Exelon. Nuclear

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

10 CFR 50.73
SRRS 5A.108

U-604010
March 29, 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 2008-001-02

Enclosed is Licensee Event Report (LER) No. 2008-001-02: Reactor Recirc Pump Trip Initiates Automatic Scram on High RPV Water Level. This report is submitted in accordance with the requirements of 10 CFR 50.73.

The enclosed report has been revised to update information on cause of event.

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/blf

Enclosures: Licensee Event Report 2008-001-02
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
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 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.

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Clinton Power Station, Unit 1	05000461	1 OF 5

4. TITLE
Reactor Recirc Pump Trip Initiates Automatic Scram on High RPV Water Level

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: None	DOCKET NUMBER: 05000
02	10	2008	2008	001 -	02	03	29	2011	FACILITY NAME: None	DOCKET NUMBER: 05000

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)
95	☐ 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
X	JB	COMP	S933	Y					

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 2/10/08 the 'B' Reactor Recirculation (RR) Pump unexpectedly tripped from fast speed to off. Reactor Pressure Vessel (RPV) water level increased to the automatic scram setpoint. Operators placed the Reactor Mode Switch in Shutdown but the automatic scram on high RPV water level occurred approximately one second prior. The operator reported reactor power at zero percent and control rods status, but had difficulty verifying four control rods due to anomalous indication on the full core display. When RPV water level decreased below the low RPV water level setpoint, operators entered Emergency Operating Procedure (EOP) 1, RPV Level Control, and then transitioned to EOP 1A, ATWS RPV Level Control, in response to the anomalous position indication of four control rods. During control rod position verification by other crewmembers, all control rods were verified to have fully inserted on the initial scram. The causes of this event are low risk perception in investigating and resolving an unexplained source of voltage in a circuit, and insufficient technical rigor in not specifying tuning of feedwater level control system (FWLCS) following a previous scram. Corrective action includes conducting briefings on the root cause of this event emphasizing risk, consequences and application of appropriate human performance fundamentals, tuning the FWLCS, and revising procedures.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REV NO.	
Clinton Power Station, Unit 1	05000461	2008	- 001 -	02	2 OF 5

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

Reactor Recirc Pump Trip Initiates Automatic Scram on High RPV Water Level

A. CONDITION PRIOR TO EVENT

Unit: 1	Event Date: 2/10/08	Event Time: 2207 hours CST
Reactor Mode: 1	Mode Name: Power Operation	Power Level: 95 percent

B. DESCRIPTION OF EVENT

On February 10, 2008 at 2206 hours, operators in the Main Control Room (MCR) received an alarm [ALM] indicating the 'B' Reactor Recirculation (RR) [AD] Pump [P] had unexpectedly tripped from fast speed to off. The 'A' Reactor Recirculation Pump remained in fast speed. The trip of 'B' Reactor Recirculation Pump caused Reactor Pressure Vessel (RPV) water level to increase, and the RPV water level high alarm annunciated. Operators responded to the event in accordance with procedures and training, and at about 2207 hours, with RPV water level at 48 inches and increasing, operators placed the Reactor Mode Switch [HS] into the Shutdown position. As the operator reached for the Reactor Mode Switch to place it into the Shutdown position, RPV water level increased to above Level 8 (52.0" Narrow Range) initiating an automatic reactor scram and the high RPV water level alarm annunciated. The operator reported to the Main Control Room Team reactor power at zero percent and control rods [ROD] status, but had difficulty verifying the position of four control rods due to an anomalous indication on the Rod Control & Information System (RC&IS) [AA] full core display. After the event, investigation identified that the automatic scram occurred approximately one second prior to the operator placing the Reactor Mode Switch into the Shutdown position.

Immediately after the scram, as RPV water level decreased below the low RPV water (Level 3) setpoint, operators entered Emergency Operating Procedure (EOP) 1, RPV Level Control, and then transitioned to EOP 1A, ATWS RPV Level Control, in response to the four control rods that showed an alternating position of "FF" and "Blank." The "FF" indicates failure of a sensor on one of two channels of control rod position indication, and "Blank" indicates no numerical or Full-In control rod position data. Concurrent with the transition from EOP-1 to EOP-1A, other crewmembers determined all control rods were fully inserted based on the full core display indicating full-in (that is, green) indication on at least one channel of control rod position indication.

Operators inhibited the Automatic Depressurization System (ADS) [SB] as directed by EOPs. At about 2209, operators initiated a manual reactor scram using Alternate Rod Insertion as directed by EOP-1A to provide additional assurance that all control rods were fully inserted. At approximately 2210, operators reset the logic for the RC&IS and further confirmed the status of all control rods as fully inserted. The Main Control Room team then transitioned from EOP-1A back to EOP-1. Operators established an operating RPV pressure band using Turbine Bypass Valves [V] and a RPV water level band using Feedwater in accordance with EOPs. ADS was restored to normal status at 2253 hours.

NARRATIVE

The plant was stabilized in Mode 3 (Hot Shutdown) using normal balance of plant systems and Turbine Bypass Valves for pressure control.

At about 2335, operators exited EOP-1.

As expected during the event, the Level 3 trip caused primary containment isolation valves [ISV] in Group 2 (Residual Heat Removal (RHR) [BO]), Group 3 (RHR), and Group 20 (miscellaneous systems) to receive signals to shut; operators verified that the valves properly responded to the Level 3 trip.

Troubleshooting determined that stray voltage across an End of Cycle – Reactor Recirculation Pump Trip (EOC-RPT) relay [RLY] caused actuation of the non-safety portion of the Division 3 EOC-RPT trip circuit, resulting in a trip of the 'B' Reactor Recirculation Pump to off from fast speed.

No other inoperable equipment or components directly affected this event.

The root cause evaluation and corrective actions for this event are tracked under Issue Report 734254.

The control rod indication issues that occurred during this event will be investigated under Issue Report 763115.

C. CAUSE OF EVENT

An evaluation was completed to determine the root causes for the unexpected reactor scram on high RPV Water (Level 8) and the 'B' Reactor Recirculation Pump trip from fast speed to off.

The evaluation determined that the reactor scram resulting from the Level 8 trip following the trip of the "B" Reactor Recirculation Pump occurred as a result of ineffective response from the Feedwater Level Control System [JB] (FWLCS). This issue was further analyzed as a result of a similar reactor scram in October 2009 (LER 2009-005). The analysis concluded that the FWLCS was not tuned properly to provide adequate margin to high RPV water level scram setpoints. This resulted in the system not being sufficiently tuned. The system is designed to be inventory dominant. Consequently, the feedwater demand signal did not decrease fast enough to reduce feedwater pump flow after the RR pump trip. The flow controllers did not respond fast enough to minimize the level transient.

Further, the evaluation concluded that the 'B' Reactor Recirculation pump tripped from fast speed to off due to induced noise resulting in elevated voltages in the non-safety portions of the EOC-RPT circuit which actuated relays that tripped the 'B' Reactor Recirculation pump breaker to off.

In the recent refueling outage (C1R11), all four divisions of EOC-RPT non-safety circuitry were modified to resolve operating experience concerning spurious actuations of this circuit at another Boiling Water Reactor (BWR)-6 plant; degraded optical isolator cards in EOC-RPT circuit caused a downshift of a Reactor Recirculation pump during a 2004 event at the other BWR-6 plant. The outage work involved replacing the resistor and capacitor surge suppression network across a relay coil with a diode to suppress voltage surges that can damage the High Level Optical Isolator (HLOI) cards [OB]. After installing the diodes for the "B" RR pump relays, the voltage across the relay coils prevented the coils from dropping out during unsuccessful Post Modification Testing. This same work was performed on the "A" RR pump relays but successfully passed the testing. As a result of the testing failure, the station decided to restore the surge suppression network for the "B" pump relays to the original design without using tools such as the Operational and

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REV NO.	
Clinton Power Station, Unit 1	05000461	2008	- 001 -	02	4 OF 5

NARRATIVE

Technical Decision Making process and corrective action process, resulting in an as-left voltage across the relay that exceeded expectations. The elevated voltage actuated the relays that tripped the "B" RR pump.

The cause of this Clinton Power Station event was the technical team had a low risk perception in investigating and resolving an unexplained source of voltage in a circuit that had a high-risk consequence (Recirculation Pump Trip). Consequently, the team failed to recognize that they were in a high-risk situation in investigating a complex problem that was not well understood. Unexpected results should have alerted them to the consequences.

The cause for the Level 8 scram following the trip of the 'B' Reactor Recirculation Pump is ineffective response from the Feedwater Level Control System as a result of the FWLCS not being tuned properly to provide adequate margin to high Reactor water level scram setpoints. Monitoring data shows that the 'B' controller was less responsive to the transient than the 'A' controller. FWLCS is an Inventory Dominant System. This should cause the Master Level Control Output to respond to a deviation from the desired setpoint. The traces of FWLCS response for this event are similar to traces from an August 2006 reactor scram (LER 2006-003) when the High Pressure Core Spray system [BG] (HPCS) was injecting. Further review indicates that the flow controllers and level controller gain and reset values found during the development of the FWLCS tuning plan in 2010 were essentially the same as the values found during initial plant startup testing. Due to a lack of technical rigor, tuning was not evaluated in 2006 and the HPCS injection was concluded to be the reason for the Level 8 scram. Monitoring data shows that the 'B' controller was less responsive to the transient than the 'A' controller. It appears this has been the case since initial plant startup. Discussions with General Electric state the controllers should respond the same.

A contributing cause for this event was the Post Maintenance Testing procedure does not require documented evidence that the original degraded condition was corrected and verified based on satisfying specifically focused acceptance criteria. The lack of appropriate acceptance criteria allowed the testing to be judged as satisfactory and did not trigger the generation of an Issue Report. The Post Modification Test did not specify final acceptance criteria for the maintenance activity in correcting elevated voltage at the High Level Optical Isolator (HLOI) cards [OB].

D. SAFETY CONSEQUENCES

This event is reportable under the provisions of 10 CFR 50.73 (a) (2) (iv) (A) as an event that resulted in an automatic reactor scram while the reactor was critical. No significant safety consequences resulted from this event because required safety systems were available and functioned as designed within safety limits.

This reactor scram event was compared to similar previous events and the plant response and behavior was almost identical to the previous events. The reactor scram was compared to Updated Safety Analysis Report (USAR) sections 15.5 and 15.3. The fission product barriers (fuel clad, reactor, pressure boundary, containment) were not challenged during this event. No Main Steam Isolation Valves closed or Safety Relief Valves lifted during this event and pressure control remained on the Main Turbine Bypass Valves. The Motor Driven Reactor Feed Pump maintained RPV water level. In accordance with the USAR, a single recirculation pump trip is not expected to cause a reactor scram. The USAR assumes normal functioning of plant instrumentation and controls. Based on data retrieved from this scram, there is a difference in Feedwater level control level versus Reactor Protection System level input. This discrepancy is being addressed via issue report 734457; however, this discrepancy in RPV water level in Feedwater Level Control caused the Reactor Protection System to shut down the reactor earlier than expected, which is considered to be a conservative action.

NARRATIVE

No safety system functional failures occurred during this event.

E. CORRECTIVE ACTIONS

The root cause report for this event and a common cause analysis report on fleet unplanned downpowers have been presented to Engineering, Maintenance, and Work Management personnel with emphasis on risk, consequences and application of appropriate human performance fundamentals. (CAPR 734254-38/42/45)

To eliminate future trips of Reactor Recirculation pumps due to spurious signals, the non-safety EOC-RPT trip relays have been removed, but are planned to be reinstalled during refueling outage C1R13 that begins in November 2011. (CAPR 734254-46)

Procedure MA-AA-716-012, "Post Maintenance Testing," has been revised to provide detailed instructions for PMT activities that ensure the originally identified degraded condition has been corrected or satisfactorily mitigated, and appropriate acceptance criteria is specified to use as the basis for determining satisfactory completion of the work/task. (CA 734254-51)

Final tuning of the FWLCS was completed prior to and during refueling outage C1R12. (CA 734254-57)

F. PREVIOUS OCCURRENCES

LER 2006-003-00, titled High Reactor Water Level Scram Result of Bad Inverter Circuit Board Solder Joint.

G. COMPONENT FAILURE DATA

Manufacturer	Nomenclature	Manufacturer Model Number
NUS	Dynamic Compensator, 1-1000 Time Constant	NUS-A047PA-2