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

March 4, 1996
LIC-96-0032

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

Reference: Docket No. 50-285

Subject: Licensee Event Report 95-007 Revision 01 for the Fort Calhoun Station

Please find attached Licensee Event Report (LER) 95-007 Revision 01 dated March 4, 1996. This report is being submitted pursuant to 10 CFR 50.73(a)(2)(ii). If you should have any questions, please contact me.

Sincerely,

T. L. Patterson
Division Manager
Nuclear Operations

TLP/epm

Attachment

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

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NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 4/30/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO THE INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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 Station Unit No. 1	05000285	1 OF 8

TITLE (4)
Potential Tripping of 480V Circuit Breakers with Digital (RMS-9) Trip Units

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 NAME	DOCKET NUMBER
11	08	95	95	-- 007 --	01	03	04	96		05000
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	1
POWER LEVEL (10)	100

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

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

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Robert F. Mehaffey, Principle Engineer Electrical	(402) 533-6505

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)				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)

General Electric (GE) RMS-9 trip units provided for the Fort Calhoun Station 480V Load Center Busses have been found to be susceptible to spurious tripping. Plant experience has shown that the long-time/short-time trip functions installed on the 480V Motor Control Center feeder breakers are subject to spurious tripping. The 4160/480 Volt transformers act as filters preventing the effects from going beyond an individual load center. Since engineered safeguards components are potentially affected by this mechanism, which could occur during a design basis event, the plant has been found to be in a condition outside of its design basis.

As a conservative measure, based on limited industry and Fort Calhoun data, it is assumed that individual load breakers equipped with a long time, instantaneous and a short time trip function are also susceptible to spurious tripping.

This event is caused by a circuit breaker subcomponent (GE RMS-9 trip units) not operating as specified by the Omaha Public Power District or represented by the manufacturer.

Corrective actions for this event consist of compensatory actions taken to maintain the plant within its design basis. These compensatory actions will remain in place until the affected circuit breaker trip units are replaced.

BACKGROUND

General Electric Company (GE) RMS-9 trip units are current sensing trip devices used in GE AK type circuit breakers. These devices are used to sense an over current condition on a circuit causing the associated circuit breaker to trip open. The trip units in question provide either a long-time and a short-time trip function for the Motor Control Center (MCC) breakers or a long time, instantaneous and a short time trip function for the load breakers.

The RMS-9 trip units were installed in Fort Calhoun Station (FCS) circuit breakers as digital replacements for oil dashpot (EC) type trip devices that were originally used in the circuit breakers. The RMS-9 units were installed starting in December of 1991, and the last installation was completed in November of 1993. The RMS-9 trip units were installed in the plants 480V AK type circuit breakers. The affected circuits supply both safety grade and non-safety grade loads.

Spurious tripping of circuit breakers with RMS-9 trip units installed in the plant started in April of 1992 at FCS and has continued through this year (1995). The most recent event occurred in August of 1995. There have been a total of nine of these types of trips since 1992 when the RMS-9 trip units installation began, only one of the trips has been on a load breaker. Some of the trips have been associated with events where the circuit was noted as having a ground on it and some events did not have an indicated ground.

DETAILED EVENT DESCRIPTION

In October of 1992, the Browns Ferry Nuclear (BFN) Station issued a 10 CFR Part 21 notification concerning their experience with GE RMS-9 trip units installed in circuit breakers in their 480V distribution system. BFN reported that they had experienced tripping of circuit breakers containing RMS-9 trip units apparently due to extremely short duration, high amplitude current transients.

The spurious breaker trips at BFN appear to be caused by grounds on the 480V three phase ungrounded distribution systems. A ground can induce a short duration current signal on the 480V system. Breaker tripping appears to be a result of the RMS-9's over sensitivity to short duration current spikes (spikes on the order of 100 microseconds) on the inputs to the RMS-9's. These current spikes are thought to be interpreted by the RMS-9 as an over current condition that requires the circuit breaker to trip.

Omaha Public Power District (OPPD) commenced an investigation, shortly after receiving the BFN Part 21 notification, to determine the potential impact on FCS plant operation using the experience gained at the BFN facility. In discussions during January of 1993 with the manufacturer (GE) they indicated that the spurious trips could be unique to the BFN facility as no other customers had reported spurious tripping.

In August 1993, the Maine Yankee nuclear plant reported in a 10 CFR Part 21 notification that they had experienced several spurious trips of circuit breakers with RMS-9 trip units installed. The circuit breakers at Maine Yankee did not have the instantaneous trip function that was apparently causing the problems at the BFN facility.

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

Shortly after the Maine Yankee notification, in August 1993, OPPD's Design Engineering Department began an evaluation of the nuisance tripping issue reported in the Maine Yankee Part 21 notification. An Engineering Assistance Request (EAR) 93-138 was initiated to determine if a similar problem could occur at FCS and determine the generic implications of this type of event.

In September of 1993 the NRC issued Information Notice (IN) 93-75 which restated the problems discussed in the BFN and Maine Yankee Part 21 notifications and added some material from NRC discussions with GE. The IN was determined not to apply to FCS as the bus feeder breakers did not make use of the instantaneous trip feature of the RMS-9 trip units.

The issue continued to be reviewed and investigated as additional information became available. System Engineering also continued to trend and track the problem as additional incidents of circuit breaker tripping occurred at the station.

In early November 1995 during the performance of an additional review of the situation, Design Engineering came to the conclusion that the interaction of some of the safety related circuit breakers, during certain plant accidents, might constitute a condition outside of the design basis of the plant.

On November 8, 1995, a Plant Review Committee (PRC) meeting was held to discuss this issue and the related conclusions. At 1408 Central Standard Time (CST) the PRC concluded that this condition constituted a condition outside of the design basis of the plant. At 1505 CST on November 8, 1995, a one hour non-emergency notification was made to the NRC pursuant to 10CFR50.72(b)(1)(ii)(B) and (C).

On February 1, 1996, a PRC meeting was held to discuss additional information that had come to light concerning this issue. The original one hour non-emergency report assumed that only the MCC breakers were susceptible to ground induced tripping. Further engineering review had recently concluded that, as a conservative measure, affected breakers feeding safeguards motors should be included in the group of susceptible breakers. At 1043 CST the PRC concluded that, given this additional information, a supplemental one hour non-emergency report should be made to clarify this additional information. At 1120 CST on February 1, 1996, a supplemental one hour non-emergency notification was made to the NRC pursuant to 10CFR50.72(b)(1)(ii)(B) and (C). This revision to the original report is being submitted pursuant to 10CFR50.73(a)(2)(ii).

The load breakers are being included as a conservative measure. The RMS-9 trip units purchased for the load breakers at FCS contain a long time, instantaneous and a short time trip function. For motor protection, the instantaneous function is used, the short time function is set at maximum. It is unclear from available data whether the RMS-9's will cause breaker trips at their maximum setpoint.

SAFETY SIGNIFICANCE

Plant experience has shown that 480V Load Center Bus feeder breakers and 480V Load Center Bus Tie breakers are not susceptible to current spikes. Plant experience has also shown that the effects of a ground are limited to the associated 480V Load Center. The 4160/480 Volt transformers act as filters preventing the effects from being transmitted to other 480V Load Centers.

The plant conditions that are most likely to lead to the potential for the tripping of redundant trains of safety equipment were determined to be those that produced a harsh environment (steam and/or spray) around affected equipment. The Large Break Loss Of Coolant Accident (LBLOCA), initiated by either a cold leg break or a pressurizer surge line break, and Main Steam Line Break (MSLB) are the limiting Design Basis Accidents (DBA) which were evaluated as having the potential to create a problem with the RMS-9 trip units. Any of these events can cause a harsh environment requiring automatic Engineered Safety Feature (ESF) response. The MSLB is the limiting Uncontrolled Heat Extraction (UHE) event. The limiting DBA can occur in Containment (UHE or LBLOCA) or Room 81 (UHE). Room 81 is a room adjacent to the containment through which the Main Steam lines pass.

Grounds on the 480V system are most likely to originate from equipment located in the Containment or Room 81 with the following characteristics:

1) equipment that is not Environmentally Qualified (EEQ),
2) equipment that is not normally de-energized, or
3) equipment that is not load shed in a DBA.

A list of plant equipment was developed that met these characteristics. The affected 480V Load Centers were reviewed to determine the loads required to mitigate the consequences of a DBA. The plant equipment determined to have the potential to be affected is listed below:

1) The safety injection system loop injection valves (HCV-311, HCV-312, HCV-314, HCV-315, HCV-317, HCV-318, HCV-320, HCV-321, HCV-327, HCV-329, HCV-331 and HCV-333) motor operators.

2) The high pressure safety injection pumps SI-2A/B/C.

3) The control room air conditioning system (VA-46A/B, VA-63A/B and VA64A/B).

4) The containment sump recirculation valves (HCV-383-3 and HCV-383-4) motor operators.

5) The main feedwater isolation valves (HCV-1103, HCV-1104, HCV-1385 and HCV-1386) motor operators.

6) Component cooling water pumps AC-3A/B.

7) Containment air cooling and filtering fans VA-3A/B.

Plant experience has shown that if a MCC feeder breaker does trip due to current spikes, neither the breaker nor the associated equipment will be damaged. The MCC and associated equipment can be restored by clearing the ground, reclosing the MCC feeder breaker and restarting the required equipment. The load breakers that have

been included in this analysis are expected to behave in a similar manner.

A break in the pressurizer surge line near the pressurizer heater cable connections may cause an immediate ground on several heaters. This represents a unique case, in which, more than one 480V Load Center may be affected simultaneously. Unrestricted operation of the pressurizer heaters can affect redundant 480V load centers. To compensate for this possible common mode failure certain heater operating restrictions have been implemented.

As stated in Westinghouse letter number NTD-NSA-SAII-95-468 "Potential Loop Valve Failure" two High Pressure Safety Injection (HPSI) valves on two reactor coolant system loops and one Low Pressure Safety Injection (LPSI) valve will provide adequate flow to the reactor core. Administrative controls on pressurizer heater operation have been implemented to meet the operability requirements for pressurizer operation per the FCS Technical Specifications and to provide the minimum number of required HPSI and LPSI loop injection valves. In the event of a single failure of an ESF train, 480V Load Center, MCC, or motor operated valve, two HPSI valves and one LPSI valve will be available.

The Control Room Heating Ventilation and Air Conditioning (HVAC) system is normally in service and is also designed to be placed in service in the initial stages of a Design Basis Accident (DBA) and to be operated continuously. A ground induced MCC trip and a single active failure could cause the loss of this function. While operator action is required to restart the Control Room HVAC, existing plant procedures provide adequate guidance on restarting Control Room HVAC and adequate time is available for the operators to restore this function. Calculation FC06311 Rev.3C (Control Room Heat Gain Without Air Conditioner VA-46A or B Cooling) indicates that in the Control Room the operators will have at least 90 minutes to restore air conditioning prior to exceeding the Technical Specification limit on control room temperature. Ninety minutes is adequate time for the operators to respond to the event and restore control room air conditioning.

The Containment Post Accident Sump Recirculation Valves, HCV-383-3 and HCV-383-4, must operate when the suction source for the Safety Injection (SI) pumps, the Safety Injection Refueling Water Tank (SIRWT), is nearly depleted. A Recirculation Actuation Signal (RAS), operates these valves to allow continued operation of the SI pumps by shifting their suction source from the SIRWT to the containment sump. The SI pumps are used to cool the reactor core. A RAS may occur as early as 24 minutes into a Large Break Loss Of Coolant Accident (LBLOCA).

The time when operation of valves HCV-383-3 and HCV-383-4 is required is break size dependant. For a LBLOCA, all SI pumps are operated, depleting the SIRWT in as little as twenty-four (24) minutes. Twenty-four minutes may not be sufficient time to allow the operators to diagnose the trip of a MCC associated with the RAS valve, and restore the power to the valve operator. A single active failure and a ground could cause the loss of both RAS valves. Without the ability to operate these valves in a timely manner it cannot be assured that the fuel peak centerline temperature limit will not be exceeded. To allow valves HCV-383-3 and HCV-383-4 to perform there designed safety function actions have been added to plant procedures allowing these valves to operate properly.

The main feed water isolation valves are considered operable based on operator action to trip the Reactor Coolant Pump (RCP) Oil Lift Pump motors when containment spray occurs and verifying the associated MCC Breakers are closed as directed in the

Operations Memorandums. This is bounded by the discussion on HPSI pump operation by preventing grounds that would cause the load breakers to trip.

LBLOCA Discussion

The following pumps must be available for mitigation of a LBLOCA (in the pressurizer surge line) in containment, to accomplish reactor core and auxiliary system cooling:

One HPSI Pump (SI-2A ,B, or C)
One Component Cooling Water (CCW) Pump (AC-3A, B, or C)

HPSI flow will be assured by operator action to trip the RCP Oil Lift Pumps (a ground will not occur immediately as there is no direct impingement). The actions are the same as those required to restore the MCC functions and are directed in the Operations Memorandums. The actions must be accomplished within 2 to 3 minutes following initiation of Containment Spray.

CCW flow is assured by all of the following:

1) Operator action to trip the RCP Oil Lift Pumps.
2) The proportional pressurizer heater trip from the pressurizer low level heater protection circuitry.
3) The trip of containment ventilation fan, VA-2A&B, from the fire detection system to prevent grounds.

Analysis shows that satisfactory performance of the SI pumps without CCW on a one time basis is possible. CCW is not required until RAS. The actions are the same as those required to resto e the MCC functions and are directed by Operations Memorandums.

FCS LBLOCA analysis credits the "Leak before Break" criteria for a cold leg break. Therefore, it is not expected that a failure would occur prior to the operators being able to detect a leak and shut the plant down to a cold standby condition. This analysis is only being credited until the RMS-9 trip units are replaced.

MSLB Discussion

The following pumps or fans must be available for mitigation of the limiting High Energy Line Break (HELB), the Main Steam Line Break in Containment, to accomplish reactor core cooling, support auxiliary system operation, containment cooling and pressure control respectively.

One HPSI Pump (SI-2A ,B, or C)
One CCW Pump (AC-3A, B, or C)

HPSI flow is assured by Operator action to trip the RCP Oil Lift Pumps (a ground will not occur immediately as there is no direct impingement). The actions are the same as those required to restore the MCC functions and are directed in the Operations Memorandums and appropriate emergency procedures. The actions must be accomplished in 2 to 3 minutes following initiation of Containment Spray.

CCW flow is assured by all of the following:

1) Operator action to trip the RCP Oil Lift Pumps.

2) The proportional pressurizer heater trip from the pressurizer low level heater protection circuitry.
3) The trip of containment ventilation fan, VA-2A&B, from the fire detection system to prevent grounds.

Analysis shows that satisfactory performance of the SI pumps without CCW on a one time basis is possible. CCW is not required until RAS. The actions are the same as those required to restore the MCC functions and are directed by Operations Memorandums.

Containment cooling, provided by containment spray and the containment ventilation fan units (either VA-3A and VA-7C or VA-3B and VA-7D) is required to mitigate the initial containment pressure peak for the limiting accident. The VA-7C/D fans are not affected by the RMS-9 problem. VA-3A/B fan operation is assured by the operator action to trip the RCP oil lift pumps. The actions are the same as those required to restore the MCC functions and are directed the Operations Memorandums.

CONCLUSIONS

Plant and industry experience has demonstrated that the GE RMS-9 trip units do not operate in the manner intended by the manufacturer or as specified by OPPD. GE originally represented the RMS-9 trip units as being fully qualified. Experience at BFN, Maine Yankee, and FCS now indicate that the RMS-9 trip units do not operate in a reliable fashion.

The situation discussed in this License Event Report (LER) has been reviewed from a beyond design basis, severe accident perspective. The overall impact upon risk is small. This is due to the fact that severe accident risk is not dominated by initiators that produce a harsh environment. Spurious opening of circuit breakers would generally tend to occur after components were in their accident positions. Opportunities would generally be available for operator recovery.

CORRECTIVE ACTIONS

Safety Analysis for Operability (SAO) 95-02 was issued to provide the necessary operability justification and required compensatory actions. These actions (1-6 listed below) have been accomplished by two Operations Memorandums and are controlled by appropriate equipment caution tags. The Operations Memorandums direct that the RCP Motor lift pumps are to be tripped when Containment Spray occurs and then verify that the MCC feeder breakers associated with the Containment Sump Recirculation MOV's are closed. Actions 1 and 2 are post-accident performed instructions, while the breakers discussed in items 3, 4 and 5 are administratively controlled open. The actions discussed in item 6 are controlled administratively. Appropriate actions have been incorporated into FCS Emergency and Abnormal Operating Procedures.

1. Open the contactors (via control switch) to Reactor Coolant Pump Motor Lift Pumps RC-3A on MCC-3B1, RC-3B on MCC-4A1, RC-3C on MCC-3A1 and RC-3D on MCC-4C1 as an action following initiation of Containment Spray. This action must be completed within 2 to 3 minutes following the initiation of containment spray in order to prevent motor load breaker trips.

2. Ensure that the feeder breakers for MCC-3A2 and MCC-4C2 are closed following the completion of 1 above.

3. Opened the feeder breakers to the Reactor Coolant Pump Motor RC-3C and RC-3D heaters on MCC-3A1 and MCC-4C1 and RC-3A and RC-3B heaters on MCC-3B1 and MCC-4A1 respectively.

4. Opened the feeder breakers to the welding outlet in room 81.

5. Opened the feeder breaker to the refueling equipment in containment.

6. Operation of pressurizer heaters has been restricted to limit the use of pressurizer heater banks one and four. The control switches for the pressurizer heater banks one and four will normally be in off. Pressurizer heater banks two and three will normally be used for all normal plant operations.

The following long term corrective action will provide a permanent solution to this problem.

7. The actions listed in SAO 95-02 will remain in effect until the affected RMS-9 trip units are replaced or modified. The affected RMS-9 trip units will be replaced or modified no later than the planned 1996 fall refueling outage, currently scheduled to begin on September 21, 1996.

SIMILAR EVENTS

LER 91-007 discusses a previous event where deficiencies in the original design of the 480V distribution system resulted in the plant being outside of its design basis.