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January 8, 1990

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U. S. Nuclear Regulatory Commission
Document Control Desk
Mail Station P1-137
Washington, D. C. 20555

SUBJECT: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Licensee Event Report 50-368/89-023-01

Gentlemen:

In accordance with 10CFR50.73(a)(2)(i)(B) attached is the subject report concerning recurring electrically induced noise which resulted in two Logarithmic Power Level Nuclear Instrumentation Channels being inoperable and a defective preamplifier module which caused a third channel to be inoperable during the approach to criticality following a refueling outage.

This report has been revised to correct a typographical error.

Very truly yours,

E. C. Ewing
General Manager,
Technical Support
and Assessment

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attachment

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NRC Form 366
(9-83)

U.S. Nuclear Regulatory Commission
Approved OMB No. 3150-0104
Expires: 8/31/85

L I C E N S E E E V E N T R E P O R T (L E R)

FACILITY NAME (1) Arkansas Nuclear One, Unit Two DOCKET NUMBER (2) | PAGE (3)
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TITLE (4) Recurring Electrically Induced Noise Resulted in Two Logarithmic Power Level Nuclear Instrumentation Channels Being Inoperable and a Defective Preampfier Module Caused a Third Channel to be Inoperable During the Approach to Criticality Following a Refueling Outage

EVENT DATE (5)			LER NUMBER (6)				REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
Month	Day	Year	Sequential Number	Revision Number	Month	Day	Year	Facility Names		Docket Number(s)	
11	17	89	02	01	11	18	90			0 5 0 0 0	

OPERATING MODE (9) 2 THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §:

OPERATING MODE (9)	(10)	20.402(b)	20.405(a)(1)(i)	20.405(a)(1)(ii)	20.405(a)(1)(iii)	20.405(a)(1)(iv)	20.405(a)(1)(v)	20.405(c)	50.36(c)(1)	50.36(c)(2)	50.73(a)(2)(i)	50.73(a)(2)(ii)	50.73(a)(2)(iii)	50.73(a)(2)(iv)	50.73(a)(2)(v)	50.73(a)(2)(vi)	50.73(a)(2)(vii)	50.73(a)(2)(viii)	50.73(a)(2)(ix)	73.71(b)	73.71(c)	Other (Specify in Abstract below and in Text, NRC Form 366A)	
					X																		

LICENSEE CONTACT FOR THIS LER (12)

Name	Telephone Number
Dana Miller, Nuclear Safety and Licensing Specialist	Area Code 5 0 1 9 6 4 - 3 1 0 0

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

SUPPLEMENT REPORT EXPECTED (14)

EXPECTED SUBMISSION DATE (15)	Month	Day	Year

Yes (If yes, complete Expected Submission Date) No

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On November 17, 1989 at 1735 hours an approach to criticality was commenced following the seventh refueling outage with two of four Logarithmic (Log) Power Level nuclear instrumentation channels declared inoperable due to electrically induced noise in the circuitry. As power level was increased it was expected that the neutron level signal would overcome the affects of the electrically induced noise and channels 'B' and 'C' would track with the other Log Power Level channels. At 1955 hours 'B' channel was declared operable and returned to service. At 2021 hours 'C' channel was declared operable and returned to service. At the same time, as operations personnel monitored the Log Power Level instruments it was noted that 'A' channel was not responding to the change in power level, therefore, 'A' channel was declared inoperable. A defective preampfier was replaced and 'A' channel restored to an operable status. Sufficient instrumentation would have been available to provide the protective function provided by the Log Power channels if required. Therefore, the safety significance was minimal. The root cause of this event was that the type of malfunction which occurred in the 'A' channel preampfier module could not be detected by the channel functional test. There are no plans to revise the functional test, however, specific acceptance criteria for channel operability is being evaluated. This event is being reported pursuant to 10CFR50.73(a)(2)(i)(B).

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		Year	Sequential Number	Revision Number	
Arkansas Nuclear One, Unit Two	0510101368	89--	023--	01	1021013

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

A. Plant Status

At the time of occurrence of this event, Arkansas Nuclear One, Unit Two (ANO-2) was in Mode 2 (Startup). Reactor Coolant System (RCS) [AB] pressure was approximately 2250 psia and RCS temperature about 545 degrees Fahrenheit. The initial reactor startup following the seventh refueling outage was in progress.

B. Event Description

On November 17, 1989, at 1520 hours while preparing to perform a reactor startup following the seventh refueling outage (2R7), channel 'C' of the Logarithmic (Log) Power Level nuclear instrumentation was declared inoperable due to electrically induced noise interference in the channel's circuitry causing the channel to indicate higher than the other Log Power Level channels. The channel was placed in a bypassed condition. Channel 'B' was declared inoperable and placed in a tripped condition at 1530 hours also due to a similar noise. Channel 'C' indicated approximately three decades higher than 'A' and 'D' channels and channel 'B' indicated about one and one-half decade higher. The Operations staff conservatively declared 'B' channel inoperable. Channels 'A' and 'D' were considered operable.

At 1735 hours on November 17, 1989, an approach to criticality commenced. As power level was increased during the reactor startup it was expected that the neutron level signal would overcome the effects of the electrically induced noise and channels 'B' and 'C' would track with the other Log Power Level channels. At 1955 hours with neutron level increased, 'B' channel was declared operable, removed from the tripped condition and returned to service. At 2021 hours the neutron power level signal overcame the effects of electrical noise on 'C' channel and 'C' channel was declared operable. The channel was removed from bypass and returned to service. As Operations personnel monitored the Log Power Level instruments, it was noted that 'A' channel was not responding to the change in power level. Channel 'A' was declared inoperable and placed in bypass at 2021 hours. Reactor criticality was achieved at 2034 hours on November 17, 1989.

A job order was issued to repair 'A' channel. A contact, which is in line with the excore detector and the preamplifier and an integral part of the preamplifier, was found open and therefore, the output from the excore detector was not being passed to the preamplifier. The preamplifier module was replaced and 'A' channel was restored to an operable status.

C. Safety Significance

The Reactor Protective System (RPS) [JC] consists of logic, switchgear and other equipment necessary to monitor selected Nuclear Steam Supply System conditions and to effect reliable and rapid reactor shutdown (reactor trip) if any or a combination of the monitored conditions reach a Limiting Safety Setting. The system functions are to protect the core, the fuel design limits, and RCS pressure boundaries for Anticipated Operational Occurrences. Four measurement channels, with electrical and physical separation, are provided for each parameter used in the generation of trip signals. During normal operation, with all four channels operable, a 2-out-of-4 coincidence logic of like trip signals is required to generate a reactor trip signal. Channel bypasses are provided to remove a channel from service for maintenance or testing. With a channel bypassed, the trip logic is converted to a 2-out-of-3 basis of like trip signals. With the Trip Circuit Breakers (TCBs) closed and Control Element Assemblies (CEAs) capable of being withdrawn, the purpose of the high Log Power Level automatic reactor trip is to ensure the integrity of the fuel cladding and RCS pressure boundary in the event of an unplanned criticality from a shutdown condition. Technical Specifications allow two channels to be inoperable providing one of the channels is bypassed and one is placed in the tripped condition, resulting in a 1-out-of-2 trip logic.

The initial approach to criticality after a refueling outage is closely monitored by Reactor Engineering personnel. A 1/M plot is used to predict criticality and a slow controlled "pull and wait" method is used during the approach. Two boron dilution monitors and startup nuclear instrumentation channels, with audible countrate, are available and used by Reactor Engineering and Operations personnel to monitor the startup.

With 'B' channel placed in the tripped condition and channel 'D' still available to trip, the system function would have been fulfilled in the unlikely event of an unplanned criticality during the approach to criticality. Additionally, Operations personnel were closely monitoring the power level during the startup and could have manually tripped the CEAs had an unplanned criticality occurred.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		Year	Sequential Number	Revision Number	
Arkansas Nuclear One, Unit Two	0510003688	89--	023--	01	1031013

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

During the time when three Log Power Level channels were inoperable, sufficient instrumentation would have been available to provide the protective function if required and to minimize the probability of an inadvertent criticality. The impact of safety significance was, therefore, considered minimal.

D. Root Cause

Approximately one week prior to the startup while performing tests on the individual CEAs, it was identified that channels 'B' and 'C' were affected by electrical noise. As each individual CEA circuit breaker was closed, the indications on channels 'B' and 'C' showed an increase. Extensive investigations, involving AND Engineering, Operations, Instrumentation and Controls, and Combustion Engineering personnel, of the cause of the noise and the reliability of the instruments indicated that as power level was increased during the reactor startup, the neutron level signal would overcome the affects of the noise and the channels would track with the other two Log Power Level channels. It was also verified that specific CEA circuit breakers were causing the noise induction into the circuits and resultant higher indications.

A channel functional test was performed on 'A' channel prior to the reactor startup. The root cause of this event is that the functional test did not identify that the preamplifier module was defective. Due to the design of the system, the functional test will not identify the malfunction which occurred in the preamplifier module.

As a contributing factor to this event, no specific acceptance criteria had been provided to the Operations staff to determine operability of the Log Power Level instrumentation channel. As a result, the operability acceptance criteria for Mode 5 (Cold Shutdown) was used. The decision by the Operations staff to declare channel 'B' inoperable was considered a very conservative decision. Additionally, the electrically induced noise into the Log Power channels did not hinder the ability of the system to perform its reactor trip safety function. Any noise will increase the channel's signal supplied to the high Log Power trip function, reducing the margin to the trip setpoint.

E. Basis for Reportability

A subsequent review and evaluation of the details related to this event determined there were three Log Power Level channels inoperable during the approach to criticality and reactor startup on November 17, 1989. Even though the exact time is not known as to when 'A' channel was inoperable, Arkansas Power and Light Company considered that the requirements of Technical Specifications were not satisfied. This event is therefore, reportable pursuant to 10CFR50.73(a)(2)(i)(B), operations prohibited by Technical Specifications.

F. Corrective Actions

An evaluation of the system design and the channel functional test was performed and it was determined that no changes need to be made to the Log Power Level instrumentation functional test procedure.

Engineering has been tasked with determining an acceptable criteria for defining channel operability. This will be completed by February 1, 1990.

AP&L is pursuing corrective actions to reduce the noise associated with the Log Power Level instrumentation to a minimum. Channel 'C' excor detector will be replaced during the next outage of sufficient duration. AP&L is evaluating the need to replace the other excor detectors. This evaluation will be completed by January 31, 1990. Additionally, a 100 percent power calibration is going to be performed to adjust the Log Power level channels at 100 percent which should result in the indications at low power levels being closer together. This calibration will be completed by January 31, 1990.

G. Additional Information

There are no previously reported similar events.

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