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May 9, 2001
L-01-060

Beaver Valley Power Station, Unit No. 2
Docket No. 50-412 License No. NPF-73
LER 2001-001-00

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 2001-001-00, 10 CFR 50.73(a)(2)(iv), "Automatic Reactor Trip Due to Loss of Condensate Pump."


Lew W. Myers

Attachment



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NAME T. S. Cosgrove, Manager Regulatory Affairs			TELEPHONE NUMBER (Include Area Code) (724) 682-5203																																					
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ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16) <p>On March 17, 2001, at approximately 2113, Beaver Valley Power Station Unit No. 2 received alarms for steam flow/feedwater flow mismatch and 4160 volt motor overcurrent alarms. It was recognized that steam generator water levels were decreasing, a condensate pump had tripped, and a main feedwater pump had tripped. Implementing Abnormal Operating Procedure 2.24.1, Loss of Feedwater, the Nuclear Shift Supervisor ordered a manual reactor trip. However, while this action was being conducted, an automatic reactor trip properly initiated in response to a low-low steam generator water level in the "B" steam generator. All control rods fully inserted into the reactor core and all required safety systems operated as designed. Emergency Operating Procedure E-0 for Reactor Trip was performed and the plant was stabilized in Mode 3. The automatic initiation of a reactor trip by the Reactor Protection System is reportable pursuant to 10 CFR 50.72 (b)(2)(iv)(B) and 10 CFR 50.73(a)(2)(iv)(A).</p> <p>The cause of the automatic trip was the tripping of the "A" Condensate Pump, 2CNM-P21A, due to electrical joint failure of its "C" phase power lead. This failure was attributed to a deficient joint configuration whereby a combination of long term heating, accelerated oxidation, and marginal sizing of the motor cable and terminal lugs resulted in an ultimate catastrophic failure of the joint. The safety significance for this event was small.</p>																																								

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PLANT AND SYSTEM IDENTIFICATION

Westinghouse-Pressurized Water Reactor System
Condensate System {SD}
Main Feedwater System {SJ}

CONDITIONS PRIOR TO OCCURRENCE

Unit 2: Mode 1 at 100 % power

The third (spare) Condensate Pump motor had been previously removed from its normally installed arrangement for refurbishment due to high temperature and vibration. There were no other systems, structures, or components that were inoperable that contributed to the event.

DESCRIPTION OF EVENT

On March 17, 2001, at approximately 2113, Beaver Valley Power Station Unit No. 2 received alarms for steam flow/feedwater flow mismatch and 4160 volt motor overcurrent alarms. It was recognized that steam generator water levels were decreasing, a condensate pump had tripped, and a main feedwater pump had tripped. Implementing Abnormal Operating Procedure 2.24.1, Loss of Feedwater, the Nuclear Shift Supervisor ordered a manual reactor trip. However, while this action was being conducted, an automatic reactor trip properly initiated in response to a low-low steam generator water level in the "B" steam generator. All control rods fully inserted into the reactor core and all required safety systems operated as designed. Emergency Operating Procedure E-0 for Reactor Trip was performed and the plant was stabilized in Mode 3.

This event was initiated by the tripping of Condensate Pump 2CNM-P21A. This, in turn, caused a condensate pump low discharge pressure (and alarm) and low feedwater pump suction pressure (and alarm). This low feedwater pump suction pressure tripped feedwater pump 2FWS-P21A. The loss of the condensate pump and feedwater pump resulted in decreasing steam generator water levels. The decreasing steam generator water level in "B" steam generator initiated the automatic Reactor Protection System trip.

The condensate pump tripped due to a failed connection on the "C" phase where the motor power lead, the motor surge capacitor lead, and the two power feeder cables are connected.

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REPORTABILITY

The automatic initiation of a reactor trip by the Reactor Protection System on March 17, 2001, was a valid reactor trip and was not part of a pre-planned sequence during testing or reactor operation. Therefore this event is reportable pursuant to 10 CFR 50.73(a)(2)(iv)(A). The NRC was notified that an automatic reactor trip occurred at BVPS Unit 2 pursuant to 10 CFR 50.72 (b)(2)(iv)(B) at 0003 hours on March 18, 2001.

CAUSE OF EVENT

The cause of the automatic trip by the Reactor Protection System was the tripping of the "A" Condensate Pump, 2CNM-P21A, due to electrical joint failure of its "C" phase power lead. This failure was attributed to a deficient joint configuration whereby a combination of long term heating, accelerated oxidation, and marginal sizing of the motor cable and terminal lugs resulted in an ultimate catastrophic failure of the joint.

SAFETY IMPLICATIONS

Following the automatic reactor trip, all control rods fully inserted into the reactor core and all required safety systems operated as designed. Emergency Operating Procedure E-0 for Reactor Trip was performed and the plant was stabilized in Mode 3.

This event was a partial loss of main feedwater which is less severe than the design basis event for complete loss of main feedwater. The complete loss of main feedwater is analyzed in BVPS Unit No. 2 UFSAR Section 15.2.7. Comparison of the UFSAR Loss of Feedwater Transient with the March 17, 2001 event indicates that BVPS Unit 2 operated conservatively regarding the UFSAR transient in all comparisons of UFSAR assumptions. The actual plant response on March 17, 2001 was bounded by the UFSAR analysis for a loss of main feedwater transient.

Safety significance of this event is low due to the small conditional core damage probability associated with a partial loss of main feedwater initiating event.

Based on the above, the safety significance of the automatic reactor trip on March 17, 2001 was small.

CORRECTIVE ACTIONS

1. The 2CNM-P21A pump motor lead damage was repaired and the three power lead connections in the lead box were re-terminated, which included corrosion inhibitor. The motor leads were reoriented at the joint connection with the motor power lead sandwiched between the two aluminum feeder leads and the motor capacitor cable on the outside of

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the aluminum leads, rather than the previous feeder-motor capacitor-feeder-motor power lead arrangement. The current arrangement provides the most effective current flow and minimizes possible heating.

2. The failed power lead splice and two additional motor cable lugs were removed from the 2CNM-P21A condensate pump motor and sent out for laboratory analysis. The "A" phase power lead that was re-terminated in 1992 showed residual corrosion inhibitor and no signs of corrosion. However, the "B" phase power lead which was from original installation showed no residual corrosion inhibitor and some signs of corrosion within the crimped connection. The laboratory results were used to formulate the root cause.
3. An evaluation was performed on the motor cable and lug sizing. It was determined that the motor lead sizing is marginal. The evaluation also determined that these motor leads can continue to be used, until they can be altered during future planned modifications.
4. An extent of condition review was performed for other aluminum to copper motor terminations on BVPS Unit 2. Aluminum cables were identified on the three Condensate Pump and the four Main Feedwater Pump motors. The "A" Condensate Pump motor lead connections were completely refurbished due to the failure. The "C" Condensate Pump motor has been released from the vendor for modification. Two of the four Main Feedwater Pump motor leads were inspected and found to be in good visual condition. Work orders were written to perform a future inspection of the motor lead connections on the "B" Condensate Pump motor and two remaining Main Feedwater pump motors. Since the "B" Condensate Pump and the four Main Feedwater Pump motors' leads were recently removed and inspected during the last refueling outage, it is not expected that the dissimilar metal leads in the "B" Condensate and the two remaining Main Feedwater Pump motors could have degraded since they were last inspected. The motor lead configuration on the "B" and "C" Condensate Pump motors will be optimally configured during their inspection.
5. An extent of condition review was performed for other aluminum to copper motor terminations on BVPS Unit 1. One work order was written to perform a future inspection on one fan motor.
6. Additional enhancements are being pursued through the corrective action program.

Corrective action completion is being tracked through the corrective action program.

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PREVIOUS SIMILAR EVENTS

A review of the Licensee Event Reports found no similar events at BVPS Unit 2 involving reactor trips associated with the Feedwater/Condensate System within the last four years. There were two events at Unit 1 involving a reactor trip associated with the main feedwater system:

LER 1-98-028, "Automatic Reactor Trip on 'A' Steam Generator Low Level Coincident with Steam Flow/Feed Flow Mismatch Signal from Manual Tripped Transmitter Bistables of F-MS-475."

LER 1-97-025, "Ground in Feedwater Flow Controller Results in High Steam Generator Level and Subsequent Turbine Trip/Reactor Trip."