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

April 19, 1991
LIC-91-0015L

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 91-07 for the Fort Calhoun Station

Please find attached Licensee Event Report 91-07 dated April 19, 1991. This report is being submitted pursuant to 10 CFR 50.73(a)(2)(ii)(B).

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 5

TITLE (4)
480V Circuit Breaker Coordination 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 3	2 0	9 1	9 1	0 0 7	0 0	0 4	1 9	9 1	N	0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 7 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
D. J. Bannister, Shift Technical Advisor	AREA CODE 4 0 2 5 3 3 - 6 8 3 1

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

CAUSE	SYSTEM	COMPONENT	MANUFAC TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC TURER	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)

During reconstitution of the design basis for the electrical distribution overcurrent tripping scheme, the portion of a Breaker/Fuse Coordination Study dealing with the 161 kV system down to the 480V Motor Control Centers (MCCs) was completed. Twenty-one 480 Volt molded case circuit breakers were determined to have overlapping breaker coordination curves with the MCC feeder circuit breakers. The lack of coordination could result in the tripping of a MCC due to a fault on one of its non-coordinated loads. On March 20, 1991, this condition was determined to be outside the design basis of the plant. Two of the twenty-one loads were determined to have an unacceptable probability of faulting during a Design Basis Accident.

This condition was caused by deficiencies in the original system design as constructed by the plant Architect/Engineer. A contributing cause was the lack of comprehensive design basis documentation to substantiate that coordinated breaker fault protection existed.

The two affected loads were isolated from the 480V system. Present design procedures require breaker coordination. Completion of the Breaker/Fuse Coordination Study will determine if any more coordination problems exist with the electrical distribution system. Problems identified by the Breaker/Fuse Coordination Study will be corrected on a schedule commensurate with their safety significance.

The Fort Calhoun Station (FCS) Unit No. 1 plant electrical distribution systems are designed to meet demands for electrical energy for plant control and operation during normal, abnormal, and accident situations.

The 4160 V system is comprised of four electrically separated buses. Buses 1A1 and 1A2, which supply only 4160 V loads, are normally connected to unit auxiliary transformers T1A1 and T1A2. These transformers are supplied from the Main Generator 22kV/345 kV system. However if the Main Generator 22kV/345 Kv system is unavailable, buses 1A1 and 1A2 can be supplied from the house service transformers T1A3 and T1A4, respectively. These transformers are supplied from the off-site 161 kV supply. Buses 1A3 and 1A4 (called "Safeguards" buses) are normally connected to house service transformers T1A3 and T1A4. However, if the off-site 161 kV supply is unavailable, buses 1A3 and 1A4 can be supplied from unit auxiliary transformers T1A1 and T1A2, respectively. In the event that both the off-site 161 kV and the Main Generator 22 kV/345 kV feeds are lost, buses 1A3 and 1A4 can be supplied from Diesel Generators D-1 and D-2 respectively for emergency power. Buses 1A3 and 1A4 supply all Engineered Safeguards (ESF) and essential support systems, either directly or through the 480 Volt distribution system.

The 480 Volt system is comprised of nine buses, powered from six 4.16 kV to 480 Volt transformers. Three of these buses are supplied by bus 1A3, three are supplied by bus 1A4, and three are manually connected to either bus 1A3 or 1A4, but normally not both, as this is prevented by interlocked bus-tie circuit breakers. Twenty-two Motor Control Centers (MCCs) receive power from the nine 480 Volt bus sections. The MCCs which are arranged throughout the plant provide power to both safety related and non-safety related equipment.

In the event of total failure of supply from the Main Generator 22kV/345kV system and the off-site 161 kV system, both 4.16 kV buses 1A3 and 1A4 are disconnected from their normal and alternate supply sources. Simultaneous load shedding of motor loads connected to 4.16 kV and 480 Volt buses is initiated by undervoltage relays. Diesel generators are started, run up to operating speed and voltage, and connected automatically to the Safeguards buses. If no Design Basis Accident (DBA) exists, reloading of the system is performed manually by the operator in accordance with an Emergency Operating Procedure. If a DBA has occurred, either a Pressurizer Pressure Low Signal (PPLS) or Containment High Pressure Signal (CPHS) would cause a Safety Injection Actuation Signal (SIAS), which eliminates selected 480 Volt MCCs and certain loads on other MCCs supplying loads not needed to mitigate the accident. PPLS or CPHS would also initiate the starting and loading of ESF equipment via automatic load sequencers.

Original design criteria as stated in the Updated Safety Analysis Report (USAR) for the electrical distribution system provide a high degree of reliability by using selective fault protection using full-rated circuit breakers. The fault of a single load on a bus or MCC would be mitigated prior to tripping the bus/MCC's feeder circuit breaker. This is primarily due to the individual circuit breakers on the bus/MCC having lower interrupt current ratings than the bus/MCC's feeder breaker. The lack of coordination could result in the tripping of an entire MCC and loss of all equipment (both safety related and non-safety related) on that MCC, due to a fault on one of its non-coordinated loads. In addition to providing reliability, breaker coordination is also credited to meet

10 CFR 50.49, Environmental Qualification of Electrical Equipment (EEQ) for both safety related and non-safety related equipment. Non-safety related equipment which is fed from safety related power sources and located in potential post-accident harsh environment areas is not specifically required to be environmentally qualified. This is allowed due to the fault protection equipment designed to isolate the non-safety related equipment from the safety related power source.

Design Basis Documents (DBDs) have been compiled as part of the Omaha Public Power District (OPPD) Design Basis Reconstitution Program. An open item existed concerning the lack of detailed documentation to substantiate the existence of coordinated relay/breaker fault protection. To resolve this issue a study of the entire FCS electrical distribution overcurrent tripping scheme was initiated. This Breaker/Fuse Coordination Study, when completed, will encompass all electrical busses at FCS, including 161 kV, 22 kV, 4160 V, 480 V Switchgear, 480 V MCCs, 120 VAC Instrument, and 125 VDC busses. Each bus or MCC will have coordination curves generated containing upstream overcurrent protection devices and the largest load overcurrent protective device plotted. In addition to these devices, a typical fuse (or largest fuse) will be plotted for each DC distribution panel and the six inverters.

As part of this study, Engineering Analysis (EA-FC-91-025 "FCS 480V Molded Case Circuit Breaker Coordination") was conducted. The analysis assumed unacceptable probability of common mode faulting during a DBA exists only in potential harsh High Energy Line Break (HELB) or Loss of Coolant Accident (LOCA) locations. Consequently the analysis scope was limited to safety related power sources which supply power to non-safety related equipment in potential harsh HELB/LOCA locations. Faulting of equipment in other locations would be of acceptably low probability during the 100 hour short term and 1000 hour long term DBA accident scenarios.

The following criteria were used by OPPD to identify potential non-coordinating breaker conditions:

(1) Only safety related power sources were reviewed.

(2) All equipment that is tripped due to 480 V load shed resulting from SIAS was not evaluated. SIAS 480 V Load Shed initiates in the initial stages of a LOCA or HELB such that the non-safety related equipment which is load shed is not expected to fault during the DBA.

(3) Equipment which is normally out of service during normal plant operation was not evaluated.

Twenty-one 480 Volt molded case circuit breakers on eight different MCCs were determined to have overlapping breaker coordination curves with the MCC feeder circuit breakers. On March 20, 1991, this condition was determined to be outside the design basis of the plant and therefore reportable pursuant to 10 CFR 50.72(b)(1)(ii)(B) and 50.73(a)(2)(ii)(B). The plant was operating in Mode 1 at 70 percent power.

The loads associated with nineteen of the non-coordinated breakers can be classified as one of the following types:

(1) Loads which are normally not in service.

(2) Rotating loads which are provided with thermal overload protection.

(3) Loads which feed sub-distribution panels with fused or breaker protected distribution circuits.

(4) Loads which feed static equipment.

While these loads are outside the design basis for the 480 Volt system as described in the USAR they are, however, located in DBA mild environments. Based on engineering judgment and past plant experience, the possibility of fault on this equipment is small and not expected to occur in conjunction with a DBA. Additionally, this type of failure is bounded by worst case single failure analyses.

Based upon the assumptions made in EA-FC-91-025, only two loads with uncoordinated load breakers were identified as located in DBA harsh environments. The two loads are welding machine outlets located in Room 81 (MCC-4A1, breaker E06) and Containment (MCC-4B1, breaker A4L).

Further analysis was conducted to determine the effect loss of MCC-4A1 or MCC-4B1 would have during either a LOCA or HELB. It was determined that safe shutdown of the reactor could still be achieved with the loss of either MCC. To eliminate this source of potential faulting, EA-FC-91-025 requested that both welding outlet breakers on the affected MCCs be danger tagged open. Plant personnel performed this on March 11, 1991 prior to the formal issuance of the analysis.

Safety Analysis For Operability (SAO) 91-03-00 was approved on March 25, 1991 which required: (1) danger tagging open or disconnecting the two non-coordinating welding receptacle breakers on MCC's 4A1 and 4B1, and (2) if either breaker had to be re-closed, then the MCC was to be declared inoperable. In the latter case, Technical Specification Limiting Condition for Operation 2.7 (Electrical Equipment) would be applied which requires the MCC be returned to operable status within eight hours. SAO 91-03-00 also concluded that the lack of optimum breaker coordination for the other loads did not present safety considerations outside the bounds of existing accident analyses. The individual local protection of the sub-distribution panels and the installed thermal overload devices in the identified motor circuits provide an adequate level of protection against potential MCC failures resulting from this breaker coordination overlap. This satisfactorily assures continued safe operation under both normal and accident conditions.

This condition was caused by deficiencies in the original system design as constructed by the plant Architect/Engineer. A contributing cause was the lack of comprehensive design basis documentation to substantiate that coordinated breaker fault protection existed. This lack of documentation resulted in one modification, which installed inverter bypass transformer EE-4S, repeating the non-coordination error by copying what the original plant design had done.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Fort Calhoun Station Unit No. 1	0 5 0 0 0 2 8 5	9 1	— 0 0 7	— 0 0	0 5 OF 0 5

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

The following corrective actions have been completed:

(1) SAO-91-03-00 was issued to justify continued operation provided the affected welding receptacle breakers in Room 81 and Containment were tagged open or disconnected.

(2) The Containment welding receptacle breaker (MCC-4B1-A4L) was danger tagged open on March 11, 1991 and has remained in that configuration.

(3) The Room 81 welding receptacle breaker (MCC-4A1-E06) was danger tagged open on March 11, 1991. A Temporary Modification (TM-91-12) was performed to disconnect power from the receptacle by removing it from the circuit. This was accomplished on March 28, 1991.

(4) Production Engineering Division modification review procedure GEI-3 requires that a Breaker/Fuse coordination review be completed (per GEI-9) any time new loads are added or modified.

The following corrective actions will be implemented:

(1) The Breaker/Fuse Coordination Study is scheduled to be completed by January 31, 1992. However, if any field data is required the Study completion date will be April 1, 1992. Results of the Study will determine if any more coordination problems exist with the electrical distribution system.

(2) Problems identified by the Breaker/Fuse Coordination Study will be corrected on a schedule commensurate with their safety significance. The schedule for resolution of these problems will be provided to NRC within 90 days following completion of the Breaker/Fuse Coordination Study.

Other Licensee Event Reports which have been submitted addressing design deficiencies are LERs 91-03, 91-04, 90-03, 90-05, 90-07, 90-09, 90-16, 90-20, 90-23, 90-25, 89-09, 89-14, 89-15, 89-24, 88-09, 88-19, 88-20, 88-32, and 88-33.