



An Exelon Company

Clinton Power Station  
R. R. 3, Box 228  
Clinton, IL 61727

10 CFR 50.73

U-603811  
April 6, 2007

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 2007-001-00

Enclosed is Licensee Event Report (LER) No. 2007-001-00: Inadequate Consideration of Vortexing in Design Calculations. This report is being submitted in accordance with the requirements of 10CFR50.73.

This letter contains no regulatory commitments.

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

Respectfully,

Bryan Hanson  
Site Vice President  
Clinton Power Station

JLP/blf

Enclosure: Licensee Event Report 2007-001-00

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

IE22

# 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: 50 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	<b>2. DOCKET NUMBER</b> 05000 461	<b>3. PAGE</b> 1 OF 3
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**4. TITLE**  
Inadequate Consideration of Vortexing in Design Calculations

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
02	07	2007	2007	- 001 -	00	04	06	2007	None	05000
									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>  95.5	<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 (10 CFR 21)	Specify in Abstract below or in NRC Form 366A							
<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)									

**12. LICENSEE CONTACT FOR THIS LER**

NAME Russell Peak, Engineering Director	TELEPHONE NUMBER (Include Area Code) (217) 937-3800
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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

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

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

On February 7, 2007, the Nuclear Regulatory Commission (NRC) issued a White Finding and Notice of Violation, for failure to select an appropriate method for calculating the minimum elevation (i.e., the analytical level) of water above the high pressure core spray (HPCS) pump suction line to preclude vortex formation and subsequent air entrainment in the pump's suction. The finding identified that prior to August 12, 2006, the initiation of suction transfer from the reactor core isolation cooling (RCIC) water storage tank to the suppression pool, as derived by calculation, may not prevent significant air entrainment in the suction of the HPCS pump and subsequent loss of function of the HPCS pump. As a result, the analytical level could have resulted in significant air entrainment potentially causing the HPCS system to be incapable of completing its safety function. A root cause evaluation determined that the cause of this event was the failure to adequately evaluate the uncertainties and associated margins in the calculation used to determine the suction transfer point. Corrective action for this event includes installation of a plant modification to increase the submergence of the suction piping in the RCIC water storage tank to preclude possible vortex formation and air entrainment. This modification was installed August 12, 2006.

**LICENSEE EVENT REPORT (LER)**

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
Clinton Power Station, Unit 1	05000461	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 OF 3
		2007	- 001	- 00	

**NARRATIVE** (If more space is required, use additional copies of NRC Form 366A) (17)

**DESCRIPTION OF EVENT**

During an NRC inspection conducted in November 2005, inspectors reviewed calculation IP-M-0384, "Evaluation of Vortex in the RCIC (Water) Storage Tank", Revision 0 (performed in 1994) and Revision 1 (performed in 1998). The original purpose of calculation IP-M-0384 was to determine the analytical level (i.e., elevation of water) where vortexing would occur above the High Pressure Core Spray (HPCS) and Reactor Core Isolation Cooling (RCIC) pumps suction lines. The analytical level was then used to calculate the automatic RCIC water storage tank to suppression pool low level suction transfer setpoint for the HPCS pump. The calculations did not adequately account for where air entrainment into the HPCS suction line could potentially occur. An operability evaluation documented the low margin condition, and on December 1, 2005, Clinton Power Station (CPS) shifted the HPCS suction source from the RCIC storage tank to the suppression pool, as allowed by Technical Specifications. In December 2005, CPS issued another revision to calculation IP-M-0384 to demonstrate that the HPCS system was operable using a different methodology that had been accepted at another utility to address vortexing concerns. In addition, an analysis was completed to evaluate the potential introduction and transport of air in the HPCS suction piping. On August 12, 2006, the HPCS suction piping in the RCIC water storage tank was modified by installing downward-turned elbows to increase submergence height to avoid vortexing.

On February 7, 2007, the NRC issued a White Finding and Notice of Violation, related to the failure to select an appropriate method for calculating the minimum elevation (i.e., the analytical level) of water above the HPCS pump suction line in the RCIC storage tank to preclude vortex formation and subsequent air entrainment in the pump's suction. Since the NRC had concerns with the methodologies used in the determination of vortex formation and air entrainment, the NRC concluded that CPS had not adequately demonstrated that the HPCS system would be capable of performing its safety function during the suction swap over from the RCIC water storage tank to the suppression pool.

This event is reportable under 10CFR50.73 (a)(2)(v)(D) as a condition that could have prevented fulfillment of the HPCS safety function.

**SAFETY ANALYSIS**

There were no actual safety consequences. However, since this was an original design issue and until the HPCS system was aligned to the suppression pool in December 2005 and modified in August 2006 to eliminate the concern regarding vortexing and air entrainment, the HPCS system may not have been capable of performing its safety function. Based on a Phase 3 Significance Determination Process evaluation, this condition was determined to have a low to moderate safety consequence.

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		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
Clinton Power Station, Unit 1	05000461	2007	- 001	- 00	3	OF 3

**NARRATIVE** (If more space is required, use additional copies of NRC Form 366A) (17)

**CAUSE OF EVENT**

A root cause evaluation determined that the cause of the event was the failure to adequately evaluate the uncertainties and associated margins in the calculation used to determine the suction transfer point.

**CORRECTIVE ACTION**

In December 2005, when it was determined that the margin was low to preclude vortexing with the configuration that existed with the suction source for the HPCS system aligned to the RCIC storage tank, the suction was transferred from the RCIC storage tank to the suppression pool. A plant modification was installed in August 2006 to increase the submergence of the suction piping in the RCIC water storage tank to preclude possible vortex formation and air entrainment.

The following additional corrective actions were identified:

1. Design basis documents for the HPCS system will be updated to include the need to analyze vortexing for the tank low-level setpoint;
2. The calculation developed for the plant modification to increase the submergence of the HPCS piping will be revised to document the uncertainty with respect to margin with regard to vortexing and air entrainment;
3. A sampling of design basis calculations will be reviewed for extent of condition;
4. Other safety-related tank vortex calculations will be reviewed, evaluated and revised as necessary; and,
5. Configuration control procedures (CC-AA-309, "Control of Design Analyses" and CC-AA-309-101, "Engineering Standard Use and Adherence") will be revised to ensure that quantification of uncertainties associated with the methodologies is performed for safety-significant functions, or justified for non-safety significant functions, and available margin is evaluated against the determined uncertainty.

**PREVIOUS SIMILAR EVENTS**

None.

**COMPONENT FAILURE DATA**

None.