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Beaver Valley Power Station, Unit No. 1
Docket No. 50-334 License No. DPR-66
LER 2000-004-00

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

In accordance with Appendix A, Beaver Valley Technical Specifications, the following Licensee Event Report is submitted:

LER 2000-004-00, 10 CFR 50.73(a)(2)(iv), "Inadvertent ESF Actuation Due to Loss of Power to 4kv Emergency Bus."

Lew W. Myers

Attachment

IE22

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NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION
(6-1998)

LICENSEE EVENT REPORT (LER)

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

APPROVED BY OMB NO. 3150-0104 EXPIRES 06/30/2001

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4)

Inadvertent ESF Actuation Due to Loss of Power to 4KV Emergency Bus

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL	REVISION	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									None	
03	30	2000	2000	004	00	04	27	2000	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10)	0 %	20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)
		20.2203(a)(1)	20.2203(a)(3)(i)	50.73(a)(2)(ii)	50.73(a)(2)(x)
		20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71
		20.2203(a)(2)(ii)	20.2203(a)(4)	X 50.73(a)(2)(iv)	OTHER
		20.2203(a)(2)(iii)	50.36(c)(1)	50.73(a)(2)(v)	
		20.2203(a)(2)(iv)	50.36(c)(2)	50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
M. S. Ackerman, Manager Licensing	(412) 393-5203

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

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED	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)

At 1204 on March 30, 2000, an 18 month automatic-load sequencing operating surveillance test was being conducted on the No. 1 Emergency Diesel Generator (EDG) during a refueling outage at the BVPS Unit No. 1. The power to the 4KV 1AE Emergency Bus was being supplied by the operating No. 1 EDG and the 4KV 1AE Emergency Bus was separated from the offsite power sources. Checks of the EDG local alarms were in progress. The EDG output breaker 1E9 unexpectedly tripped open and reclosed three times before the breaker remained open, keeping the 4KV Emergency Bus 1AE de-energized. The opening(s) of the EDG breaker caused the 4KV 1AE Emergency Bus to be de-energized. This produced a valid automatic Engineered Safety Features (ESF) actuation signal of the No. 1 EDG, even though the EDG had already been running. The Control Room operators entered the Abnormal Operating Procedure for loss of an 4KV Emergency Bus and took appropriate immediate actions. Technical Specification (TS) 3.4.1.3 was entered due to Residual Heat Removal System Train A being inoperable. The redundant train's Residual Heat Removal System cooling and spent fuel pool cooling remained available for service. The reactor coolant and spent fuel pool temperature remained constant. At 1228, power was restored to the 4KV 1AE Emergency Bus from the offsite power source. With the normal power for Residual Heat Removal System Train A restored, TS 3.4.1.3 was exited. The receipt of a valid automatic actuation of an EDG start signal is an automatic ESF train actuation and is being reported pursuant to 10CFR50.73(a)(2)(iv) as an automatic actuation of an ESF. The cause of this event was inadequate human performance. This was concluded based on the system operation and EDG/output breaker response matching an incorrect landing of the test jumper lead on Terminal No. 18 rather than on Terminal No. 19 in the EDG local alarm cabinet. There were minimal safety implications to the health and safety of the public.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

PLANT AND SYSTEM IDENTIFICATION

Westinghouse-Pressurized Water Reactor System
Emergency Diesel Generators (EDG) {EK}
4KV Emergency Bus 1AE {EB/BU}

CONDITIONS PRIOR TO OCCURRENCE

Unit 1: Mode 5 at 0 % power

There were no systems, structures, or components that were inoperable that contributed to the event.

DESCRIPTION OF EVENT

At 1204 on March 30, 2000, an 18 month automatic-load sequencing operating surveillance test was being conducted on the No. 1 Emergency Diesel Generator (EDG) {EK} during a refueling outage at the Beaver Valley Power Station (BVPS) Unit No. 1. The power to the 4KV 1AE Emergency Bus was being supplied by the operating No. 1 EDG and the 4KV 1AE Emergency Bus was separated from the offsite power sources. Checks of the EDG local alarms were in progress. The EDG output breaker 1E9 unexpectedly tripped open and reclosed three times before the breaker remained open, keeping the 4KV Emergency Bus 1AE de-energized. The opening(s) of the EDG breaker caused the 4KV 1AE Emergency Bus to be de-energized. This produced a valid automatic Engineered Safety Features (ESF) actuation signal for the No. 1 EDG, even though the EDG had already been running.

The Unit was operating in Mode 5 with the opposite train as priority. Thus the redundant 4KV 1DF Emergency Bus remained unaffected by this event. The Control Room entered the Abnormal Operating Procedure for loss of a 4KV Emergency Bus and took appropriate immediate actions. Technical Specification 3.4.1.3, which requires two operable Residual Heat Removal System trains with less than 23 feet of water in the refueling cavity in Mode 5, was entered due to Residual Heat Removal System Train A being inoperable. The redundant train's Residual Heat Removal System cooling and spent fuel pool cooling remained available for service. The reactor coolant temperature and spent fuel pool temperature remained constant. At 1228, power was restored to the 4KV 1AE Emergency Bus from the offsite power source. With the normal power for Residual Heat Removal System Train A restored, Technical Specification 3.4.1.3 was exited. A critique was held following the event.

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REPORTABILITY

De-energizing the 4KV 1AE Emergency Bus actuates an automatic EDG start signal and subsequent output breaker 1E9 closure. The receipt of a valid automatic actuation of an EDG start signal is an automatic ESF train actuation. The EDG had been running; however, the output breaker opened and reclosed three times before remaining open, in response to the automatic EDG start actuation signal. Therefore this condition is being reported pursuant to 10CFR50.73(a)(2)(iv) as an automatic actuation of an ESF. This automatic actuation of ESF was reported pursuant to 10CFR 50.72(b)(2)(ii) at 1545 on March 30, 2000 when the issue was initially identified.

ANALYSIS OF EVENT

Operating Surveillance Test 1OST-36.3, 'Diesel Generator No. 1 Automatic Test', was being performed pursuant to Technical Specifications 4.3.2.1.1 and 4.8.1.1.2. This automatic load sequencing test is required to be performed on an 18 month interval and is normally performed during a refueling outage. The BVPS Unit 1 EDG No. 1 had started, loaded as required (except for step 1 and step 2 loading anomalies discussed later) and was carrying the 1AE bus for approximately 35 minutes with checks of the EDG local alarms in progress when the EDG output breaker unexpectedly opened. Following the event, the Sequence Of Events Report (SER) computer printout, the system design and the field walkdown information was reviewed and it was concluded that an electrical protection trip did not occur.

After troubleshooting, it was concluded that a test jumper lead was inadvertently landed on Terminal No. 18 for the EDG overspeed alarm (which energized the OT and OTR relays), rather than being landed on Terminal No. 19 to energize the raw water alarm as directed by the OST. Relay OT tripped the EDG output breaker and relay OTR (while energized) blocked the close function on the breaker. After a short time period, the test jumper lead was removed by the electrician and re-landed on Terminal 19 in an attempt to obtain a better connection to energize the raw water alarm. [The electrician did not recall ever landing the lead on Terminal 18.] Following this re-landing, the raw water alarm was verified to be energized, as expected per the OST.

It was concluded that when the test jumper lead was removed from Terminal 18, relay OTR dropped out and reinstated the breaker close permissive. This is when the EDG breaker re-closed. However, the OT relay remained latched and immediately caused the breaker to trip. When the EDG breaker

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ANALYSIS OF EVENT (Continued)

opened, which results in a de-energized emergency bus, the undervoltage scheme was reinstated and after a one second time delay (62-VE100), relay 62-VE100X5 picked up and supplied the breaker control circuit with a close permissive which also includes a one second time delay (62-1E9). Then the breaker would re-close and trip due to the still maintained OT relay. This occurred several times until the breaker remained open. Although not affecting the actuation of the ESF, there was an anomaly noted following the ESF actuation. The breaker would have continued to cycle open and closed except that relay 69-VE100 was believed to be working only intermittently. This intermittent relay operation is also believed to be the basis for the slightly slower step 1 and step 2 bus-loading time frames which were observed previously, at the start of the OST when the 1AE Emergency Bus was initially de-energized per the OST procedure. The removed relay 69-VE100 was as-found tested and then repeatedly cycled without replicating any failure. As a conservative measure, the 69-VE100 relay was replaced with a new relay. Additional subsequent testing of the under voltage scheme components also produced no identified deficiencies. When the test jumper lead was landed on Terminal No. 18, the overspeed trip circuits were operating in a condition for which they were neither designed nor anticipated to be operated since the EDG remained operating. Thus these conclusions are based on matching the observed conditions and an evaluation of the component arrangements.

CAUSE OF THE EVENT

The cause of this event was inadequate human performance. This was concluded based on the system operation and EDG/output breaker response matching an incorrect landing of the test jumper lead on Terminal No. 18 rather than on Terminal No. 19 in the EDG local alarm cabinet as was believed by the test electrician performing the action. Landing the test jumper lead initially on Terminal No. 18, which is adjacent to Terminal No. 19, caused the EDG output breaker to trip and remain open. The test electrician acknowledged that the test jumper lead was initially landed without obtaining the associated anticipated alarm response. The test jumper lead was removed, re-landed on Terminal No. 19 and then the expected alarm response was received. Upon lifting of the test jumper lead from Terminal No. 18 to re-land, the EDG output breaker began cycling due to the running engine and the de-energizing of the OTR relay. Relay OT remained latched which maintained a trip of the EDG breaker. It was concluded that this was a self checking failure by the test performer to verify a test jumper lead was being landed on the proper terminal.

SAFETY IMPLICATIONS

The BVPS No. 1 EDG was undergoing a surveillance test when the 4KV 1AE emergency bus was inadvertently de-energized. This surveillance test is required to be performed during a plant shutdown, when only one EDG is required to remain operable pursuant to Technical Specifications. The redundant 4KV emergency bus (1DF) and its associated EDG (No. 2) were operable and remained operable throughout this event, which meets Technical Specifications 3/4.8.2.2 and 3/4.8.1.2, respectively.

De-energizing the 4KV 1AE Emergency Bus in Mode 5 removed one train of reactor decay heat cooling and spent fuel pool cooling. However, the redundant train reactor decay heat cooling and spent fuel pool cooling remained available. Decay heat was not high since the unit had been off line for more than 30 days. The reactor coolant temperature and spent fuel pool temperature remained constant. Other BVPS Unit 1 systems required to be operable in Mode 5 by Technical Specifications were maintained by the offsite power source which energized the redundant emergency bus (1DF). Power was restored to the 4KV 1AE emergency bus from the offsite power source after 24 minutes. Thus, there was minimal impact to the unit and there were minimal safety implications to the health and safety of the public.

With the reactor shutdown, there was no impact to the current PRA Core Damage Frequency (CDF), since the BVPS PRA does not model shutdown modes.

CORRECTIVE ACTIONS

1. Relay 69-VE100, which is believed to have caused the initial slow EDG step 1 and 2 loading and then the cessation of the EDG breaker cycling after three cycles following the de-energizing of 1AE Emergency Bus, was replaced.

2. Various EDG alarms and design functions were re-tested to verify acceptable operation. No discrepancies were identified.

3. The 18 month automatic load sequencing operating surveillance test, 1OST-36.3, was subsequently performed satisfactorily on April 1, 2000.

4. The local testing of the EDG alarms is not needed to satisfy Technical Specification requirements. The local testing of the EDG alarms will be relocated out of the 18 month automatic load sequencing operating surveillance test into another test when the EDG will not be running.

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CORRECTIVE ACTIONS (Continued)

5. Disciplinary action was taken with the electrician performing the test. The technician who was aiding the electrician was counseled.

6. Maintenance management has discussed this event and its consequences with electrical, mechanical, relay and I&C maintenance technicians to reaffirm the need to perform adequate self checking during maintenance activities and other human performance standards.

The above actions will be tracked and completed as part of the corrective action program.

PREVIOUS SIMILAR EVENTS

A review of LERs for Beaver Valley Power Station Unit 1 and Unit 2 identified four occurrences involving operating issues with automatic ESF actuations of Emergency Diesel Generator/Emergency Bus within the last three years.

BVPS Unit 1 LER 97-005, Inadvertent Operation of 345KV Bus Backup Timer Relay Results in Dual Unit Reactor Trips.

BVPS Unit 1 LER 97-032, Emergency Diesel Generator Automatic Start During Bus Transfer from Unit to System Station Transformer.

BVPS Unit 2 LER 99-005, 4KV-2A Bus Trip on Ground Overcurrent Relay 51-VA207X.

BVPS Unit 2 LER 99-006, Loss of Beaver Valley Power Station Unit No. 2 4KV Train 'B' Forced Shutdown Due to Inoperable Emergency Diesel Generator.