Omaha Public Power District
P.O. Box 399 Hwy. 75 - North of Ft. Calhoun Fort Calhoun, NE 68023-0399
402/636-2000

March 31, 1993
LIC-93-0055

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 93-004 for the Fort Calhoun Station

Please find attached Licensee Event Report 93-004 dated March 31, 1993. This report is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B). If you should have any questions, please contact me.

Sincerely,

W. G. Gates
Vice President

WGG/jrg

Attachment

c: J. L. Milhoan, NRC Regional Administrator, Region IV
S. D. Bloom, NRC Project Manager
R. P. Mullikin, NRC Senior Resident Inspector
INPO Records Center

050108

IE22

NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), 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 6

TITLE (4)
Inoperability of Power Range Nuclear Instrumentation Safety Channel D

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
03	01	93	93	-- 004 --	00	03	31	93		05000
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	1
POWER LEVEL (10)	98

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (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
	20.405(a)(1)(iii)	X	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	(Specify in Abstract below and in Text, NRC Form 366A)
	20.405(a)(1)(iv)		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 (Include Area Code)
William J. Blessie, Shift Technical Advisor	(402) 533-6896

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
X	IG	XE	W120	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 25, 1992, subchannel indication was observed to be intermittently oscillating for Power Range Nuclear Instrumentation (NI) Safety Channel A. Temporary Modification (TM) 92-078 was completed on October 31, 1992 to connect Power Range NI Control Channel A and B detectors to Safety Channels A and D respectively. On February 27, 1993, an abnormal response was noted for Channel D Axial Shape Index (ASI) in that it tracked opposite of Channels A, B and C. On March 1, 1993, it was confirmed that Channel D ASI was being calculated in reverse. Further review found that the power range NI subchannel inputs to Reactor Protection System Channel D had been reversed since completion of the temporary modification on October 31, 1992.

It was determined that the subchannel cables for the Control Channel B detector had been reversed prior to TM 92-078, apparently prior to initial startup in 1973. This problem was not identified when the Control Channel B detector was transferred to Safety Channel D in October 1992, due to insufficient post-TM testing and insufficient requirements for review of testing specified for TMs.

The Safety Channel D subchannel cables were exchanged on March 1, 1993 to correct the configuration and appropriate ASI response was verified. Additional corrective actions include revising administrative controls for post-temporary modification testing requirements.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Fort Calhoun Station Unit No. 1	05000285	93	-- 004 --	00	2 OF 6

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

BACKGROUND

The Excore Nuclear Instrumentation (NI) System at the Fort Calhoun Station (FCS) includes four wide range logarithmic channels, four power range safety channels (A, B, C and D) and two power range control channels (A and B). The detectors for these channels are located in the biological shield around the reactor core. The power range channels measure neutron flux using dual-section uncompensated ion chambers which produce an electric output signal directly proportional to reactor power. Identical chambers extend along the upper portion and lower portion of the core. Each dual-section detector is called a channel and each detector chamber is referred to as a subchannel.

The power range NI safety channels provide reactor power indication and inputs to the Reactor Protection System (RPS), the plant process computer and alarm panels. Three RPS trip functions utilize inputs from the power range NI safety channels: Variable High Power, Axial Power Distribution (APD) and Thermal Margin/Low Pressure (TM/LP).

The power range control channels are essentially the same as the safety channels, but do not have any interface with the RPS. Signals are provided to the power ratio calculator, local panel meters, the plant computer and the Reactor Regulating System (RRS). The RRS circuitry, with control channel inputs, performs no control functions. Power range NI channels are also used for neutron noise measurement as it relates to vessel internals vibration monitoring/thermal shield support integrity.

Calibration of both the safety and control power range NI channels is done using Surveillance Test Procedure RE-ST-NI-0001, "CECOR/Excore Offset Check." In this surveillance test, the power range NI channels are calibrated to match a steady state Axial Shape Index (ASI) determined using in-core instrumentation.

EVENT DESCRIPTION

On October 25, 1992, FCS was operating at 100% power (Mode 1) when subchannel deviation alarms were intermittently received and subchannel indication was observed to be intermittently oscillating for Power Range NI Safety Channel A. The problem was determined to involve the detector or detector cabling inside Containment. A decision was made to implement a temporary modification to use the Power Range NI Control Channel A detector as an input to Safety Channel A.

In order to maintain symmetry for the safety channel detector locations with respect to the reactor core, it was also necessary to connect the Control Channel B detector to Safety Channel D. These changes were made by moving the cable connections in the Control Room panels in accordance with Temporary Modification (TM) 92-078 which was completed October 31, 1992.

Reactor power was maintained at a nominal 100% power from October 25, 1992, until February 24, 1993, when a slow power reduction was initiated to reduce power to approximately 98%. After the power reduction, a small xenon oscillation was observed, and the indicated Axial Shape Index (ASI) was tracked for all four RPS channels. On February 27, 1993, an abnormal response was noted for Channel D ASI in that it tracked opposite of Channels A, B and C. The Reactor Engineer was contacted to provide guidance.

The Reactor Engineer reviewed the trend with the RPS System Engineer on March 1, 1993, and it was concluded that the only explanation from a hardware perspective was that the subchannel inputs to Power Range NI Safety Channel D were reversed. Following discussions with the Nuclear Engineering Department, a check was done to observe the hardware response to an ASI shift by a small insertion of Group A control rods. The indicated ASI for Channels A, B and C increased as expected; however, it decreased on Channel D. This confirmed that ASI for RPS Channel D was being calculated in reverse. Trip Units 1 (Variable High Power), 9 (TM/LP) and 12 (APD) were declared inoperable on Channel D at 1121 on March 1, 1993, and were placed in bypass in accordance with Technical Specification (TS) 2.15(1).

Monthly surveillance testing had previously confirmed the proper response of the circuitry up to the detector cable connections on the rear of the power range NI drawers. Thus, it was concluded that the reverse response for Channel D ASI was due to the reversal of the upper and lower subchannel input cables.

A revision to TM 92-078 was prepared and implemented to interchange the subchannel input cables for Power Range NI Safety Channel D. After the cables were exchanged, the ASI response for all four channels of RPS was verified to increase with the insertion of control rod Group A. Channel D, RPS Trip Units 1, 9 and 12 were declared operable at 2100 on March 1, 1993.

The reversed power range NI subchannel inputs to RPS Channel D existed from October 31, 1992 to March 1, 1993. This was determined to represent a violation of TS 2.15(1) requirements for RPS channel operability. This report is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B).

SAFETY ASSESSMENT

Review of the significance of this event indicates that there was no significance with respect to nuclear safety. The impact of this event on the three RPS trip functions which utilize input from the power range NI safety channels, was reviewed. The Variable High Power trip function uses the power range NI safety channel inputs for calculating NI power, by summing the lower and upper subchannel signals. The calculated NI power is not changed by reversal of the subchannels, therefore, the Variable High Power trip function was not affected.

While calculated NI power was not affected, the subchannel reversal did impact ASI calculation. ASI, calculated from power range NI safety channel inputs, is used in both the APD and the TM/LP trip units. The power range NI channels are periodically calibrated to match a steady state ASI determined using in-core instrumentation. For a transient resulting in an ASI excursion, the change to the ASI calculated for Safety Channel D would have been in the opposite direction to the changes shown on the A, B and C channels. With regard to the APD trip, this could result in either a conservative or a non-conservative condition, depending on the initial ASI and the direction of the excursion. Although the Channel D response was potentially non-conservative, no credit is assumed for the APD trip in any of the Updated Safety Analysis Report (USAR) analyses for anticipated operational occurrences or postulated accidents. Thus, it can be concluded that there was no safety impact with regard to the APD trip function.

The only anticipated operational occurrence or postulated accident crediting the TM/LP trip function is the Reactor Coolant System (RCS) Depressurization event. Review of the USAR analysis of this event concluded that no significant change in ASI would occur during an RCS Depressurization event. Since all RPS channels would start from approximately the same ASI and no significant ASI changes would be expected during such an event, it can be concluded that the D Safety Channel TM/LP trip function would have been able to perform its required function.

Other uses of power range NI channels were also reviewed. No safety significant impact was found to be associated with this event.

CONCLUSIONS

A Root Cause Analysis was performed. It was determined that the subchannel cables for the Control Channel B detector had been reversed prior to the implementation of TM 92-078. The activity which resulted in the cables being reversed is not known, however, it apparently occurred prior to the initial startup of FCS in 1973. Shape annealing test data taken on October 25, 1973, appears to indicate that the ASI response from Control Channel B was opposite that of the other five power range channels. Review of shape annealing factor test data taken April 12, 1983, clearly indicates reversed subchannels for Control Channel B. No data analysis for the control channels was performed in 1983.

Investigation under Maintenance Work Order (MWO) 930810 verified the correct routing for the cables to the outside of the containment electrical penetration. Therefore, the reversal of these cables was determined to be inside containment. Investigation of cable routing inside containment was not found to be appropriate during power operation.

The long standing, unidentified problem with Control Channel B was transferred to Safety Channel by TM 92-078 on October 31, 1992. The violation of TS 2.15(1) was associated with the transfer, in that operability of the control channels is not required by Technical Specifications, while the operability of the safety channels (as an input to the RPS) is required by TS 2.15(1). Positive verification of the response of the subchannels during the installation of TM 92-078 would have identified the error. Therefore, the cause of the Technical Specification violation was insufficient post-TM testing and insufficient requirements for review of testing specified for temporary modifications.

The investigation also determined that there had been several potential opportunities, prior to October 31, 1992, to identify the problem with Control Channel B. These opportunities related to evaluation of control channel test data, follow-up on discrepancies between detector cable labeling and drawings, and monitoring of the control channels. The drawing discrepancies may have contributed to the failure to identify the problem with Control Channel B.

CORRECTIVE ACTIONS

The following corrective actions have been or will be completed:

1. TM 92-078 was revised on March 1, 1993, to interchange the subchannel input cables for Safety Channel D. After the cables were exchanged, the ASI response for all four RPS channels was verified to respond correctly by inserting a control rod regulating group.

2. Standing Order O-25, "Temporary Modification Control," has been revised to provide additional guidance on determining functional testing requirements. The revised procedure requires testing requirements to be evaluated for the functions of the affected equipment. Documentation of this evaluation is to be included with the temporary modification package for Plant Review Committee (PRC) approval.

3. Engineering Change Notice (ECN) 93-057 was previously initiated to correct identified discrepancies in applicable drawings of power range NI detector cabling. Drawing updates will be completed by May 21, 1993. A Maintenance Work Order (MWO) was previously initiated to investigate identified labeling discrepancies involving power range NI cables. This MWO will verify labeling is consistent with the approved configuration and will be completed by the end of the 1993 Refueling Outage.

PREVIOUS SIMILAR EVENTS

LER 91-005 reported a previous violation of TS 2.15, due to misinterpretation of Technical Specifications. LER 90-018 reported a previous event involving a problem with ASI indication, resulting from a sign error in a calibration procedure. Neither of these events had the same root cause as this LER.