OPPD
Omaha Public Power District
444 South 16th Street Mall
Omaha, Nebraska 68102-2247

March 16, 2001
LIC-01-0021

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-137
Washington, DC 20555

References: 1. Docket No. 50-285
2. Letter from OPPD (S. K. Gambhir) to NRC (Document Control Desk) dated December 4, 2000 (LIC-00-0104)

SUBJECT: Licensee Event Report 2000-003 Revision 1 for the Fort Calhoun Station

Pursuant to 10 CFR 50.73(a), Omaha Public Power District (OPPD) submits the attached Licensee Event Report (LER) 2000-003, revision 1, dated March 16, 2001. The reportable condition addressed by this report is listed in 10 CFR 50.73(a)(2)(vii). If you should have any questions, please contact me.

Sincerely,

S. K. Gambhir
Division Manager
Nuclear Operations

EPM/epm

Attachment

c: E. W. Merschoff, NRC Regional Administrator, Region IV
L. R. Wharton, NRC Project Manager
W. C. Walker, NRC Senior Resident Inspector
INPO Records Center
Winston and Strawn

IE22

NRC FORM 366 (1-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 6-30-2001

Estimated burden per response to comply with this mandatory information 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 Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@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 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,

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Fort Calhoun Nuclear Station Unit Number 1	05000 285	1 OF 5

TITLE (4)

Failure of Component Cooling Water System Valves by a Potential Common-Mode

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000
11	03	2000	2000	– 003 –	01	03	16	2001	FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	4
POWER LEVEL (10)	0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) (11)

20.2201(b)	20.2203(a)(3)(ii)	50.73(a)(2)(ii)(B)	50.73(a)(2)(ix)(A)
20.2201(d)	20.2203(a)(4)	50.73(a)(2)(iii)	50.73(a)(2)(x)
20.2203(a)(1)	50.36(c)(1)(i)(A)	50.73(a)(2)(iv)(A)	73.71(a)(4)
20.2203(a)(2)(i)	50.36(c)(1)(ii)(A)	50.73(a)(2)(v)(A)	73.71(a)(5)
20.2203(a)(2)(ii)	50.36(c)(2)	50.73(a)(2)(v)(B)	OTHER Specify in Abstract below or in NRC Form 366A
20.2203(a)(2)(iii)	50.46(a)(3)(ii)	50.73(a)(2)(v)(C)	
20.2203(a)(2)(iv)	50.73(a)(2)(i)(A)	50.73(a)(2)(v)(D)	
20.2203(a)(2)(v)	50.73(a)(2)(i)(B)	X 50.73(a)(2)(vii)	
20.2203(a)(2)(vi)	50.73(a)(2)(i)(C)	50.73(a)(2)(viii)(A)	
20.2203(a)(3)(i)	50.73(a)(2)(ii)(A)	50.73(a)(2)(viii)(B)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Thomas A. Dailey, System Engineer	402-533-6730

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
D	CC	ISV	Fischer	Y	D	CC	ISV	Fischer	Y

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On October 23, 2000, the AC-1C Component Cooling Water (CCW) heat exchanger (HX) inlet valve, HCV-491A, did not fully open when placing the HX in operation. Minutes later, the AC-1B CCW HX inlet valve, HCV-490A, failed to open at all.

Following the failure of HCV-491A and HCV-490A on October 23, 2000, a failure investigation was initiated. Results of the investigation concluded the actuator springs for all four CCW HX inlet valves were marginally sized and all four valves had packing torques that were excessive. The investigation also concluded that the failures that occurred in the October 23, 2000, time frame were not related to and not caused by the same failure mechanism. In order to increase valve reliability and prevent recurrence, the actuator springs for the CCW HX inlet and outlet valves were subsequently replaced with higher capacity springs.

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

BACKGROUND

The Component Cooling Water (CCW) system is a closed loop system consisting of three motor driven circulating pumps, four heat exchangers (HX), a surge tank, valves, piping, instrumentation and controls. Cooling water flows from the cooled components to the HXs from a single header. From the four HXs, the flow goes to the three pumps through a single header and back to the cooled components. The surge tank is connected at the suction header of the pumps.

Heat is transferred from the CCW system to the Raw Water (RW) system via the CCW HXs. CCW flows through the shell side and RW flows through the tube side of the HXs. The rejected heat is then discharged by the RW system to the Missouri River. Safety related equipment that is cooled during a Design Basis Accident (DBA) is provided with a redundant cooling water supply directly from the RW system. During steady state operation, the CCW system provides cooling for the following heat loads:

- Letdown HX,
- Reactor coolant pump lube oil and seal coolers,
- Charging pump oil coolers,
- Control Element Drive Mechanism (CEDM) seal coolers,
- Containment air cooling units,
- Containment air cooling and filtering units,
- Sampling HX,
- Safety injection tank leakage coolers,
- Control room economizer coils,
- Nuclear detector well coolers,
- Spent fuel storage pool HX,
- Waste gas compressor seal water HXs,
- Vacuum deaerator pump HX,
- Steam generator blowdown sample chiller.

During shutdown operations, the shutdown cooling HXs are cooled by the CCW system. During normal operation either one or two CCW pumps and at least two CCW HXs are used to control system temperature.

Following a design basis accident the following actions occur in the CCW system:

- All three CCW pumps are started by the load sequencers.
- All four RW pumps are started by the load sequencers.
- All CCW containment isolation valves except those required to mitigate the accident are closed.
- CCW flow to the spent fuel pool heat exchanger is isolated.
- The valves admitting CCW to the high and low pressure safety injection and containment spray pump bearing coolers are opened.
- The CCW and RW inlet and outlet valves for the CCW HXs are opened.

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

The RW system can be manually aligned to cool engineered safety feature (ESF) components such as:

- High and low pressure safety injection and containment spray pump bearing coolers,
- Containment air cooling units,
- Containment air cooling and filtering units,
- Shutdown cooling HXs.

Each CCW HX isolation valve is a ten-inch, Fisher model 7600, fishtail butterfly valve coupled to a Bettis CB-415 actuator. The valves are normally operated to maintain CCW flow through at least two HXs to handle potential CCW pump starts. The valves are also operated to rotate HXs in and out of service to maintain system temperature as system heat loads and river temperatures change.

The safety related function of the CCW HX isolation valves is to open upon receipt of a safety injection actuation signal (SIAS) to allow sufficient flow through the CCW HXs to support the cooling water requirements of the safety related components served by the system.

EVENT DESCRIPTION

On October 23, 2000, the AC-1C CCW HX inlet valve, HCV-491A, did not fully open when placing the HX in operation. The valve traveled approximately 50 percent open and then stopped. At the time of the failure, two CCW pumps were operating and the system was being realigned to put additional CCW HXs in service to support shutdown cooling operations.

This specific problem is not unique to HCV-491A. Plant records indicate that all four CCW HX inlet valves have, at some time, experienced similar problems when two CCW pumps are operating. The failures, however, have been infrequent, having only occurred twice in the previous seven years.

In 1999, when HCV-491A last experienced this problem, an engineering change was initiated to replace the existing valve actuator springs on the CCW HX inlet and outlet valves with higher capacity actuator springs. The spring replacement was originally scheduled for December 2000, but the modification was expedited when HCV-491A again exhibited this problem on October 23, 2000.

Following the failures of HCV-491A and HCV-490A on October 23, 2000, a failure investigation was initiated. Results of the investigation concluded the actuator springs for the CCW HX inlet valves were marginally sized and the valve packing torque was excessive for all four inlet valves. The investigation also concluded that the two failures that occurred on October 23, 2000 were not related. (HCV-491A failed to fully open because of a combination of excessive packing torque and marginally sized actuator springs. HCV-490A failed to open because of apparent internal mechanical binding.)

All eight CCW HX inlet and outlet isolation valves have the same valve/actuator configuration, but due to certain hydraulic flow characteristics, the inlet valves require more actuator operating torque than the HX outlet valves.

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

Based on the configuration and operating similarities of all four CCW HX inlet valves, HCV-489A, HCV-490A, and HCV-492A are implicated by this failure mechanism as well; and, as such, a common-mode failure mechanism could exist. On November 3, 2000, it was determined that this event was reportable per 10 CFR 50.73(a)(2)(vii). This report is being made pursuant to 10 CFR 50.73(a)(2)(vii).

SAFETY SIGNIFICANCE

When this common-mode failure mechanism (valves failing to fully open) is applied simultaneously to two CCW HX inlet valves, it yields a system configuration where two CCW HXs have inlet valves partially open and two CCW HXs with fully open inlet valves. Plant procedures prior to the corrective actions of this LER required that at least two CCW HXs be in service at all times. Therefore, at the most, only two inlet valves are required to open under accident conditions.

Previous analysis has shown that a failure of a CCW valve to open on one HX is tolerable for a river temperature of up to 83 degrees Fahrenheit when the river is at its Technical Specification low level limit of 976.75 feet. For this specific failure scenario however, there is no existing analysis to determine its significance. As such, the computerized system model was used. Also, the results of the model analyses differed depending on what valve position is assumed for the subject CCW HX inlet valves. Plant records indicate that the failure position varies from 30 to 50 percent open.

For this particular analysis, a conservative estimate of 30 percent open was used for inlet valve position. For this system configuration, the computerized system model indicated that for two inlet valves at 30 percent open and two inlet valves full open, the total CCW flow through the two "partial-flow" HXs was approximately 70 percent of a single "full-flow" HX. Although total system flow through the four HXs is lower, the overall heat transfer capacity of the system was comparable to or greater than the three "full flow" HX alignment because of the significant additional heat transfer surface area contributed by the fourth HX. In addition, this failure scenario is only possible when river temperature is less than 70 degrees Fahrenheit because of system operating requirements. Therefore, it can be concluded the case with two CCW valves at 30 percent open is bounded by the previously analyzed case where one CCW valve fails to open when the additional heat transfer surface area and significantly lower river temperatures are considered. This means that even with the common-mode failure mechanism documented in this LER, the CCW system was able to perform its safety related design function.

As noted in the background information, the RW system is capable of directly cooling all the critical loads cooled by the CCW system. This capability is documented in plant abnormal and emergency operating procedures. Therefore, it has been concluded that this condition would have no impact on the public and no impact on plant personnel.

A safety significance determination has determined that the change in core damage frequency is low enough to make this a green finding.

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

CONCLUSION

Results of the investigation concluded the actuator springs for the four CCW HX inlet valves were marginally sized and the valve packing torque was excessive. The following three factors are the most probable causes of the failure noted above:

1. HCV-491A-O (Bettis CB-415 actuator) with the smaller capacity valve actuator spring was inadequately sized to overcome the total required operating torque of the valve in all modes of system operation.

2. The valve packing torque on HCV-491A is more than three times the originally estimated packing torque and had a significant impact on the total required operating torque.

3. Hydrodynamic torque was not adequately considered during the initial sizing of the actuator. Fisher did not calculate total required torque over the entire range of valve travel but only at the full open and full close positions based on the specified differential pressures they were given by the Omaha Public Power District (OPPD) at the time the valves and actuators were being specified. For a butterfly type valve, hydrodynamic torque is typically greater at some mid-position than it is at the full open or full closed position.

CORRECTIVE ACTIONS

1. The 80 pound springs in the air actuators for all eight CCW HX inlet and outlet valves have been replaced with 100 pound springs. An operability determination has also been completed to document the operability of the CCW HX inlet and outlet valves.

2. The eight CCW inlet and outlet isolation valves have been diagnostically tested under the station's air operated valve program to measure key operating parameters (including packing torque). The valves will again be tested on a periodic frequency to ensure continued satisfactory operation and to verify packing torque has not significantly increased.

SAFETY SYSTEM FUNCTIONAL FAILURE

This event did not result in a safety system functional failure in accordance with NEI 99-02, revision 0.

PREVIOUS SIMILAR EVENTS

LER 1982-009 documents a similar failure of these CCW valves.