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Richard L. Anderson
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10 CFR 50.73

1CAN021902

February 18, 2019

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Licensee Event Report 50-313/2018-004-00
Arkansas Nuclear One – Unit 1
Docket No. 50-313
Renewed Facility Operating License No. DPR-51

Dear Sir or Madam:

Pursuant to the reporting requirements of 10 CFR 50.73, attached is the subject Licensee Event Report concerning an automatic reactor trip due to the loss of a non-vital 4160 volt bus at Arkansas Nuclear One, Unit 1.

There are no new commitments contained in this submittal.

Should you have any questions concerning this issue, please contact Tim Arnold, Manager, Regulatory Assurance, at 479-858-7826.

Sincerely,

ORIGINAL SIGNED BY RICHARD L. ANDERSON

RLA/rwc

Attachment: Licensee Event Report 50-313/2018-004-00

cc: Mr. Scott A. Morris
Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
1600 East Lamar Boulevard
Arlington, TX 76011-4511

NRC Senior Resident Inspector
Arkansas Nuclear One
P. O. Box 310
London, AR 72847

Institute of Nuclear Power Operations
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Attachment to

1CAN021902

Licensee Event Report 50-313/2018-004-00

NRC FORM 366 (04-2018) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 03/31/2020

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Arkansas Nuclear One – Unit 1	05000313	1 OF 5

4. TITLE

Reactor Trip Due to the Loss of a Non-Vital 4160 Volt Bus

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									N/A	**05000**
12	18	2018	2018	004	00	02	18	2019	FACILITY NAME N/A	DOCKET NUMBER **05000**

9. OPERATING MODE

Mode 1

10. POWER LEVEL

100%

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
	☐ 50.73(a)(2)(i)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A	

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
Timothy L. Arnold, Manager, Regulatory Assurance	(479) 858 - 7826

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO ICES	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO ICES
A									

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On December 18, 2018, Baker testing of the Arkansas Nuclear One, Unit 1, Main Chiller motor was being performed. Unit 1 was operating at 100%. Baker motor testing is completed to gather performance monitoring data on various motors. The testing is intended for use in detection of motor health, input power, and other dynamic electrical problems with electric motors.

At approximately 1120 on December 18, 2018, during restoration from the subject testing, an electrical arc was observed. The arc was observed upon the removal of the third voltage test clip from a non-vital 4160 volt (V) bus. The arc caused the two fuses in one of the electrical phases to open in order to protect the bus Control Power Transformer. The loss of the control power circuit resulted in the 4160V feed from the unit Auxiliary Transformer opening, causing the 4160V bus to de-energize. The Startup Transformer feeder breaker to the 4160V bus did not automatically close upon loss of 4160V bus voltage because its closing logic was not satisfied. The loss of the 4160V bus resulted in load shedding of the respective buses, automatic start and connection of the associated Emergency Diesel Generator to the respective vital 4160 bus, and a subsequent plant transient.

The plant transient lead to a reactor trip on high Reactor Coolant System pressure following the loss of one of the two operating Main Feedwater pumps. After the reactor trip, the unit was stabilized in Mode 3 with feedwater being supplied to the Steam Generators by the unit Auxiliary Feedwater pump.

LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Arkansas Nuclear One, Unit 1	05000-313	2018	- 004	- 00

NARRATIVE

A. PLANT STATUS

Arkansas Nuclear One, Unit 1 (ANO-1) was operating at 100% rated thermal power (RTP). There were no other structures, systems, or components (SSCs) that were inoperable at the time that contributed in the event.

B. BACKGROUND

The Baker Instrument Explorer Motor Test is performed for the purpose of gathering performance monitoring data on various motors. The test is intended for use in detection of process, motor health, input power, and other dynamic electrical problems with electric motors.

With respect to this event, the equipment was being used to test the ANO-1 Main Chiller motor at the respective 4160V non-vital switchgear. As the technicians were in the process of securing from the test and in accordance with the Entergy fleet procedure, the bus voltage reference test “clips” were being removed from the energized negative sequence relay wire ring terminals located in the switchgear breaker. Although an engineering change had previously been developed to replace existing terminal block wiring termination screws with threaded banana jack adapters on 4160V and 6900V switchgear; however, this modification had not yet been evaluated for this specific breaker. The subject test points are in close proximity to one another and also to a ground reference.

C. DESCRIPTION OF EVENT

On December 18, 2018, ANO-1 was completing the Baker test of the Main Chiller motor while operating at 100% RTP. After removing two of the three voltage test clips, an arc was observed upon removal of the third voltage test clip from the wire ring terminal on the negative sequence relay. The arc caused the two fuses in Phase A to open in order to protect the 4160V non-vital bus Control Power Transformer (CPT). The loss of control power to the under voltage protective relay circuit of the bus resulted in the opening of the unit Auxiliary Transformer feeder breaker to the bus, causing the bus to de-energize. The loss of the non-vital 4160V bus resulted in the loss of power to the respective vital 4160V bus, which subsequently resulted in the automatic start and connection of the associated Emergency Diesel Generator (EDG), restoring power to the vital 4160V bus.

The loss of the non-vital 4160 volt bus caused a loss of one of the two operating condensate pumps, and inability for the standby pump to auto start due to being powered from the bus that was lost. ANO-1 is designed such that the loss of two condensate pumps at RTP would result in an automatic plant runback to approximately 40% power at 30%/minute. However, the runback did not occur due to a faulty fuse holder in the associated Integrated Control System (ICS), which prevented the ICS from recognizing that two condensate pumps had been lost. Subsequently, the suction pressure available to the Main Feedwater (MFW) pumps lowered. The resulting under-feed condition caused both MFW pumps to increase speed in an attempt to maintain Steam Generator levels. The ICS, recognizing a mismatch between MFW flow and reactor power, began automatically lowering reactor power. After approximately 7 seconds, one MFW pump tripped, which resulted in an automatic signal from ICS to runback the plant to approximate 40% power. Because of the initial failure to initiate an automatic runback upon the loss of two condensate pumps, an unrecoverable condition was created that resulted in an automatic reactor trip on high Reactor Coolant System (RCS) pressure.

As designed, the reactor trip resulted in a main generator lockout which provided the logic necessary for the Startup Transformer feeder breaker to the affected non-vital 4160V bus to close and re-energized the bus from an offsite power source.

Event Sequence

10:00:00 Performance of an online (dynamic) motor electrical test for the Main Chiller compressor motor began with ANO-1 operating at 100% power.

11:20:00 Testing completed and technicians began disconnecting the voltage test clips and current test clamps used to connect the Baker Explorer test unit to the energized negative sequence relay.

11:25:00 An arc was observed while removing the voltage clip from the wire ring terminal of the energized negative sequence relay. This resulted in opening the two fuses in Phase A of the associated CPT and negative sequence relay circuit causing the actuation of the subject non-vital 4160V bus under voltage protection relay.

11:25:26 Non-vital 4160V bus A Phase CPT fuse opened; bus voltage indication lost.

11:25:28 Under voltage condition on respective 480V buses.
Loss of the non-vital 4160V bus from unit Auxiliary Transformer.

11:25:28 Approximate time EDG start.

11:25:30 RCS pressure rising.
Respective vital 4160V bus feeder breaker from non-vital 4160V bus tripped.

11:25:39 EDG connected to respective vital 4160V bus.
MFP trip alarm.

11:26:29 Reactor Protection System (RPS) Channel C tripped on high RCS pressure.

11:26:30 RPS Channel A tripped on high RCS pressure; reactor trip.
Startup Transformer #1 (SU1) connected to non-vital 4160V buses
Aforementioned 480V bus under voltage condition cleared

11:31:18 Affected non-vital 4160V bus indicating no voltage, but is energized from SU1.

The unit was stabilized in Mode 3 following the transient. Event Notification number 53793 documents the initial NRC notification.

D. EVENT CAUSES

The direct cause of the event was determined to be an electrical arc event when removing the test leads due to the close proximity of the test lead to ground.

The first causal factor of the event was that maintenance technical fundamentals were not consistently applied. Control of maintenance procedures provide guidance and expectations that hardened barriers are to be in place when lifting and landing leads when possible. Due to the close proximity of the components this area, the technicians did not install barriers. This was considered acceptable due to normalizing risk based on previous success of similar work when hardened barriers where not used.

In addition, the technician performing the evolution was not designated in the pre-job brief as the individual to disconnect the test equipment from the switchgear. The technician's role changed at the job site. This played a part in the event because by not being the individual who installed the equipment, the technician who removed the test lead was not familiar with the close conditions of the work site and the risk of the nearby ground. Additionally, this was the first time the individual had performed this task and the first time the individual had used the specific sized test leads.

The second causal factor involved the failure to identify and mitigate bus trip risk during the performance of electrical testing. The scope of the component and operational impact statements for the work order package focused on the potential Main Chiller maintenance impacts to the plant. Impact reviews did not recognize the risk or plant impact associated with a potential loss of the associated non-vial 4160V bus, largely due to past successful performances of the testing on other equipment and ineffective consideration of industry operating experience. The reviews also did not recognize the close proximity of the connection points for the test equipment.

The third causal factor involved the failure to have engineered test points installed based on previous operating experience.

E. CORRECTIVE ACTIONS

The following corrective actions are in progress with the longest process-related action due date being May 23, 2019: The actions listed below are not all inclusive.

Plant electrical work activities that require use of non-engineered test points, jumper installation, or lifted leads with the system in service which have the potential to cause a plant trip, transient, or entry into a Technical Specification Limiting Condition of Operation, will be identified early in the work management process. These identified activities will require a cross-discipline review focusing on potential consequences, the probability of an event occurring during the performance of the work, and the development of mitigation actions where appropriate. The associated fleet work management procedure will be revised to address this information.

Performance management and training will also be evaluated, and engineered test points, where needed, will be installed on bus breakers during the appropriate outage.

F. SAFETY CONSEQUENCES

This event had no actual safety consequences impacting plant or public safety. In addition, a risk assessment of this event was performed. Based on the results of this assessment, the risk is considered low.

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G. BASIS FOR REPORTIBILITY

This event is reportable pursuant to the following criteria:

10 CFR 50.73(a)(2)(iv)(A) Any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B) of this section.

Paragraph (B)(1) lists “Reactor protection system (RPS) including: reactor scram or reactor trip”.

Paragraph (B)(8) lists “Emergency AC electrical power systems, including: emergency diesel generators (EDGs)”.

The guidance provided in NUREG 1022 states under 10 CFR 50.73(a)(1):

The holder of an operating license for a nuclear power plant (licensee) shall submit a Licensee Event Report (LER) for any event of the type described in this paragraph within 60 days after the discovery of the event.

H. ADDITIONAL INFORMATION

10 CFR 50.73(b)(5) states that this report shall contain reference to “any previous similar events at the same plant that are known to the licensee.” NUREG 1022 reporting guidance states that term “previous occurrences” should include previous events or conditions that involved the same underlying concern or reason as this event, such as the same root cause, failure, or sequence of events.

A review of the ANO corrective action program and LERs for the previous three years was performed. There were no similar events identified at ANO during this time period.

Energy Industry Identification System (EIIS) codes and component codes are identified in the text of this report as [XX].