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June 28, 1990

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Docket No. 50-317
License No. DPR 53

Dear Sirs:

The attached LER 90-18, is being sent to you as required under 10 CFR 50.73 guidelines.

Should you have any questions regarding this report, we would be pleased to discuss them with you.

Very truly yours,

R. E. Denton
Manager

JV/bjd
Attachment

cc: Mr. T. T. Martin
Director, Office of Management Information
and Program Control

Messrs: G. C. Creel
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LICENSEE EVENT REPORT (LER)

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 (F-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) Calvert Cliffs, Unit 1										DOCKET NUMBER (2) 0 5 0 0 0 3 1 7 1 OF 0 5										PAGE (3) 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 (8)									
0	5	2	9	9	0	9	0	0	1	8	0	0	0	6	2	8	9	0	0 5 0 0 0				
OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (Check one or more of the following) (11)																					
5		20.402(b)				20.406(e)				60.73(a)(2)(iv)				73.71(b)									
POWER LEVEL (10)		0 0 0				20.408(a)(1)(i)				60.36(e)(1)				60.73(a)(2)(v)				73.71(e)					
		20.408(a)(1)(ii)				60.36(c)(2)				60.73(a)(2)(vi)				OTHER (Specify in Abstract below and in Text, NRC Form 306A)									
		20.408(a)(1)(iii)				X 60.73(c)(2)(i)				60.73(a)(2)(viii)(A)													
		20.408(a)(1)(iv)				60.73(a)(2)(ii)				60.73(a)(2)(viii)(B)													
		20.408(a)(1)(v)				60.73(a)(2)(iii)				60.73(a)(2)(ix)													
LICENSEE CONTACT FOR THIS LER (12)																							
NAME John Volkoff, Compliance Engineer										TELEPHONE NUMBER 3 0 1 2 6 0 1 3 6 4 9													
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)																							
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC													
B	I	G	D	E	T	W	1	2	O	N													
SUPPLEMENTAL REPORT EXPECTED (14)										EXPECTED SUBMISSION DATE (15)					MONTH DAY YEAR								
X YES (If yes, complete EXPECTED SUBMISSION DATE)										NO					0 5 3 1 9 0								

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 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 post-installation test of the system did not detect the problem. Other causes of the event are being investigated.

Corrective actions include correction of the detector connection labeling and connecting system leads to the correct detector connections. Post-installation testing of the excore detectors will be reviewed and 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.

Other corrective actions will be specified after the investigation is completed.

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TEXT (If more space is required, use additional forms)

1. 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 instances where the plant computer was not available in MODE 1. During these periods, 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 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 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 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

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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 on the detectors 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 takes the difference of the upper and lower detectors of the X and Y channels as part of the calculation.

$$\begin{array}{lcl}
 \text{Lx} = \text{Lower X channel} & & \\
 \text{Ly} = \text{Lower Y channel} & & \\
 \text{Ux} = \text{Upper X channel} & & \\
 \text{Uy} = \text{Upper Y channel} & &
 \end{array}
 \quad
 \begin{array}{c}
 (\text{Lx}-\text{Ux})+(\text{Ly}-\text{Uy}) \\
 \hline
 \text{Ux}+\text{Uy}+\text{Lx}+\text{Ly}
 \end{array}
 = \text{ASI}$$

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 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. An investigation will be conducted to confirm that no 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 post-installation test of the system did not detect the problem with the detector connector labeling. Additional contributing causes of the event are still being investigated.

The calibration of the Y channel is normally done at steady state power, making the ASI approach an acceptable value (approximately zero). This made the problem difficult to detect.

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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 linear heat rate 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 at least three occasions, Unit-1 was in MODE 1 and the plant computer was out of service. Since the PRC was not operable, core power distribution was not being continuously monitored to assure that it was within TS 4.2.1.2 limits. Therefore, the TS was not being satisfied during those occasions when the plant computer was out of service. However, subsequent analysis of data indicates that the ASI was not outside TS limits during those occasions which have been identified.

ASI limits are most likely to be approached during plant startup. Current investigation indicates that the plant computer has always been in service during periods of plant startup. Thus, ASI has typically been 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.

The investigation currently indicates that no adverse safety consequences resulted from this event. This conclusion will be confirmed following completion of this investigation.

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IV. CORRECTIVE ACTIONS

1. The markings on the Unit-1 Y channel excore detector connections have been corrected and the leads correctly connected.
2. Post-installation testing of the excore detectors will be reviewed and revised to ensure such an event would 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 problem does not exist at Unit-2.
4. Other corrective actions will be specified after research is completed.

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.