics associated with the Reactor Protection System (RPS) [JC], Emergency Core Cooling System (ECCS), and Containment and Reactor Vessel Isolation Control System [JM]. The STS injects short-duration test signal pulses in the NSPS Logic to verify proper response of the logic to various input combinations. When in the automatic mode, the STS injects test pulses in the logic at 60-minute test intervals. The STS normally operates to automatically test all four NSPS divisions in a continuous, cyclic manner. The STS ceases to operate in automatic mode if failure is detected in any one of the four logic divisions. The STS test sequence can be manually restored to automatic operation for the remaining three divisions. Once the failure is corrected, the STS can then be restored to fully automatic operation for all four divisions. The STS was designed to not influence the safety-related functions of the NSPS cards.

C. CAUSE OF EVENT

The apparent cause of the unexpected valve operations is two design deficiencies which do not allow the STS to meet its design specification. The first design deficiency is the STS 5 VDC power supply does not have low voltage protection to prevent a failure mode that results in the generation of electronic noise. The second design deficiency is the improper coordination timing between the STS coupling capacitor [CAP] and pulse stretcher circuits on the NSPS load driver cards which allowed electronic noise to cause unexpected valve operations. The effects of this combination of power supply low voltage and lack of coordination between the coupling capacitor and pulse stretcher have allowed signals of sufficient duration to reposition valves. When the Division 1 STS power supply was turned off, no further unexpected valve operations occurred.

NARRATIVE

D. SAFETY CONSEQUENCES

This event is reportable under the provisions of 10 CFR 50.73 (a)(2)(iv)(A) due to the invalid actuation of PCIVs for isolation Groups 11 and 17 on March 15, 2010. This licensee event report constitutes a revision to Event Notification 45901 completed on 5/5/10.

The unexpected closure of PCIVs for isolation Groups 11 and 17 during this event did not compromise their design safety functions which are to automatically close and isolate VP and WO containment penetrations. By automatically closing to the designed safe position, the valves demonstrated their capability to perform their safety functions to close. Additionally, the closing of these valves did not affect any safety functions. Actuations of RT system valve 1G33F039, RCIC system valve 1E51F019, and LPCI system valve 1E12F042A during this event did not result in a loss of safety function.

E. CORRECTIVE ACTIONS

The power supplies for all four STS Divisions have been replaced with temporary power supplies having low voltage protection.

STS power supplies will be permanently replaced to include low voltage protection as plant conditions allow.

Options for the STS issues will be developed and presented to the Plant Health Committee for approval.

F. PREVIOUS OCCURRENCES

None

G. COMPONENT FAILURE DATA

Component Description:	5 VDC STC POWER SUPPLY 1C71AK615A POWER, SUPPLY, SWITCH MODE, 10A, 100-130 VAC, 4.5-5.5V, SINGLE
Model:	RMT001-AA-20995
Part Number:	169C8805P004
Manufacturer:	KEPCO, INC