



FirstEnergy Nuclear Operating Company

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10 CFR 50.73

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

SUBJECT:
Beaver Valley Power Station, Unit No. 1
Docket No. 50-334, License No. DPR-66
LER 2007-002-00

Enclosed is Licensee Event Report (LER) 2007-002, "Undetected Loss of 138 kV 'A' Phase to System Station Service Transformer Leads to Condition Prohibited by Plant Technical Specification."

There are no regulatory commitments contained in this submittal. Any actions discussed in this document that represent intended or planned actions are described for the NRC's information, and are not regulatory commitments.

If you have questions or require additional information, please contact Mr. Colin P. Keller, Manager, Regulatory Compliance at 724-682-4284.

Sincerely,

Peter P. Sena III

Attachment

- c: Mr. S. J. Collins, NRC Region I Administrator
- Mr. D. L. Werkheiser, NRC Senior Resident Inspector
- Ms. N. S. Morgan, NRR Project Manager
- INPO Records Center (via electronic image)
- Mr. L. E. Ryan (BRP/DEP)

JE22
NRR

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

Estimated burden per response to comply with this mandatory collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@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.

1. FACILITY NAME Beaver Valley Power Station Unit Number 1	2. DOCKET NUMBER 05000334	3. PAGE 1 of 7
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4. TITLE
Undetected Loss of 138 kV 'A' Phase to System Station Service Transformer Leads to Condition Prohibited by Plant Technical Specification

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
11	27	2007	2007	002	00	01	25	2008	None	
									FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE 1	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)									
10. POWER LEVEL 100	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)						
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(a)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)						
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)						
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)						
	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)						
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)						
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)						
<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER							
<input type="checkbox"/> 20.2203(a)(2)(vi)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A							

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME Colin P. Keller, Manager, Regulatory Compliance	TELEPHONE NUMBER (Include Area Code) (724) 682-4284
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13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	EA	XFMR	Kuhlman	Y					

14. SUPPLEMENTAL REPORT EXPECTED				15. EXPECTED SUBMISSION DATE		
<input type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE). <input checked="" type="checkbox"/> NO				MONTH	DAY	YEAR

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

During a non-routine walkdown of the offsite switchyard on 11/27/2007, a site construction supervisor discovered that the 'A' phase conductor on a Beaver Valley Power Station Unit No. 1 (BVPS-1) three-phase 138 kV power line had broken off in the switchyard. This break occurred between the offsite feeder breaker and the line running onsite to the 'A' train System Station Service Transformer (SSST) located inside the site security fence. The station declared the 'A' train offsite power circuit inoperable and entered BVPS-1 Technical Specification (TS) 3.8.1 Condition A for one of the two required offsite circuits inoperable. Subsequent evaluation concluded that the break on the 138 kV phase 'A' occurred on 11/01/2007 based upon review of offsite and onsite computer-based grid line information. Since the undetected SSST failure that occurred on 11/01/2007 was not restored within 72 hours as required by TS 3.8.1 Action A, this was a condition prohibited by plant Technical Specifications and is reportable pursuant to 10 CFR 50.73(a)(2)(i)(B).

The root cause of this event is knowledge-based error. Site personnel did not fully recognize the characteristics of the three legged WYE-G / WYE-G WYE-G secondary core form transformer design, leading to a surveillance procedure weakness in detecting power line failures. With this type of transformer, it is difficult to sense a phase loss through only voltage measurements, even under moderate loading conditions. If site personnel had known the characteristics of this type of transformer, adequate indication and surveillance acceptance criteria may have been provided to detect an open phase. The safety significance of this event was very low.

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PLANT AND SYSTEM IDENTIFICATION

Westinghouse - Pressurized Water Reactor {PWR}
 138 kV Offsite Feed to System Station Service Transformer (which supplies 4.16 kV Onsite AC Power) {EA}

CONDITIONS PRIOR TO OCCURRENCE

Unit 1: Mode 1 at 100 percent power.

There were no systems, structures, or components beyond the 'A' train 138 kV line that were inoperable at the start of the event that contributed to the event.

DESCRIPTION OF EVENT

During a non-routine walkdown of the offsite switchyard on 11/27/2007, a site construction supervisor discovered that the 'A' phase conductor on a Beaver Valley Power Station Unit No. 1 (BVPS-1) three-phase 138 kV power line had broken off in the switchyard. This break occurred between the offsite feeder breaker (OCB-92-FDS) and the line running onsite to the 'A' train System Station Service Transformer (SSST) located inside the site security fence. The switchyard walkdown was being performed to investigate line voltage differences. The terminal broke on the switchyard side of a Revenue Metering Current Transformer/Voltage Transformer (CTVT), which was installed in 2006 to track the station's power usage through this line. During normal station power operation, there is no appreciable current going through this 138 kV line as the station busses (loads) are normally powered from the unit generator. [See simplified power sketch on page 7.]

The station declared the 'A' train offsite power circuit inoperable at 0955 hrs on 11/27/2007 and entered BVPS-1 Technical Specification 3.8.1 Condition A for one of the two required offsite circuits inoperable. The subject line was repaired and the 'A' train offsite power circuit was declared operable at 1253 hours on 11/28/2007, exiting Technical Specification 3.8.1 Condition A.

Subsequent evaluation concluded that the break on the 138 kV phase 'A' occurred on 11/01/2007 based upon review of offsite and onsite computer-based grid power line information for the loss of current on the open phase. The failure was not identified by any BVPS alarm at that time. During a offsite power surveillance performed on 11/14/2007, minor voltage variations were noted between the 'A' train SSST three phases. The 'A' train SSST Load Tap Changer had to be placed in manual in order to return its phase voltages to

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within specification. A condition report was added to the corrective action program to document that the Load Tap Changer was not correctly controlling the SSST voltage in the automatic mode.

BVPS-1 Technical Specification Surveillance Requirement 3.8.1.1 states "Verify correct breaker alignment and indicated power availability for each required offsite circuit" and is required to be performed on a 7 day frequency. This surveillance is performed at BVPS-1 by site procedure 1OST-36.7 and was successfully completed on 11/02/2007, 11/07/2007, 11/08/2007, 11/14/2007 (twice), and 11/21/2007 without identifying the 138 kV phase 'A' open circuit. This surveillance checks breaker alignments and phase-to-phase voltage on the secondary side (plant side) of the SSST.

Subsequent investigation determined that acceptable secondary phase-to-phase voltage can be indicated during a lack of the 138 kV 'A' phase on the primary side of the SSST due to induced voltage from the 'B' and 'C' primary phases when there is no appreciable load on the transformer. If the SSST had appreciable loads without one of the three primary phases, significant phase-to-phase imbalances would occur and would be recognized on the secondary side voltage instrumentation (assuming the phase imbalances were not significant enough to cause a trip of these operating loads). There is no definitive 138 kV phase amperage indication instrumentation in the BVPS control room. Thus, the site surveillance procedure was not capable of detecting a loss of one phase on the primary side of the SSST when the SSST was carrying no appreciable load.

REPORTABILITY

On 11/27/2007, the line side high voltage terminal to the "A" phase revenue metering CTVT was found to be failed resulting in an open circuit. This failure de-energized one of the three offsite transformer primary phases ('A' phase) going to the 'A' Train BVPS-1 SSST. Computer information indicated that this phase was lost on 11/01/2007. This failure made the 'A' train SSST inoperable and thus, one of the two BVPS-1 safety related offsite circuits inoperable.

BVPS-1 Technical Specification 3.8.1 Limiting Condition for Operation requires that two qualified offsite circuits between the offsite transmission network and the onsite Class 1E AC Electrical Power Distribution System be operable. With one required offsite circuit inoperable, Required Action A.3 requires that the required offsite circuit be restored to operable within 72 hours. Since the undetected SSST failure that occurred on 11/01/2007 was not restored within 72 hours, this was a condition prohibited by plant Technical Specifications and this condition is reportable pursuant to 10 CFR 50.73(a)(2)(i)(B).

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CAUSE OF EVENT

The most probable cause of the power cable terminal connection failure on the 'A' phase of the 138 kV line was due to an improper manufacturer's brazing process which may have provided less than full design cable holding capability.

The root cause of this event is knowledge-based error. Site personnel did not recognize that the three legged WYE-G / WYE-G WYE-G secondary core form transformer design on the SSST would maintain the voltage on an open phase to nearly the same voltage as the other two (powered) phases during a normal site loading configuration. With this type of transformer, it is difficult to sense a phase loss via only voltage measurements, even under moderate loading conditions. If site personnel had known the characteristics of this type of transformer, adequate indication and surveillance acceptance criteria may have been provided to detect an open phase. A contributing cause is procedure content. The guidance in Operations Surveillance procedure 1OST-36.7 had inadequate acceptance criteria and directed Operations to initiate actions to calibrate the automatic SSST Load Tap Changer control circuitry, making it unlikely that other causes would be aggressively investigated. This contributed to the lengthened time of discovery to find the open phase.

SAFETY IMPLICATIONS

The function of the 138 kV transmission system is to provide an independent offsite power supply to safety related components. The two redundant 138 kV lines are part of the offsite circuits.

With a lack of the 'A' phase on the 'A' train offsite feed from the 138 kV source, a transfer of major site loads from its normal Unit-feed transformer to the System-feed transformer (which would automatically occur upon any loss of the station's main generator) would have resulted in the loss of this offsite power source due to significant phase imbalances with the transfer of these station electrical loads. Thus, there was only one effective offsite electrical circuit, the 'B' train offsite power circuit through the 'B' train SSST, from 11/01/2007 to 11/28/2007.

The plant risk associated with the broken terminal on the "A" phase of the BVPS Unit 1 138 kV offsite feed to the 1A System Station Service Transformer (SSST) that occurred between 11/01/2007 and 11/28/2007, thereby exceeding the TS 3.8.1 LCO and placing the unit in a condition prohibited by Technical Specifications, is considered to be very low, due to the remaining mitigation capability and operator recovery actions that could be

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credited to mitigate the event. This risk assessment includes 7.2 hours when the 'A' train emergency diesel generator was out of service during the 'A' train SSST failure.

Based upon the above, the safety significance of the event condition was very low.

CORRECTIVE ACTIONS

- Several prompt actions were completed. An Operations Standing Order was generated at both BVPS Units to perform a physical walk down of 138 kV transmission lines when the offsite power availability surveillance is performed until the surveillance procedures are revised (the physical walk down is a short term action until a longer term solution is developed). A temporary modification was implemented to remove the Kuhlman Electric Model KA-145 Revenue Metering CTVT on the 'A' phase of the BVPS Unit 1 "A" Train SSST and install a jumper to bypass this removed CTVT, restoring this offsite power circuit to full service.
- Surveillance criteria are being evaluated at both BVPS Units for enhancements to verify offsite power availability under both loaded and unloaded conditions, given the BVPS offsite power configuration and equipment at each Unit. The offsite power availability surveillance at each Unit will then be revised to incorporate this enhanced acceptance criteria. Where appropriate, additional guidance will address the load tap changer operation on the offsite power transformers during both automatic and manual operation.
- Other potential plant enhancements are being evaluated which include increasing the station's ability to detect an open condition on each of the offsite power lines.
- The Revenue Metering CTVTs on the 'B' and 'C' phases of the BVPS Unit 1 and the three phases on the BVPS Unit 2 'A' Train SSSTs have now been removed. The remaining six original Revenue Metering CTVTs on the 'B' Train offsite power lines for the BVPS Unit 1 SSST and BVPS Unit 2 SSST will also be removed. Long term disposition for these revenue meters is under evaluation.
- This event was described in an Operating Experience Report which has been issued to the industry.

Completion of the above and other corrective actions are being tracked through the BVPS corrective action program.

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PREVIOUS SIMILAR EVENTS

A review found one prior BVPS Unit 1 and no prior BVPS Unit 2 Licensee Event Reports within the last five years for an event involving an inappropriate offsite power circuit condition.

- BVPS Unit 1 LER 2003-003, "Automatic Actuation of Emergency Diesel Generator Following Loss of Emergency Bus Offsite Source." This LER event resulted from an unexpected opening of an onsite 4kV feeder breaker due to a false ground overcurrent trip caused by an inappropriate ground relay geometry. Corrective actions originating from LER 2003-003 would not be expected to have prevented the event discussed in LER 2007-002.

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Simplified Unit Electrical Distribution Drawing

