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April 23, 1990

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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 50-368/90-009-00

Gentlemen:

In accordance with 10CFR50.73(a)(2)(i)(B), attached is the subject report concerning a functional test of the 480V Engineered Safety Features undervoltage system which was determined to be inadequate resulting in a failure to meet Technical Specification operability requirements

Very truly yours,

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

ECE/DM/abw  
Attachment

cc: Regional Administrator  
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## LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Arkansas Nuclear One, Unit Two										DOCKET NUMBER (2) PAGE (3) 015010101 31 61 8110F1014																											
TITLE (4) Functional Test of 480V Engineered Safety Features Undervoltage System Determined to be Inadequate Resulting in Failure to Meet Technical Specification Operability Requirements																																					
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)																				
01	31	21	31	91	01	91	01	--	01	01	91	--	01	01	01	41	21	31	91	01	015010101	015010101															
OPERATING MODE (9) 1 THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) ( )																																					
POWER LEVEL (10)		11010		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)		50.73(a)(2)(iv)		50.73(a)(2)(v)		50.73(a)(2)(vi)		50.73(a)(2)(vii)		50.73(a)(2)(viii)(A)		50.73(a)(2)(viii)(B)		50.73(a)(2)(ix)		73.71(b)		73.71(c)		Other (Specify in Abstract below and in Text, NRC Form 366A)	
LICENSEE CONTACT FOR THIS LER (12)																																					
Name										Telephone Number																											
Dana Millar, Nuclear Safety and Licensing Specialist										Area Code 50129641-311010																											
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)																											
Yes (If yes, complete Expected Submission Date) No										Month Day Year																											
ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)																																					

On March 23, 1990, Arkansas Nuclear One (ANO) identified that an inadequate channel functional test had been performed on the 480V Engineered Safety Features (ESF) undervoltage (UV) relays. Previously, a functional test had been performed on the relays, however, the alarm and trip functions associated with the channel had not been tested. A detailed review of licensing bases documents and system design was conducted and it was concluded on March 24, 1990, that an adequate functional test had previously been performed and the Technical Specifications were satisfied. On March 26, 1990, after discussions with the NRC, it was concluded that the functional test was inadequate. ANO management declared the UV system inoperable and the appropriate Technical Specification Action Statement was entered. The cause of this event is considered to be from a change in the level of testing required for the 480V ESF UV system to satisfy the functional test definition in accordance with current industry practice. Actions were initiated to develop a test procedure for a channel functional test. On March 27, 1990, a channel functional test was performed satisfactorily for the UV system on the 480V ESF buses using the new test procedure. Since the UV system performed properly when tested, there were no safety concerns related to this event.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
Arkansas Nuclear One, Unit Two		Year	Sequential Number	Revision Number	
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TEXT (If more space is required, use additional NRC Form 366A's) (17)

A. Plant Status

At the time of discovery of this condition Arkansas Nuclear One Unit Two (ANO-2) was operating at 100 percent of rated thermal power in Mode 1 (Power Operation). Reactor Coolant System (RCS) [AB] temperature was approximately 580 degrees Fahrenheit and RCS pressure 2250 psia.

B. Event Description

The ANO-2 4160 Volt (V) system is designed for protection against a loss of offsite power. The system consists of four buses: 2A1, 2A2, 2A3, and 2A4. Buses 2A1 and 2A2 supply power to non-Engineered Safety Features (ESF) auxiliaries. Buses 2A3 and 2A4 supply power to ESF equipment essential for safe shutdown and accident mitigation. The ESF buses are capable of being supplied from either the Unit Auxiliary Transformer, Startup Transformer 2, or Startup Transformer 3 via buses 2A1 and 2A2. Each vital 4160V bus is also capable of being supplied by its associated Emergency Diesel Generator (EDG) [EK].

Buses 2A3 and 2A4 are designed with undervoltage (UV) relays 127-2A3/A, 127-2A3/B, 127-2A4/A, and 127-2A4/B to monitor the voltage condition of the buses. If a loss of voltage on these buses is sensed by the associated UV relays, at 78 percent of bus voltage (approximately 3120V), all loads except the 480V ESF load centers 2B5 and 2B6 will be shed, the feeder breakers for offsite power supply to the buses from 2A1 and 2A2 will open after a two second time delay and the associated EDG will automatically start. When the EDG has attained rated speed and voltage (within 15 seconds), the loads will be connected automatically per the specified sequence. The UV relays described above are connected in parallel, two per bus. Operation of either relay will isolate its associated bus from its offsite source. This design logic prevents the possibility of a single relay failure resulting in a failure to isolate the safety bus from offsite power. Each UV relay contact in turn actuates an auxiliary relay (127-2A3/XA, 127-2A3/XB, 127-2A4/XA, and 127-2A4/XB). The contacts of the auxiliary relays are also wired in parallel, two per bus. Four additional auxiliary relays actuated by these contacts initiate the actual safety functions of isolating and stripping the bus, starting the associated EDG, and closing the EDG output breaker.

The 4160V bus UV system is supported by a second level of UV protection circuitry on the 480V vital buses 2B5 and 2B6 for sustained degraded offsite power grid voltage conditions. Bus 2B5 is fed from 4160V bus 2A3, and bus 2B6 is fed from 4160V bus 2A4. There are two relays per 480V vital bus set at 92 percent of bus voltage (27-1/2B5 and 27-2/2B5 for bus 2B5 and 27-1/2B6 and 27-2/2B6 for bus 2B6). The relay contacts are wired in series providing a coincident logic in order to initiate protective action. This design is to preclude spurious trips of the offsite power source to the ESF buses. These relays will also isolate offsite power at the 4160V level by opening the feeder breaker to buses 2A3 and 2A4 after an eight second delay. The delay is to prevent undesired separation from offsite power during momentary 480V bus UV conditions.

Technical Specification 4.3.2.1.1, Table 4.3-2, item 7b requires that a channel check, channel calibration and a channel functional test be performed on the 480V ESF UV instrumentation channels. The channel calibration and channel functional tests are required to be performed at least once per eighteen months, while the channel check is required every twelve hours.

On March 23, 1990, ANO identified that a channel functional test of the UV system for the 480V ESF electrical bus had possibly not been performed adequately. By definition, as stated in Technical Specifications, a channel functional test shall be the injection of a simulated signal into the channel as close as practicable to the sensor to verify operability of the channel including the alarm and/or trip functions associated with the channel. In the past the functional test consisted of a calibration of the individual relays and verification that the relay actuated at 92% of rated bus voltage when a simulated signal was applied to the relay. However, a functional test of the channel circuitry including the alarm and trip function associated with the channel had not been performed. Additional reviews of the licensing bases documents and system design were conducted and it was concluded on March 24, 1990, that an adequate functional test as required by Technical Specifications was performed.



LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)	PAGE (3)						
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TEXT (If more space is required, use additional NRC Form 366A's) (17)

A review of the channel functional test for the 4160V UV system was also performed. It was concluded that an adequate channel functional test was performed for the system, however, some enhancements could be made to the testing procedure.

At about 1030 hours on March 26, 1990, a conference call between the NRC Region IV, Nuclear Reactor Regulation and AND management was initiated to further discuss the issue. At the conclusion of this call, the NRC questioned if an adequate 480V ESF UV system test had been performed. After review, AND management declared the 480V ESF UV system inoperable and enter the associated Technical Specification Action Statement at approximately 1235 hours on March 26, 1990. Actions were initiated to develop a test procedure for the channel functional test, which would include the entire channel (i.e., alarm and trip functions), to have the Plant Safety Committee (PSC) review the test procedure and to conduct the test.

C. Root Cause

In 1976 while ANO-2 was in its construction phase, a generic safety issue concerning protection of safety related electrical buses and associated equipment from the effects of sustained degraded voltage from the offsite electrical grid system resulted from an occurrence at the Millstone Unit 2 facility. At this time the initial effort to address this issue for ANO-2 was focused primarily on reviews and evaluations of the design of the undervoltage protection systems and related analyses performed to demonstrate adequate protection. Testing requirements and associated Technical Specifications for the systems were addressed approximately four months prior to the initial issuance of the ANO-2 Technical Specifications in July 1978. Specifically, in a letter dated March 30, 1978, AP&I responded to an NRC request for information on this subject and stated: "At least once per 18 months the trip set points of the 92% and 78% undervoltage relays will be verified as specified in the Technical Specifications (Table 3.3-4; item 7, and Table 4.3-2; item 7)." This indicates it was ANO's intent to satisfy the Technical Specification surveillance requirements by verification of the relay actuation setpoints once per 18 months.

However, on March 26, 1990, as a result of further discussions with the NRC, AND management determined that the 480V UV system had not been adequately tested. The UV system was declared inoperable and steps were initiated to perform a channel functional test on the entire channel. Therefore, the cause of this event is considered to be from a change in the level of testing required for the 480V ESF UV system to satisfy the channel functional test definition in accordance with current industry practice.

D. Corrective Actions

The 480V vital UV system was declared inoperable on March 26, 1990, at approximately 1235 hours. A test procedure was written and approved by the PSC. At approximately 1437 hours on March 27, 1990, the testing of the 480V UV system was satisfactorily completed and the associated Technical Specification Action Statement exited. In the future, this new testing procedure will be used to perform periodic testing as required by Technical Specifications.

Although a functional test of each of the 4160V ESF UV relays had been performed satisfactorily each eighteen months, considering current industry practices and operating experience obtained over the past several years, AND management recognized that enhancements should be made to the existing testing procedure. The enhancements will verify that the entire circuitry is tested through each UV relay. AND has concluded, however, that it is impractical to test the 4160V UV relays at power. Performance of the 4160V test at power could result in complete de-energization of the safety related bus, start the EDGs and introduce unnecessary transients on other safety related systems with no perceived safety benefits. A full functional test of the 4160V ESF UV system will be completed during the next outage while in Cold Shutdown (Mode 5) or during the next refueling outage (2RB, scheduled to begin in March 1991), whichever is first.

A preliminary review of the ANO-1 testing procedures for the 480V ESF UV system has been performed, which concluded that the testing was adequate. A complete evaluation and review of the testing methods used on the 480V ESF UV system for ANO-1 will be completed by July 20, 1990.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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

Additionally to help prevent recurrence of these types of conditions, the ANO Business Plan has established a program to reverify and revise procedures, as necessary, to ensure that the procedures consistently identify the Technical Specification surveillance requirements and in fact do document operability of the component/system as required by the surveillance requirements. The scheduled completion date for this activity is July 1, 1992. Due to the large number of functional tests required by Technical Specifications, the procedures which are considered functional tests will be reviewed, verified and revised, as necessary, prior to the review of other surveillance requirements.

E. Safety Significance

Of primary concern to this condition was the potential for the loss of all normal and preferred AC power to the station auxiliaries, with reliance on the EDGs to start. Each eighteen months a functional test associated with the EDGs is performed. A loss of power by itself is simulated which verifies the de-energization of the ESF buses, load shedding from the ESF buses, EDG auto-start and re-energizing the ESF buses and sequencing on the individual loads. At least one of the UV relays on the 4160V ESF bus must actuate for the EDG to receive a start signal and tie on to the 4160V ESF bus. There was, therefore, a high degree of assurance that the EDGs would be available to provide power to the ESF loads in the event of a loss of normal or preferred AC power.

Although the 480V UV system had not previously been tested as an integrated system, when testing was performed on March 27, 1990, the system functioned properly. Therefore, ANO concludes that had an event occurred which required the system to actuate, it would have performed its safety function.

In conclusion, with satisfactory tests completed for the 480V UV system, there were no safety concerns associated with this condition.

F. Basis for Reportability

A functional test had previously been performed on each UV relay in the 480V ESF buses. After discussions with the NRC, ANO management concluded that this testing was not adequate to satisfy the requirements of a channel functional test as defined by Technical Specifications. This condition is, therefore, reportable pursuant to 10CFR50.73(a)(2)(i)(B), as a condition prohibited by Technical Specifications.

G. Additional Information

Previously reported conditions which resulted in inadequate channel functional tests were reported in 50-368/90-006-00.

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