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R. E. DENTON
GENERAL MANAGER
CALVERT CLIFFS

January 31, 1991

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit No. 1; Docket No. 50-317; License No. DPR 53
Licensee Event Report 90-018, Revision 01

Gentlemen:

The attached report is being sent to you as required under 10 CFR 50.73 guidelines. Should you have any questions regarding this report, we will be pleased to discuss them with you.

Very truly yours,

RED/JV/bjd
Attachment

cc: D. A. Brune, Esquire
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NRC FORM 366 (5-89) | U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED OMB NO. 3150-0104
EXPIRES 4/30/92
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH 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.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Calvert Cliffs, Unit 1	0 5 0 0 0 3 1 7	1 OF 0 5

TITLE (4): Axial Shape Index Not Continuously Monitored as Required by Technical Specifications Due to Incorrect Labeling of Power Range Detector Connectors

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)
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0 5	2 9	9 0	9 0	0 1 8	0 1	0 1	3 1	9 1		0 5 0 0 0

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (Check one or more of the following) (11)			
POWER LEVEL (10)	0 0 0	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)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		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 AREA CODE	
John Volkoff, Compliance Engineer	3 0 1	2 6 0 - 3 6 4 9

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	
B	I C	D E T	W 1 2 0	N							

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 fifteen single-space typewritten lines) (16)

On May 29, 1990, it was determined that the upper and lower cable connections for the Unit-1 Y-channel excore power range detectors were reversed, making the Power Ratio Calculator (PRC) inoperable. The PRC is required for continuous Axial Shape Index monitoring in MODE 1 when the plant computer is not available. There have been four instances when the plant was in MODE 1 and the plant computer was not available. This condition is not in accordance with Technical Specifications.

The root cause of the event was the improper labeling of the detector connections. A contributing factor was that the pre-installation test of the system did not detect the problem.

Corrective actions include correction of the detector connection labeling and connecting system leads to the correct detector connections. Pre-installation testing of the excore detectors has been reviewed and will be revised. Data will be collected for Unit-2 X- and Y-channel excore detectors during the next Unit-2 startup to confirm that the problem does not apply to Unit-2. The design specification for the detectors has been improved to ensure proper labeling in the future.

I. DESCRIPTION OF EVENT

On May 29, 1990, it was determined that the Power Ratio Calculator (PRC) was inoperable because the upper and lower cable connections for the Y-channel excore power range detectors were reversed. The PRC is required only when the plant computer is not available for Axial Shape Index (ASI) determination in MODE 1 (Power Operation). There have been four instances where the plant computer was not available and ASI was not being continuously monitored in MODE 1 as required by Technical Specifications (TS). At the time of discovery, Calvert Cliffs Unit-1 was in Cold Shutdown (MODE 5) at a temperature of 117 degrees Fahrenheit and atmospheric pressure.

ASI is monitored as a function of thermal power in order to assure operation within the TS Limiting Conditions for Operation (LCO) for Linear Heat Rate (LHR) and Departure from Nucleate Boiling (DNB). Either the incore or excore detectors may be used to monitor the ASI. Normally, the incore detectors are used via the plant computer to monitor ASI. When the plant computer is not in service, the excore detectors are used in conjunction with the PRC to monitor ASI.

There are six excore detector channels. Four channels (A, B, C, D) provide inputs to the Reactor Protection System (RPS) and two channels (X and Y) are part of the Reactor Regulating System. The X- and Y-channel excore detectors provide the input to the PRC. The X- and Y-channels each have an upper and lower detector. The connector markings are reversed from most of the industry because the assembly is installed with the connectors on the bottom instead of the top, reversing the position of the upper and lower detectors. The PRC uses the difference between the upper and lower detector signals from both channels to produce an ASI signal.

During investigation of a separate issue, a plant engineer noted that there was a discrepancy among the excore detectors. When the upper detectors of the A, B, C, D, and X-channels indicated a higher power than the lower detectors, the upper detector of the Y-channel indicated a lower power than the lower Y-channel detector. A Non-Conformance Report was initiated on September 11, 1990 to examine the problem.

The adequacy of the PRC and detector circuitry design was verified and the operation of the channel from the detector connection to the indication was tested.

It was concluded that the circuitry from the detector connectors to the indication in the Control Room was operating correctly. During the Unit-1 startup and shutdown in April, 1990, data was gathered to compare the response of the upper and lower Y-channel detectors. This was required because the power disparity seen by the upper and lower detectors is greatest during startup and shutdown, thus enhancing the indication of any problem in the system. As a

precaution, the PRC was considered inoperable during the power operations so that if the plant computer was out of service, the plant would be shutdown in accordance with the appropriate TS Action Statement. The data, combined with the previous investigation, led to the conclusion on May 29, 1990, that the upper and lower Y-channel detector output cable connection labeling was reversed.

The reversal of the signals supplied to the PRC from the Y-channel detectors resulted in the calculated ASI approaching zero, making the PRC inoperable. The ASI approached zero because the method of calculation used by the PRC uses the difference of the upper and lower detectors of the X- and Y-channels as part of the calculation.

Lx = Lower X-channel
Ly = Lower Y-channel
Ux = Upper X-channel
Uy = Upper Y-channel

$$\frac{(Lx-Ux)+(Ly-Uy)}{Ux+Uy+Lx+Ly} = ASI$$

Generally, Lx is approximately equal to Ly
Ux is approximately equal to Uy

The switch in upper and lower Y-signals changed the sign of those values in the numerator. The relative values of the signals are as noted above. This caused the calculated ASI value to approach zero, regardless of the difference between upper and lower detectors.

Monitoring and testing of the excore RPS and incore channels would detect a similar problem in those channels. There is no similar problem indicated in those channels.

A similar problem is not indicated for Unit 2. Data will be collected to confirm no similar problem exists.

II. CAUSE OF EVENT

The root cause of the event is that the Y-channel excore detector connectors were incorrectly labeled by the manufacturer. A contributing factor was that the pre-installation test of the system did not detect the problem with the detector output cable connection labeling.

The calibration of the Y-channel is normally done at steady state power when the expected actual ASI value is approximately zero. The reversed Y-signals caused the calculated ASI to approach zero. This made the problem difficult to detect.

III. ANALYSIS OF EVENT

This event has been determined to be reportable under 10 CFR 50.73(a)(2)(i)(B) as operating in a condition prohibited by TS.

TS 4.2.1.2 requires that the LHR be determined to be within its limits by continuously monitoring the core power distribution with either the incore or the excore detector monitoring system. The incore monitoring system is the primary method for satisfying this TS. The excore system is only used when the plant computer is out of service. On four occasions, Unit-1 was in MODE 1, the plant computer was out of service, and the PRC was not operable. Thus, core power distribution was not being continuously monitored and the TS was not satisfied. Subsequent analysis of data indicates that the ASI was unlikely to have been outside TS limits during these occasions.

ASI limits are most likely to be approached during plant startup. Our investigation indicates that the plant computer has always been in service during periods of plant startup. Thus, ASI was continuously monitored during those periods when ASI limits were most likely to be approached.

During steady state operations, ASI is normally stable and is not expected to approach TS limits. Time periods when the plant computer was not in service were during steady state operations. Thus, during the periods when the plant computer was not available, it is very unlikely that the ASI approached TS limits.

During plant shutdown, the margin to LHR and DNB limits increases. Although the ASI varies during plant shutdown, because the margin to those limits is increasing, it is unlikely that the TS limits would have been exceeded under these circumstances.

ASI is also monitored by RPS Channels A, B, C, and D. However, the ASI is only required to be monitored and logged once per shift on those channels. RPS Channels A, B, C, and D provide an ASI pre-trip alarm and trip function to ensure that excessive axial peaking caused by xenon oscillations or CEA movement will not cause fuel damage. The pre-trip alarm and trip function actuate outside of the PRC Axial Shape Index Limiting Condition for Operation (LCO) TS limits, but bound the amount that ASI could exceed the LCO.

No adverse safety consequences resulted from this event.

IV. CORRECTIVE ACTIONS

1. The labeling on the Unit-1 Y-channel excore detector connections have been corrected and the leads correctly connected.

2. Pre-installation testing procedures of the excore detectors have been reviewed and will be revised to ensure that mislabeled detector connections will be detected and corrected in the future.

3. Data will be collected for Unit-2 X- and Y-channel excore detectors during the next Unit-2 startup to confirm that the signals are not reversed.

4. The design specification for the excore detectors has been improved to ensure proper labeling in the future.

V. ADDITIONAL INFORMATION

1. Affected Component Identification

Component	IEEE 805 System ID	IEEE 803 Component ID
Y-Channel Excore Detector	IG	DET
Power Ratio Calculator	IG	J1

2. Similar Events

There have been no previous similar events involving the mislabeling of connectors at Calvert Cliffs. LER 50-317/90-01 addressed an event where 2 leads were reversed, but the labeling was correct.