



**Omaha Public Power District**

444 South 16<sup>th</sup> Street Mall  
Omaha, NE 68102-2247

LIC-13-0171

November 27, 2013

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, DC 20555-0001

**Reference:** 1. Docket No. 50-285  
2. Letter from the OPPD (Louis P. Cortopassi) to NRC (Document Control Desk), Licensee Event Report 2013-003, Revision 0, dated April 1, 2013 (LIC-13-0039)

**Subject:** Licensee Event Report 2013-003, Revision 1, for the Fort Calhoun Station

Please find attached Licensee Event Report 2013-003, Revision 1. This report is being submitted pursuant to 10 CFR 50.73(a)(2)(ii)(B) and 10 CFR 50.73(a)(2)(v)(D). There are no new commitments being made in this letter.

If you should have any questions, please contact Terrence W. Simpkin, Manager, Site Regulatory Assurance, at (402) 533-6263.

Sincerely,

Louis P. Cortopassi,  
Site Vice President and CNO

LC/rjr

**Attachment**

c: M. L. Dapas, NRC Regional Administrator, Region IV  
J. M. Sebrosky, NRC Senior Project Manager  
L. E. Wilkins, NRC Project Manager  
J. C. Kirkland, NRC Senior Resident Inspector

**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 Fort Calhoun Station								2. DOCKET NUMBER 05000285	3. PAGE 1 OF 4																													
4. TITLE Calculations Indicate the HPSI Pumps will Operate in Run-out During a DBA																																						
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																													
1	30	2013	2013	003 - 1		11	27	2013	FACILITY NAME DOCKET NUMBER 05000																													
9. OPERATING MODE 5			11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)																																			
			<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 checked="" 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)	Specify in Abstract below or in NRC Form 366A
12. LICENSEE CONTACT FOR THIS LER FACILITY NAME Erick Matzke										TELEPHONE NUMBER (Include Area Code) 402-533-6855																												
13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT																																						
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX																													
14. SUPPLEMENTAL REPORT EXPECTED <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE)								<input checked="" type="checkbox"/> NO		15. EXPECTED SUBMISSION DATE		MONTH	DAY	YEAR																								
ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)																																						
At approximately 1721 Central Standard Time, on January 30, 2013, during hydraulic evaluations for the alternate hot leg injection project, Design Engineering determined that the high pressure safety injection (HPSI) pumps would operate in a run-out condition under worst case design bases accident conditions. The calculated HPSI pump flow is beyond the manufacturer's head-flow curves developed from original pump testing. The station was shutdown in Mode 5 when discovered and the condition was entered into the station's corrective action program as Condition Report 2013-02100. The HPSI pumps were declared inoperable.																																						
A causal analysis identified that the initial HPSI pump cross-tie valve (HCV-304 and HCV-305) required position, impeller design, and runout characteristics identified during pre-operational testing were not translated into design and licensing basis documents. This allowed several HPSI system configuration and procedural changes that reduced the margin to reliable pump operation. A new analysis shows that a new design flow rate of 450 gpm is acceptable for up to 1000 hours. Orifices have been installed and tested that limits maximum flow to prevent the HPSI pumps from operating beyond 450 gpm during a design basis accident.																																						

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Fort Calhoun Station	05000285	YEAR	SEQUENTIAL NUMBER	REV NO.	2 OF 4
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**NARRATIVE****BACKGROUND**

Fort Calhoun Station (FCS) is a two-loop reactor coolant system of Combustion Engineering (CE) design. The Updated Safety Analysis Report (USAR) Section 6.2 provides the following information concerning the design basis of the safety injection system which includes three high pressure safety injection (HPSI) pumps.

The safety injection system is designed to prevent fuel and cladding damage that could interfere with adequate emergency core cooling, and to limit the cladding-water reaction to less than approximately 1 percent for all break sizes in the primary system piping up to and including the double-ended rupture of the largest reactor coolant pipe, for any break location, and for the applicable break time.

The safety injection system also provides rapid injection of borated water for added shutdown capability during rapid cooldown of the reactor coolant system caused by a rupture of a main steam line. No fuel damage would result from this accident with safety injection system operation, even with the most reactive control element assembly stuck in its fully withdrawn position. The system requirements during a main steam line rupture are discussed in Section 14.12, Main Steam Line Break Accident.

The system requirements during a design basis large break loss of coolant accident (LOCA) are met with the assumption of three of the four safety injection tanks delivering borated water to the core and with one HPSI pump delivering approximately 75 percent of its rated flow to the core and one low-pressure injection pump delivering approximately 75 percent of its rated flow to the core.

**EVENT DESCRIPTION**

At approximately 1721 Central Standard Time, on January 30, 2013, during hydraulic evaluations for the alternate hot leg injection project, Design Engineering determined that the HPSI pumps would operate in a run-out condition under worst case design basis accident conditions. The calculated HPSI pump flow is beyond the manufacturer's head-flow curves developed from original pump testing. The station was shutdown in Mode 5 when discovered and was entered into the corrective action program as Condition Report 2013-02100. The HPSI pumps were declared inoperable.

In February 2013, the HPSI pump vendor evaluated previous HPSI calculations. The evaluation confirmed that previous assumptions in calculations were invalid and the HPSI pumps cannot reliably operate in the extended flow region (pump flow beyond the 425 gpm maximum flow tested when the pump was manufactured). Pump runout is the flow condition beyond the maximum flow that was proven by manufacturer flow testing to result in acceptable pump operation. Beyond this point, the pumped fluid may cavitate and the rotating element can become unstable. The resulting effect can lead to pump damage including failure due to loss of clearances and rubbing between rotating and stationary pump parts.

The 1991 vendor information was found to be incorrect since the limiting factor for HPSI pump NSPH is the second stage impeller due to the unique design of the pumps. The unique HPSI pump 2nd stage design feature was not contained in design and licensing basis documents. This unique HPSI pump 2nd stage design feature which resulted in limited HPSI pump flow margin was unknown to FCS staff, including those personnel responsible for accuracy and approval of vendor analyses and calculations.

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**NARRATIVE**

The HPSI pumps have been susceptible to runout conditions since initial plant start-up in 1973. During the October 1972 Safety Injection Preoperational Testing, HPSI pump runout operation was noted by the Operator and Field Engineer. The test procedure noted that HPSI loop injection valves were throttled to resolve the runout condition.

At approximately 1721 CST on February 7, 2013, a late 8-hour notification was made to the Headquarters Operations Office under 10CFR50.72(b)(3)(ii)(B), any event or condition that results in the nuclear power plant being in an unanalyzed condition that significantly degrades plant safety (Event Number 48730). The late notification was entered into the station's corrective action program (CR 2013-05070). This written report is being submitted in accordance with 50.73(a)(2)(ii)(B), any event or condition that resulted in the nuclear power plant being in an unanalyzed condition that significantly degraded plant safety, and 10 CFR 50.73(a)(2)(v)(D), any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

**CONCLUSION**

A causal analysis identified that the HPSI pump cross-tie valves HCV-304 and HCV-305 required position, impeller design, and runout characteristics identified during pre-operational testing were not translated into FCS design and licensing basis documents. This resulted in several HPSI system configuration and procedural changes that reduced margin to reliable pump operation.

**CORRECTIVE ACTIONS****Completed Corrective Actions to Correct/Prevent the Runout Condition:**

New analysis (FC08254, HPSI Pump Maximum and Minimum Flow - SI-2A, SI-28 and SI-2C, completed after the causal analysis) shows that a new design flow rate of 450 gpm is acceptable for up to 1000 hours.

Orifices have been installed and tested that limits maximum flow to prevent the HPSI pumps from operating beyond 450 gpm during a design basis accident.

HPSI loop injection valve position has been set to balance HPSI safety injection flow into the four RCS loops.

**Remaining Corrective Actions to Correct/Prevent the Runout Condition:**

Ensure site testing procedures and preventive maintenance work orders periodically verify that HPSI and LPSI safety injection pump flow into the four reactor coolant loops is balanced, meets pump flow operability criteria, and satisfies accident analysis assumptions. (Due 6/15/2014)

**Corrective Actions to Verify Design and Licensing Bases:**

Identify and define the licensing bases for the emergency core cooling system (ECCS) pump functions and assure licensing bases documentation is current, accurate, complete, and retrievable. This action applies to HPSI, low pressure safety injection, and containment spray systems (CS). This action is replicated from RCA 2013-05570 (FCS Design and Licensing Basis Configuration Control) CAPR-1 and modified to prioritize and accelerate the Licensing Bases reviews and revisions for ECCS pumps to the initial phases of the RCA 2013-05570 CAPR-1 project. (Due 10/5/2014)

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**NARRATIVE**

Identify and define the design bases for the ECCS pump functions and assure design bases documentation remains current, accurate, complete, and retrievable. This action applies to HPSI, LPSI, and CS systems. This action is replicated from RCA 2013-05570 (FCS Design and Licensing Basis Configuration Control) CAPR-2 and modified to prioritize and accelerate the Design Bases reviews and revisions for ECCS pumps to the initial phases of the RCA 2013-05570 CAPR-2 project. (Due 10/5/2014)

**SAFETY SIGNIFICANCE**

HPSI pumps are credited in USAR Section 6.2 to respond to design basis accidents, including a large break LOCA. The HPSI pumps must be able to operate reliably to supply sufficient water for core cooling. However, HPSI pump operation is unreliable when operated in the extended flow region of the manufacturer's pump curve during the injection phase. The available net positive suction head is insufficient to support pump operation in the extended flow region. As a result, one or more of the HPSI pumps may be damaged and fail to provide core cooling during a design basis LOCA resulting in core damage. However, for a design basis large break LOCA, both the HPSI and LPSI pumps are designed to operate for accident mitigation.

**SAFETY SYSTEM FUNCTIONAL FAILURE**

This event does result in a safety system functional failure in accordance with NEI-99-02.

**PREVIOUS EVENTS**

Fourteen licensee event reports (LER) with event dates since January 1, 2010, were identified with the same reporting criteria. Several of these LERs have causal analyses which are still in progress. Since the condition described in this LER was a result of actions taken by the station in 1990 and 2008 and an incorrect vendor document in 1991, it is a legacy condition that would not have been prevented by any corrective actions taken by the station since January 2010.