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Nuclear

Clinton Power Station  
8401 Power Road  
Clinton, IL 61727-9351

U-603912  
August 28, 2009

10 CFR 50.73  
SRRS 5A.108

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

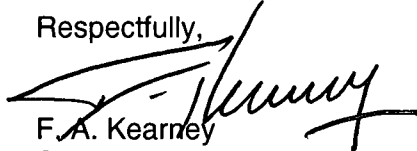
Subject: Licensee Event Report 2009-001-00

Enclosed is Licensee Event Report (LER) No. 2009-001-00: Safety Function Lost Due to Capacitor Failure on Circuit Card. This report is being submitted in accordance with the requirements of 10 CFR 50.73

There are no regulatory commitments contained in this letter.

Should you have any questions concerning this report, please contact Mr. D. A. Tran, at (217)-937-4068.

Respectfully,



F. A. Kearney  
Site Vice President  
Clinton Power Station

RSF/blf

Enclosures: Licensee Event Report 2009-001-00

cc: Regional Administrator – NRC Region III  
NRC Senior Resident Inspector – Clinton Power Station  
Director, Division of Nuclear Security, Office of Nuclear Security and Incident Response  
Office of Nuclear Facility Safety – IEMA Division of Nuclear Safety

JE22  
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### 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.

<b>1. FACILITY NAME</b> Clinton Power Station, Unit 1	<b>2. DOCKET NUMBER</b> 05000461	<b>3. PAGE</b> 1 OF 4
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**4. TITLE**  
Safety Function Lost Due to Capacitor Failure on Circuit Card

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
07	02	09	2009	001 - 00		08	28	09	None	05000
									FACILITY NAME	DOCKET NUMBER
									None	05000

<b>9. OPERATING MODE</b>  1	<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §:</b> (Check all that apply)
<b>10. POWER LEVEL</b>  97	<input type="checkbox"/> 20.2201(b) <input type="checkbox"/> 20.2203(a)(3)(i) <input type="checkbox"/> 50.73(a)(2)(i)(C) <input type="checkbox"/> 50.73(a)(2)(vii) <input type="checkbox"/> 20.2201(d) <input type="checkbox"/> 20.2203(a)(3)(ii) <input type="checkbox"/> 50.73(a)(2)(ii)(A) <input type="checkbox"/> 50.73(a)(2)(viii)(A) <input type="checkbox"/> 20.2203(a)(1) <input type="checkbox"/> 20.2203(a)(4) <input type="checkbox"/> 50.73(a)(2)(ii)(B) <input type="checkbox"/> 50.73(a)(2)(viii)(B) <input type="checkbox"/> 20.2203(a)(2)(i) <input type="checkbox"/> 50.36(c)(1)(i)(A) <input type="checkbox"/> 50.73(a)(2)(iii) <input type="checkbox"/> 50.73(a)(2)(ix)(A) <input type="checkbox"/> 20.2203(a)(2)(ii) <input type="checkbox"/> 50.36(c)(1)(ii)(A) <input type="checkbox"/> 50.73(a)(2)(iv)(A) <input type="checkbox"/> 50.73(a)(2)(x) <input type="checkbox"/> 20.2203(a)(2)(iii) <input type="checkbox"/> 50.36(c)(2) <input type="checkbox"/> 50.73(a)(2)(v)(A) <input type="checkbox"/> 73.71(a)(4) <input type="checkbox"/> 20.2203(a)(2)(iv) <input type="checkbox"/> 50.46(a)(3)(ii) <input type="checkbox"/> 50.73(a)(2)(v)(B) <input type="checkbox"/> 73.71(a)(5) <input type="checkbox"/> 20.2203(a)(2)(v) <input type="checkbox"/> 50.73(a)(2)(i)(A) <input type="checkbox"/> 50.73(a)(2)(v)(C) <input type="checkbox"/> OTHER <input type="checkbox"/> 20.2203(a)(2)(vi) <input type="checkbox"/> 50.73(a)(2)(i)(B) <input checked="" type="checkbox"/> 50.73(a)(2)(v)(D) <input type="checkbox"/> OTHER <div style="text-align: right; font-size: small;">Specify in Abstract below or in NRC Form 366A</div>

12. LICENSEE CONTACT FOR THIS LER	
NAME D. A. Tran, System Engineer	TELEPHONE NUMBER (Include Area Code) 217-937-4068

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	JE	CAP	121KMA	Y					

<b>14. SUPPLEMENTAL REPORT EXPECTED</b> <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO	<b>15. EXPECTED SUBMISSION DATE</b> MONTH:      DAY:      YEAR:
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**ABSTRACT** (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On 7/02/09, the Nuclear System Protection System (NSPS) Self-Test System identified a failure of the Division 3 High Pressure Core Spray (HPCS) logic circuit card (HPCS-1). This failure resulted in the output initiation signals from this card being blocked, preventing the safety function of automatic HPCS initiation and automatic start of the Division 3 emergency diesel generator (DG) and the Division 3 Shutdown Service Water System pump. Operators declared the HPCS, the DG, and the SX systems inoperable but available and entered the applicable Technical Specification action requirements. The Reactor Core Isolation System was verified to be operable as required by Technical Specifications. The cause of the Division 3 logic circuit card failure was a knit-line delamination and associated cracks on a ceramic capacitor in the Power On Initialization circuit due to a manufacturing anomaly that limited the expected lifetime of this capacitor. The defective ceramic capacitor caused the output initiation signals from this card to be blocked, preventing automatic HPCS initiation signals. Corrective actions for this event include repairing the Division 3 logic circuit card that failed, obtaining a spare Division 3 logic circuit card and creating a Performance Centered Maintenance template and evaluating strategies for performing preventive maintenance activities on NSPS circuit cards.

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**NARRATIVE**

**PLANT OPERATING CONDITIONS**

Unit: 1  
 Event Dates: 7/2/09  
 Event Time: 7/2/09, 0100 hours Central Daylight Time  
 Mode: 1 (Power Operation)  
 Reactor Power: 97 percent

**DESCRIPTION OF EVENT**

At 0100 hours on 7/2/09, control room operators received an alarm [ALM] indicating the Nuclear Systems Protection System (NSPS) [JE] Self Test System (STS) failed. Initial investigation identified the reason for the failure was a failure of Division 3 logic circuit card 1PAP663BA16A114: High Pressure Core Spray (HPCS) [BG] Error Code 1 (HPCS-1) system test. The operators attempted to restart the STS and it failed again for the same reason. In accordance with station procedures, the Instrumentation Maintenance Department was required to investigate the second failure, and this task was assigned to the day-shift. Issue Report 938015 was initiated to track investigation of this issue.

The NSPS consists of four independent and redundant divisions of safety-related solid-state circuitry used to scram the reactor and to initiate emergency core cooling systems and engineered safety feature systems. The STS is a testing and surveillance system designed to automatically and continuously monitor the NSPS functional circuitry. The STS provides the means to continuously monitor the logic circuit integrity and the circuit continuity of the NSPS systems once every 40 minutes.

At about 1035 hours, initial troubleshooting at the station determined the Division 3 STS logic was locked-up and the Division 3 HPCS logic circuit card was identified to be the problem.

At 1108 hours, the Operations shift manager held a preemptive discussion with the Main Control Room team concerning a manual start of HPCS with logic inoperable due to concerns with the Division 3 logic circuit card.

At 1137 hours, preparations commenced to allow on-site testing of the Division 3 logic circuit card and to develop a strategy to obtain vendor repair of the card if needed.

At 1230 hours, a dedicated main control room operator was designated to manually start and initiate HPCS if required.

At 1415 hours, troubleshooting concluded that the most likely cause of the STS failure was malfunction of the Power On Initialization (POI) circuitry on the Division 3 logic circuit card. This failure resulted in the output initiation signals from this card being blocked, preventing automatic HPCS initiation and automatic start of the Division 3 emergency diesel generator [EK] [DG] and the Division 3 Shutdown Service Water System (SX) [BI] pump [P]. At this time, operators declared the HPCS, Division 3 DG, and Division 3 SX systems inoperable but available and entered the applicable Technical Specification action requirements, requiring restoration of HPCS within 14 days. The failure of the Division 3 logic circuit card does not prevent manual start of the HPCS pump, opening of the injection valve, manual start of the Division 3 DG or manual start of Division 3 SX pump using hand switches in the Main Control Room. Operators verified the Reactor Core Isolation System (RCIC) [BN] was operable as required by Technical Specification required actions.

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At about 1608 hours, the Division 3 logic circuit card was removed for further site testing (using a GENRAD tester). During this site testing, the POI circuitry of the Division 3 HPCS logic circuit card failed the test. Subsequently, the Division 3 logic circuit card was sent to the supplier for further troubleshooting and diagnostic testing. Supplier investigation of the Division 3 logic circuit card confirmed the card failure was due to degraded coupling ceramic capacitors [CAP] in the POI circuitry. The card was repaired by the supplier and returned to the station.

At 1350 hours on 7/7/09, following completion of installation of the card, post-maintenance testing and restoration of the automatic functions of the card, HPCS, and Division 3 DG and SX were declared operable.

No other inoperable equipment or components directly affected this event.

**CAUSE OF EVENT**

The cause of the Division 3 logic circuit card failure is attributed to a knit-line delamination and associated cracks that caused a low insulation resistance of the ceramic capacitor in the POI circuit of the card that was installed in 1987. The ceramic capacitor is one of two coupling capacitors in series with a resistor to form a time delay that prevents erroneous signals from actuating field devices during circuit card power-up. The purpose of the POI circuit is to set latches to a predetermined state during power-up or during a circuit card removal, and to inhibit the outputs to the field instrumentation during power-up to allow logic setting time. The circuit analysis determined that one degraded ceramic capacitor on the POI circuit caused the HPCS-1 circuit card to malfunction, blocking initiation signals for HPCS, Division 3 DG and Division 3 SX systems. The vendor failure analysis of the capacitor was unable to identify the cause of the knit-line delamination and cracks; however, further industry research shows the most probable cause of the defective capacitor is a manufacturing anomaly that limited the expected life of the capacitor.

**SAFETY ANALYSIS**

This event is reportable under the provisions of 10 CFR 50.73(a)(2)(v)(D) due to a condition that could have prevented fulfillment of the HPCS safety function to mitigate the consequences of an accident.

The HPCS and Division 3 DG and Division 3 SX systems were inoperable but available from 0100 hours on 7/2/09 until declaration of operable status at 1350 hours on 7/7/09, except for a period of 71 minutes from 1200 hours to 1311 hours on 7/7/09. During this time, the HPCS and Division 3 DG and Division 3 SX systems were inoperable and unavailable while control power fuses for the HPCS pump were removed for installation of the repaired Division 3 logic circuit card.

During the times the HPCS and Division 3 DG and Division 3 SX systems were available, the manual start capability of the HPCS pump and the functions for opening the injection valve using hand switches in the main control room continued to be available for operator manual initiation if required. Additionally, the manual initiation functions for the Division 3 DG and SX systems were available in the main control room if required during this time.

The RCIC system was operable during this event. Although no credit is taken in the safety analysis for the RCIC System, it performs a similar function as HPCS but has reduced makeup capability. Nevertheless, it will maintain inventory and cool the core, while the Reactor Coolant System is still pressurized, following a reactor pressure vessel isolation. If HPCS fails to maintain reactor water level above Level 1, it is backed up by automatic initiation

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**NARRATIVE**

of Automatic Depressurization System in combination with Low Pressure Coolant Injection [BO] and Low Pressure Core Spray [BM] systems; these systems remained operable during this event.

**CORRECTIVE ACTION**

The Division 3 logic circuit card that failed has been repaired and a spare Division 3 logic circuit card will be obtained.

A Performance Centered Maintenance template will be created and strategies for performing preventive maintenance activities will be evaluated for NSPS circuit cards.

**PREVIOUS OCCURRENCES**

The 7/2/09 event was a repeat failure of STS identified on 6/24/09 (in issue report 934532) that caused the STS system to stop testing. The STS 6/24/09 failure was an intermittent failure on the HPCS-1 circuit card that was reset and ran successfully in fully automatic test mode. This event was not reportable under the provisions of 10 CFR 50.73.

**COMPONENT FAILURE DATA**

Circuit Card Manufacturer: General Electric  
 Nomenclature: HPCS-1 circuit card  
 Manufacture Model Number: 147D8500G001  
 Part Number: 1PAP663BA16A114

Ceramic Capacitor Manufacturer: KEMET Electronic Corporation  
 Nomenclature: Multi-Layer Ceramic Capacitor, one micro-Farad  
 Manufacturer Model Number: 1CK06BX105K