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U. S. Nuclear Regulatory Commission
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Subject: Arkansas Nuclear One - Unit - 2
Docket No. 50-368
License No. NPF-6
Licensee Event Report 50-368/1999-005-01

Gentlemen:

In accordance with 10CFR50.73(a)(2)(i)(B), enclosed is a supplement to the subject report concerning a Core Protection Calculator channel to describe changes to the corrective actions.

Very truly yours,

Jimmy D. Vandergrift
Director, Nuclear Safety

JDV/tfs

enclosure

IE22

RGN-001

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

LICENSEE EVENT REPORT (LER)

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.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Arkansas Nuclear One - Unit 2	05000368	1 of 5

TITLE (4) Two Trip Functions Of One Core Protection Calculator Channel Were Potentially Inoperable Longer Than Allowed By Technical Specifications Due To Excore Channel Test Switch Malfunction

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
08	31	1999	1999	005	01	06	08	2000	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR: (Check one or more) (11)							
POWER LEVEL (10)	100		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
			20.405(a)(1)(iv)		50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		Abstract Below
			20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		and in Text

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Thomas F. Scott, Nuclear Safety and Licensing Specialist	501-858-4623

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	JC	17	G223	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 15 single-spaced typewritten lines) (16)

During review of core follow trends on August 31, 1999, Reactor Engineering personnel discovered anomalous behavior of Safety Channel "B" excore detector middle subchannel. Deviation from normal had begun on August 25. Channel "B" Core Protection Calculator (CPC) was declared inoperable because trip setpoints could have been non-conservative for Departure from Nucleate Boiling Ratio (DNBR) and Local Power Density (LPD) with the deviation present. When a test switch in a gain circuit of the excore linear subchannel was cycled as part of the troubleshooting, detector response returned to an acceptable value. Channel "B" operability was restored following satisfactory completion of surveillance testing. Having the CPC channel inoperable without performing the required actions resulted in operation prohibited by Technical Specifications. A method was developed and implemented to monitor excore detector signals using the Plant Monitoring System computer to allow more timely response to deviations due to hardware problems. The cause of this condition was determined to be resistance fluctuations across the test switch.

A. Plant Status

At the time this condition was discovered, Arkansas Nuclear One Unit 2 (ANO-2) was operating in Mode 1 in steady-state conditions at 100 percent power. Channel "D" Core Protection Calculator (CPC) [JC] Local Power Density (LPD) and Departure from Nucleate Boiling Ratio (DNBR) functions were inoperable and being maintained in bypass or trip due to a condition described in Licensee Event Report (LER) 50-368/1999-004-00.

B. Event Description

Two trip functions of one CPC channel were potentially inoperable longer than allowed by Technical Specifications (TS).

The ANO-2 excore nuclear instrumentation (NI) [IG] system includes four safety channels. Each safety channel utilizes a detector assembly made up of three fission chambers used to measure flux in the upper, middle, and lower regions of the core independently. The safety channels have two ranges: wide range logarithmic power (2E-8 to 200 percent) and wide range linear power (0 to 200 percent). Each detector feeds a linear amplifier that provides input to the Reactor Protective System (RPS) [JC] CPC trips for LPD and DNBR. Outputs of the three linear amplifiers (per channel) are also provided to a summer that combines the signals and provides input to the RPS Linear Power Level trip. The center chamber, alone, inputs to the logarithmic power circuitry feeding the RPS Logarithmic Power trip. In a gain circuit of the linear subchannel for each detector, an "Alpha Test Switch" is provided. These switches increase the gain of the individual linear subchannel to allow detection of current present from each chamber due to alpha decay of the U-235 fissile material. They are also used to verify amplifier circuit continuity following routine surveillance testing.

Table 3.3-1 of Technical Specification 3.3.1.1 provides operability requirements for RPS instrumentation, including LPD and DNBR trip functions. The table specifies that a minimum of three channels is required to be operable for LPD and DNBR. Action 3 requires that, with the number of operable channels one less than the specified minimum operable channels, within one hour one of the inoperable channels must be verified in bypass and the other inoperable channel verified to be in the tripped condition. It also requires placing all affected functional units in the bypassed or tripped condition, as specified.

During a review of core follow trends on August 31, 1999, ANO Reactor Engineering personnel discovered anomalous behavior of Safety Channel "B" excore detector middle subchannel. At approximately 0400 on August 25, 1999, the signal from that subchannel began deviating from normal. The signal slowly oscillated above normal over the next three days. Trends indicated signal variations of up to four percent power that were not due to actual fluctuations in core power. The signal was stabilizing with a slight bias above its original value when the condition was discovered. Channel "B" was

declared inoperable at 1341 on August 31, 1999. Channel "D" was placed in trip and DNBR and LPD functions of Channel "B" were bypassed. Troubleshooting by Maintenance and Engineering personnel involved cycling the Alpha Test Switch after power was removed from the excore drawer. After the drawer was re-energized, the middle subchannel slight bias was verified to have been eliminated with the signal stabilized near its original value. The monthly surveillance test was satisfactorily completed. In addition, core power distribution parameters calculated by the "B" CPC Channel returned to values more consistent with the other two operable channels. Channel "B" was restored to an operable status at 2243 and removed from bypass at 2246 on August 31, 1999.

C. Root Cause

The cause of this condition was determined to be gradual resistance fluctuations across the Alpha Test Switch. Determination of the final root cause will be contingent upon further testing of one or more test switches with possible destructive examinations.

D. Corrective Actions

Following restoration of operability to Channel "B" on August 31, 1999, Operations personnel performed monitoring of excore subchannel performance on an approximately hourly frequency using the same methodology by which the initial condition was identified. By September 3, 1999, a means was developed and implemented to allow Operations personnel to monitor the excore subchannel performance such that a recurrence of this type of condition would be able to be detected within one hour. A spreadsheet was developed to calculate standard deviations in excore detector raw signals at the subchannel level. The calculated deviations are compared against the average from the other three channels. A threshold was established above which further investigation of the cause of the deviation should be initiated. The method was implemented on the Plant Monitoring System (PMS) [ID] to provide automated monitoring of the excore signals. An Operations Night Order provided directions concerning actions if an alarm is received from this program until the change to the annunciator corrective procedure was implemented.

Subsequent review indicated that this method of monitoring was not sufficiently sensitive. A revision to the monitoring program was implemented to indicate either a detector drift or a spike; however, this method was too sensitive and resulted in nuisance alarms. Another monitoring method was implemented that calculates the slope of the most recent 30 minutes of data for one channel and compares the slope to the average slope of the other three channels at that level. If the slope of one channel deviates from the average of the other three channels for 10 of the last 30 minutes, an alarm is generated. This method has been found to be more sensitive to slow drifts but less susceptible to nuisance alarms due to random noise. Further adjustments to the monitoring technique may be necessary depending on the nuisance alarm frequency.

Because of the potential generic implication that normal operational channel check surveillances would not detect an instrument decalibration of this type, all other plants with CPCs were notified of this condition by September 3, 1999.

ANO replaced the Channel "B" middle channel Alpha Test Switch. A failure analysis of this switch will be performed by the switch manufacturer. Documentation of findings and identification of additional actions are expected to be completed by February 28, 2001.

E. Safety Significance

The significance of having operated with LPD and DNBR functions of CPC Channel "B" with potentially non-conservative setpoints due to the effect of the Alpha Test Switch resistance cannot be exactly determined without expending significant resources to evaluate the wide range of specific cases that can exist. Previous evaluations associated with the Channel "D" condition demonstrated sensitivity of the CPC uncertainty analysis to even small (one percent) amounts of drift or bias in the middle subchannels. The limited duration of the condition and its effect on only one channel serve to mitigate the safety significance.

F. Basis for Reportability

Operating with CPC Channel "B" DNBR and LPD trip functions potentially non-conservative, and therefore inoperable, from August 25 to 0815 on August 31, 1999, and from 1045 to 1341 on August 31, 1999, while Channel "D" was inoperable and bypassed, without complying with the requirements of Action 3 of TS 3.3.1.1, constituted operation prohibited by Technical Specifications. From 0815 to 1045 on August 31, 1999, while Channel "C" was bypassed for testing, Channel "D" was inoperable and tripped, and Channel "B" was inoperable and neither bypassed nor tripped, ANO-2 was in TS 3.0.3 because there are no applicable actions for having less than the three operable channels required by TS Table 3.3-1. Entry into TS 3.0.3 also constitutes operation prohibited by Technical Specifications. This report is submitted in accordance with 10CFR50.73(a)(2)(i)(B).

G. Additional Information

Licensee Event Report 50-368/1999-004-00 documented one CPC channel being potentially inoperable due to excore detector signal drift. That condition is believed to have resulted from loss of fill gas from the middle fission chamber. Corrective actions from that condition had not been completely implemented when this condition was discovered.

There have been no previous LERs submitted by ANO involving Alpha Test Switches.

The Alpha Test Switch is located in a drawer designated Model ELE 304-3000-1 manufactured by General Atomic Company, Manufacturer Code G063. The switch is identified as "S-11" on the drawing for the drawer. The switch manufacturer is Grayhill, Inc., Manufacturer Code G223.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].