Omaha Public Power District
444 South 16th Street Mall
Omaha, Nebraska 68102-2247
402/636-2000

December 17, 1990
LIC-90-0969

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

Reference: Docket No. 50-285

Gentlemen:

Subject: Licensee Event Report 90-25, Revision 1 for the Fort Calhoun Station

Please find attached Licensee Event Report 90-25, Revision 1 dated December 17, 1990. This report is being submitted pursuant to requirements of 10 CFR 50.73(a)(2)(ii)(B). Revised portions are indicated by vertical bars in the margins.

If you should have any questions, please contact me.

Sincerely,

W. G. Gates

W. G. Gates
Division Manager
Nuclear Operations

WGG/tcm

Attachment

c: R. D. Martin, NRC Regional Administrator
W. C. Walker, NRC Project Manager
R. P. Mullikin, NRC Senior Resident Inspector
INPO Records Center

IE22 1/1

NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WTH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Fort Calhoun Station Unit No. 1	0 5 0 0 0 2 8 5	1 OF 0 7

TITLE (4): Containment Cooling Water Systems Outside Design Basis

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 9	2 9	9 0	9 0	0 2 5	0 1	1 2	1 7	9 0	N	0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

[ ] 20.402(b)	[ ] 20.405(c)	[ ] 50.73(a)(2)(iv)	[ ] 73.71(b)
[ ] 20.405(a)(1)(i)	[ ] 50.36(c)(1)	[ ] 50.73(a)(2)(v)	[ ] 73.71(c)
[ ] 20.405(a)(1)(ii)	[ ] 50.36(c)(2)	[ ] 50.73(a)(2)(vii)	[ ] OTHER (Specify in Abstract below and in Text, NRC Form 366A)
[ ] 20.405(a)(1)(iii)	[ ] 50.73(a)(2)(i)	[ ] 50.73(a)(2)(viii)(A)	
[ ] 20.405(a)(1)(iv)	[X] 50.73(a)(2)(ii)	[ ] 50.73(a)(2)(viii)(B)	
[ ] 20.405(a)(1)(v)	[ ] 50.73(a)(2)(iii)	[ ] 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Jon Ressler, Mechanical Engineer	AREA CODE 4 0 2 6 3 6 - 2 4 2 6

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)

[ ] YES (If yes, complete EXPECTED SUBMISSION DATE) [X] NO

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

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

In the course of resolving Design Basis Document open items, conditions were identified involving the Component Cooling Water (CCW), Raw Water (RW), and Containment Spray (CS) systems which placed the Fort Calhoun Station outside its design basis for post-accident containment cooling as defined in the Updated Safety Analysis Report and the basis for Technical Specification 2.4. The CCW conditions involved the potential for degradation of containment air cooler performance and/or loss of CCW system operability following a loss of instrument air. The RW conditions involved the inability of the RW system to provide backup cooling to CCW for the containment air coolers. The CS conditions involved the potential for the loss of operability of a single operating CS pump following a single active failure of an emergency diesel generator.

These conditions resulted from original plant design deficiencies. Corrective actions include implementation of a temporary modification to preclude loss of CCW following a loss of instrument air, and a permanent modification to assure adequate post-accident CS flow without threatening the operability of a single operating CS pump. Applicable bases to Technical Specification 2.4 have been revised. Additional permanent modifications will be implemented to enhance post-LOCA CCW availability, and the containment pressure/temperature analysis will be revised accordingly.

Under the original design basis for Fort Calhoun Station Unit No. 1, peak internal containment pressure following a Loss of Coolant Accident (LOCA) would be limited below the containment design pressure of 60 psig by either the Containment Air Recirculation, Cooling and Iodine Removal System or the Containment Spray System. The heat sinks for these systems are the Component Cooling Water (CCW) and Raw Water systems. These multi-train Engineered Safety Features and Essential Auxiliary Support Systems are configured in two redundant cooling groups, each powered by a separate emergency diesel generator. Operability requirements are noted in Technical Specification 2.4.

The Containment Air Recirculation, Cooling and Iodine Removal System includes the containment air cooling and filtering units (VA-3A and VA-3B) and the containment air cooling units (VA-7C and VA-7D). The air to water heat exchangers in these units (coils VA-1A/B and 8A/B) are normally cooled by the CCW system. Air flows through charcoal filters for post-accident radioiodine removal in VA-3A and VA-3B before being cooled.

There are three Containment Spray (CS) pumps which feed two redundant networks of headers and spray nozzles in the containment building. Upon receipt of a Containment Spray Actuation Signal, the CS pumps start and the CS header isolation valves (HCV-344 and HCV-345) open. Water from the Safety Injection Refueling Water Tank (SIRWT) is then sprayed into the containment atmosphere to provide cooling. Suction for the CS pumps is automatically realigned to the containment sump upon receipt of the Recirculation Actuation Signal (RAS) once SIRWT inventory is depleted. The CS water is cooled by CCW via the shutdown cooling heat exchangers after the RAS.

The Raw Water (RW) system acts as the heat sink for the CCW system, circulating water from the Missouri River through the RW/CCW heat exchangers. The RW system was also designed to provide direct cooling to critical components normally cooled by CCW in the unlikely event of a loss of CCW. Interface valves for direct RW backup cooling are provided for the containment air cooling coils, the control room air conditioners, the shutdown cooling heat exchangers, and the safety injection and containment spray pump seal and bearing coolers. These are normally closed, fail open instrument air operated valves equipped with non-safety grade air accumulators. The accumulators were intended to prevent the interface valves from inadvertently opening during testing or maintenance, which would release CCW corrosion inhibitor to the Missouri River. Implementation of direct RW cooling is a remote-manual operator action, consisting of closing the CCW valves and opening the CCW/RW interface valves to these components.

Omaha Public Power District (OPPD) has in recent years implemented a Design Basis Reconstitution Program which has included the production of System Design Basis Documents. In the course of resolving open items associated with these Design Basis Documents, engineering consultants identified separate but related conditions (detailed below) on the CCW, RW, and CS systems which appeared to be outside the design basis for post-accident containment cooling as defined in the Fort Calhoun Station Unit 1 Updated Safety Analysis Report (USAR) and the basis for Technical Specification 2.4. Based upon verbal preliminary notification of these conditions, OPPD management implemented an orderly plant shutdown to place the plant in Mode 3 (Hot Shutdown) on September 28, 1990. This was deemed to be the most reasonably conservative course of action pending final determinations. These conditions were reported to the NRC pursuant to 10CFR50.72(b)(2)(i) on September 29, 1990 upon receipt of final engineering verifications of the conditions.

The first condition affected operability of the CCW system for containment heat removal. The CCW/RW interface valves would fail open on a loss of instrument air (IA) assumed as part of the post-LOCA accident scenario. The IA system is not a safety-related system; therefore, its availability cannot be credited in a post-accident situation. Although these valves are equipped with backup air accumulators, the accumulators are not qualified as safety-grade items and also cannot be credited to operate. With the interface valves assumed to fail open, CCW system inventory would then be lost to the RW system and ultimately to the Missouri River, since CCW system operating pressure is higher than RW system operating pressure. This would result in a loss of operability of the CCW system due to inventory depletion.

In addition, valves to many essential and nonessential heat exchangers served by CCW fail open upon a loss of instrument air. The resultant system flow distribution would deprive the containment air cooling coils of their design CCW flow by allowing CCW flow to nonessential equipment. This would result in heat removal performance by the containment air coolers below that assumed in the design basis. The use of RW backup to the containment air coolers for short term containment pressure suppression is not credited in the USAR because of the time required for operator action and the rapid occurrence of the containment peak pressure in a large break LOCA scenario.

The second condition found was that the RW system cannot perform as an equivalent backup to CCW for the containment air cooling coils. Hydraulic analysis revealed that the RW pump discharge pressure would not be sufficient to compensate for the elevation rise to the containment cooling coils and the low back pressure on the RW discharge side of the cooling coils. The RW flow would discharge from these coils to the Missouri River at a lower elevation, so the only back pressure on the RW discharge side of the coils would be provided by line resistance.

The result would be a vacuum condition inside the containment air cooling coils when fed by RW. The low saturation temperature associated with this vacuum would create the potential for vaporization of RW in the cooling coils during accident conditions, which would degrade their performance.

Because of the above noted problems with the CCW and RW systems, the heat removal and pressure mitigation capability of the containment air cooling coils would be less than that specified by the design basis.

The other identified condition involved the CS system. The three CS pumps are SI-3A, -3B, and -3C. Upon a loss of offsite power, SI-3A would be powered by Emergency Diesel Generator No. 1 (DG-1), and SI-3B would be powered by Emergency Diesel Generator No. 2 (DG-2). SI-3C is normally aligned to be powered by DG-2, but can be manually realigned to be powered by DG-1. In the event of a CSAS, a loss of offsite power, and the single failure of DG-2, the resultant CS system alignment would have SI-3A operating alone feeding both CS headers. In this configuration, analysis showed that system hydraulic resistance and low containment pressure would cause SI-3A to operate in a runout mode, where the power requirement of the pump would exceed the motor's 300 HP capacity. However, the motor would operate within its 1.15 service factor (345 HP) with containment pressure above 45 psig. Higher containment pressure would provide back pressure to reduce pump flow rate and thus decrease required pump power. With containment pressure below 45 psig, the 1.15 service factor would be exceeded and the service life of the motor would be greatly reduced. This would create the possibility of a loss of operability of the sole operating CS pump and the resultant lack of containment pressure mitigation assumed by the CS design basis.

The containment pressure analysis contained in the Fort Calhoun USAR section 14.16 evaluates two accident scenarios: a Main Steam Line Break (MSLB) inside containment, and a Loss of Coolant Accident (LOCA). The MSLB evaluation in the USAR shows that, without crediting the operation of either the containment air cooling or containment spray systems, the resulting maximum containment pressure would still be below the containment design pressure of 60 psig. The identified conditions therefore do not affect the USAR analysis for maximum containment pressure for a MSLB accident.

The containment pressure analysis for a large break LOCA, however, requires a containment cooling contribution to maintain peak containment pressure below 60 psig. An assessment of the containment pressure safety implications of the postulated CS condition (SI-3A feeding two spray headers) was performed. The assessment concluded that manual actions guided by existing emergency procedures and available technical support would provide the means to adequately limit containment pressure. This would be accomplished through the return to operable status of the containment air coolers and the containment spray system prior to exceeding the containment pressure limit.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

The radiological consequences analysis does not take credit for any post-accident radioiodine removal by the CS system. This function is performed by the containment air cooling and filtering units independent of the availability of cooling water to these units.

The primary cause of these conditions is attributed to deficiencies in the original systems design as constructed by the plant Architect/Engineer. As stated earlier, these deficiencies were discovered through OPPD's Design Basis Reconstitution Program.

Prior to resuming power operation of Fort Calhoun Station, OPPD implemented the following corrective actions:

(1) A permanent electrical modification (MR-FC-90-53) was installed on the CS system start logic. This modification provides an interlock for CS header isolation valve HCV-344 which prevents it from opening if the two pumps powered from DG-2 (SI-3B and SI-3C) are not operating. This valve is designed to fail open on loss of air; however, it would be held closed by a previously installed backup nitrogen accumulator qualified for at least 4 hours, sufficient time to place CS pump SI-3C in service. This modification prevents the one-pump, two-header CS alignment upon a single failure of DG-2. It was confirmed that a one-pump, one-header alignment provides sufficient CS flow for containment pressure suppression without crediting any contribution for containment air coolers, while maintaining pump SI-3A motor horsepower within its service factor for all containment pressures.

(2) A temporary modification (TM-90-22) was installed to hand-jack (physically lock with the manual handwheel) all the CCW/RW interface valves closed. This eliminates the possibility of losing CCW inventory to the RW system upon a loss of instrument air. The alignment of RW backup now requires manual operator action at each valve plus remote manual actuation. Applicable procedures were revised accordingly.

(3) The basis section of Technical Specification 2.4 was administratively redefined to delete the statements regarding redundancy of CS and containment air coolers for post-accident peak containment pressure suppression. The Limiting Conditions for Operation were not affected. This basis redefinition was made pursuant to 10CFR50.59.

Following completion of these items, the plant resumed power operation at 0318 hours on October 5, 1990.

These corrective actions ensure that in the short term post-LOCA, adequate containment spray flow would be delivered to maintain the peak containment pressure below 60 psig without threatening CS pump operability. With this assurance, credit for design CCW flow to the containment air coolers is no longer required because the CS system alone will perform the short term containment pressure suppression function.

The remaining cooling functions for the CCW system are post-accident long term items. It has been verified by ABB Combustion Engineering that the CCW flow available to the shutdown cooling heat exchangers would be adequate for the long term cooling function. Should a problem develop with CCW in the long term, there would be sufficient time for implementation of operator actions to maintain the cooling functions of the CCW system. These actions are addressed in existing plant procedures.

Based on review of the current CCW/RW interface valve configuration (i. e., hand-jacked closed), OPPD has determined that qualification of the existing non-safety related air accumulators on these valves is not required at this time.

The following actions will be implemented:

(1) The redefinition of the Technical Specification 2.4 basis will be included in a future administrative amendment to the Fort Calhoun Station Operating License. The USAR will be revised accordingly by or before the 1991 annual update submittal.

(2) The actuation/control configuration of the shutdown cooling heat exchanger CCW isolation valves will be modified to ensure that CCW to these heat exchangers remains isolated until a Recirculation Actuation Signal (RAS) occurs. This would enhance CCW flow to other essential equipment, including the containment air coolers, during the period prior to RAS initiation.

(3) The containment air cooler CCW isolation valve actuators will be modified to provide the capability to isolate CCW flow to nonfunctional (i.e., fans not running) containment coolers. This modification, although not essential to resolving the CCW/RW concerns, would give Operators the ability to provide optimal CCW flow to essential operating equipment, such as the shutdown cooling heat exchangers, during the long term following an accident.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

(4) Flow balance calculations will be performed to support revised post-accident design basis conditions for the CCW and RW systems. The flow balance calculations will reflect the expected as-built system configurations following implementation of the modifications noted above. These calculations will determine how much containment heat removal can be credited to the containment air coolers for post-LOCA conditions. This information will then be used in a revised post-LOCA containment pressure/temperature analysis.

The actions noted in (2), (3), and (4) above are expected to be completed prior to startup from the 1993 refueling outage.

Other Licensee Event Reports which have been submitted addressing design deficiencies are LERs 90-03, 90-05, 90-07, 90-09, 90-16, 90-20, 90-23, 89-09, 89-14, 88-09, 88-19, 88-20, 88-32, 88-33, and 87-18.