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February 4, 2002  
L-02-014

***Beaver Valley Power Station, Unit No. 1***  
***Docket No. 50-334 License No. DPR-66***  
***LER 2001-004-00***

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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 2001-004-00, 10 CFR 50.73(a)(2)(iv)(A), "Manual Reactor Trip Due to Loss of Station Instrument Air."

A handwritten signature in cursive script, appearing to read "Lew W. Myers", is written over a horizontal line.

Lew W. Myers

Attachment

LER 2001-004-00

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|   |        |   |                        |   |        |  |     |                                     |               |   |  |
|---|--------|---|------------------------|---|--------|--|-----|-------------------------------------|---------------|---|--|
| <b>NRC FORM 366</b><br>(7-2001)   |        | <b>U.S. NUCLEAR REGULATORY COMMISSION</b> |                        | <b>APPROVED BY OMB NO. 3150-0104</b><br>Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@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 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. |        | <b>EXPIRES 7-31-2004</b>   |     |                                     |               |   |  |
| <b>LICENSEE EVENT REPORT (LER)</b><br>(See reverse for required number of digits/characters for each block)   |        |   |                        |   |        |  |     |                                     |               |   |  |
| <b>1. FACILITY NAME</b><br>Beaver Valley Power Station Unit No. 1   |        |   |                        | <b>2. DOCKET NUMBER</b><br>05000334   |        | <b>3. PAGE</b><br>1 OF 5   |     |                                     |               |   |  |
| <b>4. TITLE</b><br>Manual Reactor Trip Due to Loss of Station Instrument Air  |        |   |                        |   |        |  |     |                                     |               |   |  |
| <b>5. EVENT DATE</b>  |        |   | <b>6. LER NUMBER</b>   |   |        | <b>7. REPORT DATE</b>  |     | <b>8. OTHER FACILITIES INVOLVED</b> |               |   |  |
| MO  | DAY    | YEAR                                      | YEAR                   | SEQUENTIAL NUMBER   | REV NO | MO   | DAY | YEAR                                | FACILITY NAME | DOCKET NUMBER   |  |
| 12  | 07     | 2001                                      | 2001 – 004 – 00        |   |        | 02   | 04  | 2002                                | None          |   |  |
| <b>9. OPERATING MODE</b>  |        |   | <b>10. POWER LEVEL</b> |   |        | <b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)</b> |     |                                     |               |   |  |
| 1   |        |   | 100                    |   |        |  |     |                                     |               |   |  |
|   |        |   | 20.2201(b)             |   |        | 20.2203(a)(3)(ii)  |     | 50.73(a)(2)(ii)(B)                  |               | 50.73(a)(2)(ix)(A)  |  |
|   |        |   | 20.2201(d)             |   |        | 20.2203(a)(4)  |     | 50.73(a)(2)(iii)                    |               | 50.73(a)(2)(x)  |  |
|   |        |   | 20.2203(a)(1)          |   |        | 50.36(c)(1)(i)(A)  |     | X 50.73(a)(2)(iv)(A)                |               | 73.71(a)(4)   |  |
|   |        |   | 20.2203(a)(2)(i)       |   |        | 50.36(c)(1)(ii)(A)   |     | 50.73(a)(2)(v)(A)                   |               | 73.71(a)(5)   |  |
|   |        |   | 20.2203(a)(2)(ii)      |   |        | 50.36(c)(2)  |     | 50.73(a)(2)(v)(B)                   |               | OTHER<br>Specify in Abstract below or in<br>NRC Form 366A |  |
|   |        |   | 20.2203(a)(2)(iii)     |   |        | 50.46(a)(3)(ii)  |     | 50.73(a)(2)(v)(C)                   |               |   |  |
|   |        |   | 20.2203(a)(2)(iv)      |   |        | 50.73(a)(2)(i)(A)  |     | 50.73(a)(2)(v)(D)                   |               |   |  |
|   |        |   | 20.2203(a)(2)(v)       |   |        | 50.73(a)(2)(i)(B)  |     | 50.73(a)(2)(vii)                    |               |   |  |
|   |        |   | 20.2203(a)(2)(vi)      |   |        | 50.73(a)(2)(i)(C)  |     | 50.73(a)(2)(viii)(A)                |               |   |  |
|   |        |   | 20.2203(a)(3)(i)       |   |        | 50.73(a)(2)(ii)(A)   |     | 50.73(a)(2)(viii)(B)                |               |   |  |
| <b>12. LICENSEE CONTACT FOR THIS LER</b>  |        |   |                        |   |        |  |     |                                     |               |   |  |
| NAME  |        |   |                        |   |        | TELEPHONE NUMBER (Include Area Code)   |     |                                     |               |   |  |
| L. R. Freeland, Manager Regulatory Affairs  |        |   |                        |   |        | (724) 682-5284   |     |                                     |               |   |  |
| <b>13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT</b>  |        |   |                        |   |        |  |     |                                     |               |   |  |
| CAUSE   | SYSTEM | COMPONENT                                 | MANU-FACTURER          | REPORTABLE TO EPIX  |        |  |     |                                     |               |   |  |
|   |        |   |                        |   |        |  |     |                                     |               |   |  |
| <b>14. SUPPLEMENTAL REPORT EXPECTED</b>   |        |   |                        |   |        | <b>15. EXPECTED SUBMISSION DATE</b>  |     | MONTH                               | DAY           | YEAR  |  |
| YES (If yes, complete EXPECTED SUBMISSION DATE)   |        |   |                        |   |        | X  | NO  |                                     |               |   |  |
| <b>16. ABSTRACT</b> (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)  |        |   |                        |   |        |  |     |                                     |               |   |  |
| <p>At 1353 hours on December 7, 2001, the operating station air compressor 1SA-C-1A tripped while station air compressor 1SA-C-1B was de-energized for preventive maintenance. The running compressor tripped due to a blown fuse in its control circuitry. The blown fuse was caused by a short circuit that was the result of uninsulated screwdriver contact in an energized circuit between compressors 1SA-C-1A and 1SA-C-1B. The on-shift operations crew responded per the appropriate alarm response procedure, and entered Abnormal Operating Procedure (AOP) 1.34.1, "Loss of Station Instrument Air". Operators were dispatched locally to compressor 1SA-C-1A, the compressor's supply breaker and to the backup diesel air compressor 1SA-C-2. A local start of 1SA-C-1A was unsuccessful due to the blown control power fuse. The backup diesel air compressor was started and placed in service; however, system pressure had already reached an abnormally low level and the backup diesel compressor was unable to restore system pressure due to insufficient capacity. The low system air pressure caused Loop 1C main steam trip valve, TV-1MS-101C, to begin to close as indicated by alarm "Steamline Stop Valve Not Fully Open". At 1401 hours, Beaver Valley Power Station (BVPS) Unit 1 reactor was manually tripped due to the loss of station air in accordance with AOP-1.34.1. 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 direct cause for the manual trip was a loss of station air due to the unavailability of both station air compressors. The root cause of the event was determined to be the failure of the station work process to adequately plan, review, control, assign risk significance, and provide adequate oversight for work activities. This event is reportable pursuant to 10 CFR 50.72 (b)(2)(iv)(B) and 10 CFR 50.73(a)(2)(iv)(A) as a valid reactor trip and was not part of a pre-planned sequence during testing or reactor operation. The safety significance of this event was low.</p> |        |   |                        |   |        |  |     |                                     |               |   |  |

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## PLANT AND SYSTEM IDENTIFICATION

Westinghouse-Pressurized Water Reactor (PWR)  
Station/Instrument Air System (LD)

## CONDITIONS PRIOR TO OCCURRENCE

Unit 1: Mode 1 at 100 % power

Station air compressor 1SA-C-1B was inoperable/unavailable due to maintenance and was therefore unavailable to mitigate the loss of station air pressure event. There were no other system, structures or components that were inoperable that contributed to the event.

## DESCRIPTION OF EVENT

On December 7, 2001, Unit 1 station air compressor 1SA-C-1B was de-energized for preventive maintenance. Electricians were performing preventative maintenance tasks inside the control panel of station air compressor 1SA-C-1B when an uninsulated screwdriver shaft made contact with an energized circuit. An energized cross-tie circuit exists between the Unit 1 station air compressors 1SA-C-1A and 1SA-C-1B that provides a start signal to the standby compressor upon a trip of the operating compressor. The screwdriver contact created a short circuit and a blown fuse in the control circuitry, which resulted in a trip of the operating station air compressor 1SA-C-1A. With the loss of the operating compressor, the station air header pressure decreased due to normal station air demand. At 1353 hours the low station air pressure alarm was received in the control room. The on-shift operations crew responded per the appropriate alarm response procedure, and entered Abnormal Operating Procedure (AOP) 1.34.1, "Loss of Station Instrument Air". Operators were dispatched locally to station air compressor 1SA-C-1A, the compressor's supply breaker and to the backup diesel air compressor 1SA-C-2. A local start of 1SA-C-1A was unsuccessful due to the blown control power fuse. The backup diesel air compressor was successfully started and placed in service; however, system pressure had already reached an abnormally low level and the backup diesel compressor was unable to restore system pressure due to insufficient capacity. At 1401 hours the low system air pressure caused Loop 1C main steam trip valve, TV-1MS-101C, to begin closing as indicated by alarm "Steamline Stop Valve Not Fully Open". AOP 1.34.1 directs the operators to manually trip the reactor upon receipt of indication that a main steam isolation (trip) valve (MSIV) begins to close in order to mitigate an MSIV closure transient from occurring. Therefore, at 1401 hours, operators manually tripped the Unit 1 reactor due to the loss of station air in accordance with AOP-1.34.1. 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.

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## REPORTABILITY

The manual initiation of a reactor trip via the Reactor Protection System by the BVPS Unit 1 control room operator on December 7, 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 50.72 (b)(2)(iv)(B) and 10 CFR 50.73(a)(2)(iv)(A). The NRC was notified that a manual reactor trip occurred at BVPS Unit 1 pursuant to 10 CFR 50.72 (b)(2)(iv)(B) at 1623 hours on December 7, 2001 (EN# 38548).

## CAUSE OF EVENT

The direct cause for the manual trip was a loss of station air due to the unavailability of both station air compressors. Operator action was taken to manually trip the reactor when the Loop 1C main steam trip valve, TV-1MS-101C, started to close as indicated by a alarm "Steamline Stop Valve Not Fully Open". The loss of station air resulted when 1SA-C-1A tripped due to a blown fuse in the control circuitry while 1SA-C-1B was de-energized for maintenance. The root cause of the event was determined to be the failure of the station work process to adequately plan, review, control, assign risk significance, and provide adequate oversight for work activities on important plant equipment.

The following six barriers were breached in the events that led up to the trip of the operating compressor (1SA-C-1A) on December 7, 2001:

1. Work Planning Barrier: Planning of work package was ineffective in identifying the presence of an energized cross-tie circuit in the Unit 1 station air compressors 1SA-C-1A and 1SA-C-1B. Details of the work instructions for the preventative maintenance task was inadequate, drawing review/knowledge of staff was less than adequate, and assignment of proper risk to the work package was impeded by the lack of a critical component list.
2. Scheduling Barrier: Pre-approval of work packages well in advance of work being scheduled did not provide adequate opportunity to review the risk related to work being performed given specific plant conditions.
3. Clearance Barrier: Clearance preparation and review did not identify the presence of the energized crosstie circuit prior to hanging the clearance. The shared control circuitry drawing for compressors 1SA-C-1A and 1SA-C-1B made it difficult to identify the common circuit between the compressors.
4. Craft Barrier: Electricians did not identify the presence of cross-tie circuit in work package walkdown, briefing, or checks for energized circuits. Additionally, the electrician failed to use properly insulated tools to perform work per station expectations.

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5. Management Oversight Barrier: Morning managers meeting discussion of the station air compressor preventative maintenance program was ineffective in identifying the presence of the cross-tie circuit or true risk of performing the maintenance work as planned.
6. Corrective Action Process Barrier: Past condition and problem reports for the Unit 1 station air compressors could have provided an opportunity to identify the presence of the energized cross-tie circuit. None of these previous events resulted in a loss of the station air compressors, however; the circuit issues identified in these condition and problem reports could have raised the level of 'questioning attitude' related to how the circuit design was developed.

In addition, station personnel did not fully understand the limitations of the diesel air compressor 1SA-C-2, which did not have an automatic start feature on low air pressure or sufficient capacity to recover station air pressure to prevent the need for a manual reactor trip. This led to a false sense of security that 1SA-C-2 was an adequate contingency backup air supply during the time that that 1SA-C-1B was on clearance for preventative maintenance. A corrective action from the June 22, 2001 loss of instrument air event (BVPS Unit 1 LER 2001-001) was to install a larger capacity diesel driven air compressor with an automatic start feature. This air compressor was on site and scheduled for installation within the next several weeks of the December 7, 2001 trip; however, the implementation of this corrective action was not timely to prevent this trip.

## SAFETY IMPLICATIONS

Unit 1 was at normal 100% power operations prior to the manual reactor trip. An evolution was in progress that contributed to the event and impacted plant response. The evolution was the maintenance being performed on station air compressor 1SA-C-1B. Station air compressor 1SA-C-1B was inoperable/unavailable due to maintenance and was therefore unavailable to mitigate the loss of station air pressure event. All ESF systems functioned as expected for this event. The turbine tripped correctly as a result of the reactor trip and the main generator tripped correctly in conjunction with the turbine trip. All of the auxiliary feedwater pumps started correctly and all reactor control rods indicated on bottom following the reactor trip. Emergency Operating Procedure E-0 for Reactor Trip was performed and the plant was stabilized in Mode 3. A comparison of plant response to the Unit 1 UFSAR also found that the plant response was conservative with respect to assumptions modeled in the UFSAR analysis for a loss of station air.

The plant risk associated with the BVPS Unit 1 manual reactor trip on December 7, 2001, due to a loss of instrument air pressure is considered to be low. This is based on the conditional core damage probability for the event when considering the actual component unavailabilities that were present at the time of the trip.

Based on the above, the safety significance of the manual reactor trip on December 7, 2001 was low.

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## CORRECTIVE ACTIONS

1. Interim station guidance for increased review of work activities was implemented. These controls provide for a review of work activities to establish a risk level and increased management review and approval of the activity depending on the risk level of the activity. The interim controls will remain in place until procedure changes reflecting the revised processes are implemented.
2. Warning labels were placed on the control cabinets for the 1SA-C-1A and 1SA-C-1B air compressors to warn personnel of circuit crosstie interface in the panels.
3. Separate drawings will be created for the control circuitry for compressors 1SA-C-1A and 1SA-C-1B.
4. An investigation will be performed for the feasibility of removing the crosstie interface circuit from the Unit 1 station air compressors.
5. An evaluation will be performed to improve the station planning process.
6. An evaluation will be performed to improve the station scheduling process.
7. A review will be performed of the causal factors related to electrician use of tools and skill of the craft practices related to working in energized or de-energized equipment.
8. A larger capacity diesel air compressor with an automatic start feature on low air pressure was installed in the Unit 1 station air system.

Completion of above corrective actions and resulting follow-up actions is being tracked through the Corrective Action Program.

## PREVIOUS SIMILAR EVENTS

A review of past Beaver Valley Power Station Licensee Event Reports for the last five years found one similar event at BVPS Unit 1. A manual reactor trip due to loss of station instrument air occurred on June 22, 2001, and was reported by LER 2001-001 on August 13, 2001.