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May 5, 1992

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U. S. Nuclear Regulatory Commission
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SUBJECT: Arkansas Nuclear One - Unit 1
Docket No. 50-313
License No. DPR-51
Licensee Event Report 50-313/92-001-00

Gentlemen:

In accordance with 10CFR50.73(a)(2)(v), enclosed is the subject report concerning circuit breaker coordination within the DC Power System.

Very truly yours,

James J. Fisicaro

James J. Fisicaro
Director, Licensing

JJF/EKH/mmg
Enclosure
cc: Regional Administrator
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NRC Form 366
(6-89)

U.S. Nuclear Regulatory Commission
Approved OMB No. 3150-0104
Expires: 4/30/92

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4) Inadequate Circuit Breaker Coordination Which Resulted From Deficiencies In The Original Design Created The Potential For A Temporary Loss Of Redundant DC Equipment Due To A Single Fault

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)
										0 5 0 0 0
0 4	0 8	9 2	9 2	-- 0 0 1	-- 0 0	0 5	0 5	9 2		0 5 0 0 0

OPERATING MODE (9)	N	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)	X 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
		__ 20.405(a)(1)(iii)	__ 50.73(a)(2)(i)	__ 50.73(a)(2)(viii)(A)	Abstract below and
		__ 20.405(a)(1)(iv)	__ 50.73(a)(2)(ii)	__ 50.73(a)(2)(viii)(B)	in Text, NRC Form
		__ 20.405(a)(1)(v)	__ 50.73(a)(2)(iii)	__ 50.73(a)(2)(x)	366A)

LICENSEE CONTACT FOR THIS LER (12)

Name	Telephone Number
	Area Code
Elizabeth K. Holbert, Nuclear Safety and Licensing Specialist	5 0 1 9 6 4 - 5 0 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) X No				

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

On April 8, 1992 while reviewing the design of the Arkansas Nuclear One Unit 1 DC Power Systems, a deficiency with circuit breaker coordination between the main load center circuit breakers and the branch circuit breakers located in the associated distribution panels was discovered. The load center circuit breakers may not have selectively coordinated with the branch circuit breakers located on the referenced panels. For high current faults greater than 2000 amps on the branch circuits, the load center circuit breaker could have tripped and temporarily deenergized the entire panel until the main feeder breaker could be reset. In addition, if non-safety related circuits from opposite train panels were in close proximity, a single event could have potentially rendered both the red and green train DC components temporarily inoperable. The root cause of this condition was determined to be inadequacies in the original design. The load center circuit breakers supplying the distribution panels were replaced with fuses which coordinate with the branch circuit breakers correctly.

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

A. Plant Status

At the time this condition was identified, Arkansas Nuclear One Unit 1 (ANO-1) was in cold shutdown conditions with Reactor Coolant System (RCS) [AB] temperature at 85 degrees and pressure 0 psig. Refueling outage 1R10 was in progress.

B. Event Description

On April 8, 1992 while reviewing the design of the ANO-1 DC Power Systems [EJ] in preparation for an Electrical Distribution System Functional Inspection, Design Engineering personnel discovered a deficiency with circuit breaker coordination between the main load center circuit breakers and the branch circuit breakers located in the associated distribution panels. It was possible that the load center circuit breakers could have tripped prior to the branch circuit breakers in the event of a high current fault in excess of 2000 amps thus causing an entire distribution panel to become temporarily deenergized.

The 125 VDC Power System is designed to provide continuous power for 6.9 kV switchgear control, 4.16 kV switchgear control, 480 VAC load center control, Reactor Control (Control Rod Drive) [AA], Reactor Instrumentation and Protection System [JC], Engineered Safeguards System [JE], Inverters (120 V Vital AC System [ED]), and other equipment necessary for normal unit operation and emergency shutdown. Two independent, physically and electrically separated 125 volt batteries provide DC power to the 125 VDC load centers (D01 and D02) which supply distribution panels D11, RA1, D21, and RA2. Panels D11 and D21 provide DC power for 6.9 kV and 4.16 kV switchgears, 480 VAC load centers, main control board panels, and miscellaneous general purpose local control panels. Panels RA1 and RA2 supply DC power for equipment associated with the Engineered Safeguards System as well as non-safety related equipment.

The load center circuit breakers which supplied the distribution panels had thermal magnetic trip elements. The magnetic (instantaneous) trip characteristic of these elements might not have selectively coordinated with the magnetic trip elements on the branch circuit breakers located on the referenced panels. Specifically, for high current faults greater than 2000 amps on the branch circuits, the load center breaker could have tripped and deenergized the entire panel. Many of the branch circuits on these panels are not safety related; therefore, several safety related loads could have been temporarily deenergized (until the main feeder breaker could be reset) from a fault that occurred on a non-safety related circuit. In addition, if non-safety related circuits from opposite train panels were in close proximity and within the critical distance from the circuit breakers, a single event (e.g., a High Energy Line Break) could have potentially rendered both the red and green train DC components temporarily inoperable. However, in order for this to be of concern, a high current fault would have had to occur less than approximately 60 feet

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from a branch circuit breaker since the resistance of the conductor would have reduced the fault current to less than 2000 amps. Since a Design Change was developed and implemented to resolve this issue prior to plant startup, reviews and evaluations were not conducted to determine if the common mode failure mechanism actually existed.

C. Root Cause

The root cause of this condition was determined to be inadequacies in the original design. The original design placed thermal magnetic circuit breakers in both the load center and the downstream panels. The design did not provide proper coordination between the circuit breakers. This allowed the potential for common mode failures. In addition, the calculation which analyzed the coordination between the load center and the panel circuit breakers did not address the fact that non-selectivity existed for faults in excess of 2000 amps on the branch circuits.

D. Corrective Actions

The D01 and D02 circuit breakers supplying panels D11, D21, RA1, and RA2 were replaced with fuses which coordinate with both the upstream battery fuses and the downstream panel circuit breakers. A fault on the branch circuit will now trip the branch circuit breaker prior to blowing the fuse at D01 or D02.

E. Safety Significance

The possibility of the postulated event having occurred is reduced by the fact that the circuit breakers were only miscoordinated for high current faults over 2000 amps. Additionally, the current would have been reduced to less than 2000 amps for faults greater than 60 feet from the branch circuit breakers for the largest conductor size for D11, D21, or RA2 non-safety related branch circuits (20 feet for panel RA1 circuits) due to the resistance of the conductor. These distances are conservative since the calculated fault current does not take into account the resistance of the load center circuit breaker, the battery fuse and disconnect switch, and cable terminations. Also the main feeder breaker could have been manually reset in the event the entire distribution panel was deenergized thus restoring power to the panel. This condition is considered to have been of minimal safety significance.

F. Basis for Reportability

This condition is considered reportable pursuant to 10CFR50.73(a)(2)(v) since a single event could potentially have rendered both the red and green train DC components temporarily inoperable.

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G. Additional Information

There have been no previous similar events reported as Licensee Event Reports by ANO. LER 50-313/91-007-00 dealt with fuse/circuit breaker coordination; however, the root cause for this LER was design inadequacies related to the Design Change Packages (DCPs) which documented replacement of the emergency batteries for ANO-1 and ANO-2. The calculations associated with these DCPs noted the miscoordination of the fuses and the circuit breakers but used qualitative arguments based on conservatisms used in the calculations to deem the coordination acceptable. Therefore, since the root causes of these two LERs are not the same this is not considered a similar event.

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