



Clinton Power Station
8401 Power Road
Clinton, IL 61727

U-604296
June 28, 2016

10CFR50.73
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 2013-008-01

Enclosed is Licensee Event Report (LER) No. 2013-008-01: Failure of Division 1 Transformer Leads to Isolation of Instrument Air Supply to Containment, Lowering Scram Pilot Air Header Pressure, and Manual Reactor Scram. This report is an update to LER 2013-008-00 submitted February 3, 2014. It includes LER 2013-008-00 and an updated Section C, Cause of the Event, which includes a summary of the vendor's analysis of the failed dry transformer. The updated information in Section C is denoted by revision bars located in the right-hand margin. This report is being submitted in accordance with the requirements of 10 CFR 50.73.

There are no regulatory commitments contained in this report.

Should you have any questions concerning this report, please contact Mr. Dale Shelton, Regulatory Assurance Manager, at (217) 937-2800.

Respectfully,

A handwritten signature in black ink, appearing to read "T. Stoner".

Theodore R. Stoner
Site Vice President
Clinton Power Station

KP/cac

Attachment: Licensee Event Report 2013-008-01

cc:

Regional Administrator— NRC Region III
NRC Senior Resident Inspector - Clinton Power Station
Office of Nuclear Facility Safety — Illinois Emergency Management Agency

FE22
NRR



LICENSEE EVENT REPORT (LER)
(See Page 2 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 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.

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4. TITLE
Failure of Division 1 Transformer Leads to Isolation of Instrument Air Supply to Containment, Lowering Scram Pilot Air Header Pressure, and Manual Reactor Scram

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
12	08	2013	2013	- 008	- 01	06	28	2016		05000
									FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)			
1	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
10. POWER LEVEL 097	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> 73.77(a)(1)
	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> 73.77(a)(2)(i)
	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> 73.77(a)(2)(ii)
	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> OTHER	Specify in Abstract below or in NRC Form 366A	

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT Dale A. Shelton, Regulatory Assurance Manager	TELEPHONE NUMBER (Include Area Code) 217-937-2800
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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	ED	XFMR	G184	Y					

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
<input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO				

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

On 12/8/13 at 2026 hours with the plant in Mode 1 at 97.3 percent reactor power, operators received multiple alarms due to the trip of 4160 volt 1A1 breaker which resulted in a loss of power to two Division 1 480 volt unit substations. Operators were immediately dispatched and found a 4160/480 volt stepdown transformer failed. Many Division 1 components lost power. The loss of power caused an instrument air (IA) containment isolation. The loss of IA affected various containment loads, including the scram pilot air header, the main steam isolation valves and the reactor water cleanup system. At 2036 hours, the scram pilot air header low pressure alarm was received, and in response to an anticipated automatic reactor scram, operators immediately initiated a manual reactor scram. All control rods fully inserted into the core. Reactor pressure vessel water level dropped to the low reactor water level 3 setpoint (normal result of a scram from high power) and operators entered the Reactor Pressure Vessel Control Emergency Operating Procedure. The most probable cause of the transformer failure was a turn to turn failure of the high side windings due to insulation breakdown over time, prior to its expected end of life. An installed spare was connected to replace the failed Division 1 transformer.



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NARRATIVE

PLANT AND SYSTEM IDENTIFICATION

General Electric—Boiling Water Reactor, 3473 Megawatts Thermal Rated Core Power Energy Industry Identification System (EIS) codes are identified in the text as [XX]

EVENT IDENTIFICATION

Failure of Division 1 Transformer Leads to Isolation of Instrument Air Supply to Containment, Lowering Scram Pilot Air Header Pressure, and Manual Reactor Scram

A. Plant Operating Conditions before the Event

Unit: 1 Event Date: 12/08/13 Event Time: 2036
 Mode: 1 Mode Name: Power Operation Reactor Power: 97.3 percent

B. DESCRIPTION OF EVENT

On 12/8/2013 at 2026 hours, with the plant in Mode 1 (Power Operation) at 97.3 percent reactor power, multiple alarms [ALM] were received in the Main Control Room (MCR) due to the trip of 4160 volt [EB] 1A1 breaker [BKR] 1 AP07EJ which resulted in a loss of power to Division 1 480 volt unit substations 1A [ED] and A1. Area operators were immediately dispatched to investigate the trip of the breaker. Many Division 1 components lost power. Operators entered the action requirements for numerous Technical Specification Limiting Conditions for Operation. Major impacts to the station as discussed in this report include: loss of Instrument Air (IA) [LE] supply to Containment loads, affecting the Control Rod Drive system (CRD) [AA], main steam isolation valves (MSIVs) [ISV] [SB], and the Reactor Water Cleanup system (RWCU) [CE]; loss of Secondary Containment [VG] differential pressure; loss of Low Pressure Core Spray system (LPCS) [BM] capability; and loss of Residual Heat Removal (RHR) [BN] Train A capability.

Operators in the MCR noted the loss of power caused IA containment isolation valves to close so operators began monitoring the control rod drive (CRD) scram pilot air header pressure for potential of control rods [ROD] to drift due to the loss of air. At 2035 hours, the MCR received an alarm for Rod Control and Information System inoperable due to the loss of power to the Division 1 Rod Action Control System (RACS). The loss of instrument air affected various other containment loads, including the MSIVs and the RWCU system.

At 2036 hours, when the pre-established scram pilot air header low pressure alarm limit was reached, operators immediately placed the reactor mode switch [HS] into the shutdown position, initiating a manual reactor scram. At 2037 hours, reactor pressure vessel water level dropped to the low reactor water Level 3 setpoint (normal result of a scram from high power) and operators entered Emergency Operating Procedure (EOP) -1, Reactor Pressure Vessel (RPV) Control. At 2042 hours, operators verified all control rods fully inserted into the core using the Division 2 RACS.

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At 2037 hours, normally closed Group 2 (Residual Heat Removal (RHR) [BO]), Group 3 (RHR), and Group 20 (miscellaneous systems) containment isolation valves received signals to close as expected and operators subsequently verified the valves were closed.

At 2043 hours, operators manually initiated the standby gas treatment system (SGTS) [BH] to restore Secondary Containment differential pressure that became positive when the Fuel Building ventilation system isolated due to the loss of 480 volt power.

At 2052 hours, a report from the field indicated that the 480 volt Unit Sub A 4160 / 480 volt stepdown transformer [XFMR] 0AP05E2 was the source of the fault that caused the trip of the 4160 volt breaker 1 AP07EJ. A subsequent visual inspection of the transformer identified damage to the A and B phase windings.

At 2114 hours, operators manually opened the outboard instrument air containment isolation valve 11A012A in accordance with the loss of power off-normal procedure to restore the instrument air supply to the containment.

At 0121 hours on 12/9/13, the plant was in a stable condition and operators exited EOP-1.

RPV pressure control was maintained using main steam line drains to the main condenser [COND] and RPV water level control was maintained using condensate / condensate booster systems [SD] and the CRD system.

This event is reportable under the provisions of: 10 CFR 50.73(a)(2)(iv)(A) due to the unplanned actuations of the Reactor Protection System [JC] (RPS) and containment isolation valves; 10 CFR 50.73(a)(2)(v)(C) due a loss of normal ventilation and differential pressure to Secondary Containment; and 10 CFR 50.73(a)(2)(v)(D) as a result of the loss of Division 1 480 volt power causing the loss of accident mitigation abilities of the LPCS system. Event Notification Number 49617 was made to the NRC on 12/9/13 at 0015 hours Central Standard Time.

This event was entered into the Clinton Power Station corrective action program under Issue Report 1594407.

C. CAUSE OF EVENT

A definitive root cause cannot be determined. The transformer vendor was contacted to assist in determining the most likely cause for the failure. Photographs of the failed transformer were provided to the vendor. The vendor compared these photographs to photographs of other failed transformers and indicated that based on their visual assessment, the most probable cause of the 0AP05E2 transformer failure is a turn to turn failure of the high side windings due to insulation breakdown over time.

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The OAP05E2 transformer was installed in 1980 with a 40 year life expectancy (2020). The transformer failed seven years prior to its expected end of life. Based on the vendor's dry transformer performance history, the failure of OAP05E2 transformer is considered a low probability event within the expected 40 year life cycle.

Following the submittal of LER 2013-008, CPS requested the dry transformer vendor to examine the unit to establish a clear cause of failure. The transformer was disassembled and three coils of the unit were removed from the core and shipped to the transformer vendor for failure analysis. The vendor's inspection identified two failures apparent in the windings, a Phase B arc and a Phase A turn to turn short circuit. The Phase B arc caused insulation damage and some erosion of the conductor in one turn of the High Voltage winding. The vendor was unable to determine a definitive root cause of the unit failure.

Based on the transformer vendor's failure analysis, the cause of failure of OAP05E2 described in LER 2013-008-00 dated February 3, 2014 remains unchanged as a turn to turn failure of the high side windings due to insulation breakdown over time.

D. SAFETY ANALYSIS

The failure of OAP05E2 transformer and subsequent trip of 4160 volt circuit breaker 1AP07EJ placed the station in a potential scram condition due to loss of instrument air to the containment and scram pilot air header. Manual operator actions were taken to shut down the reactor prior to an automatic scram and place the plant in a safe and stable condition. The loss of 480 volt power caused the Fuel Building Ventilation System to isolate resulting in positive secondary containment pressure. Operators placed the Division 2 SGTS in service to restore secondary containment negative pressure. All Division 2 and Division 3 Emergency Core Cooling Systems remained operable and available throughout this event for accident mitigation if needed. No plant safety limits were exceeded and no Emergency Core Cooling System actuations occurred.

E. CORRECTIVE ACTIONS

An Engineering Change document was developed to utilize the spare OAP05E7 transformer. Maintenance personnel performed necessary work to transfer leads, cables, conduit, etc. from the OAP05E2 transformer to the OAP05E7 transformer. The OAP05E7 transformer was energized and the station restored Division 1 to service and restarted the unit.

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F. PREVIOUS SIMILAR OCCURENCES

CPS experienced one other dry type transformer failure on 2/3/1996. This transformer was a non-safety radiological waste building transformer and its fault was non-consequential. Conditions (transformer load and cycling due to cold outside temperatures) were the most likely cause of the 2/3/1996 transformer failure. A transformer autopsy was determined to be cost prohibitive and a definitive cause of the 2/3/1996 transformer failure was not identified. The 12/8/2013 failure was reviewed and determined to be unlike the 2/3/1996 failure.

G. COMPONENT FAILURE DATA

Component Description: I-T-E Dry Type Transformer; 4160V/480V; 750KVA
 Manufacturer: GOULD-BROWN-BOVERI
 Model: VU-9
 Year Built: 1980