ACCESSION #: 9903050070

NON-PUBLIC?: N

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Beaver Valley Power Station Unit 1 PAGE: 1 OF 8

DOCKET NUMBER: 05000334

TITLE: Manual Reactor Trip Due To Continuing Degradation of Main

Condenser Parameters

EVENT DATE: 01/23/99 LER #: 99-001-00 REPORT DATE: 02/19/99

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 073

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

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COMPONENT FAILURE DESCRIPTION:

CAUSE: X SYSTEM: SH COMPONENT: LCV MANUFACTURER: M120

REPORTABLE EPIX: Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

At approximately 1024 hours on 1/23/99, the Unit 1 Reactor was manually tripped from approximately 73% power, as a conservative and proactive step in response to continuing degradation of Main Condenser parameters. The Reactor control rods fully inserted and plant systems operated as expected. Emergency Operating Procedures were entered, the Unit was stabilized, and station recovery from the Reactor trip was satisfactorily

completed. NRC 4-hour notification of this event was made, per 10 CFR 50.72(b)(2)(ii), at approximately 1251 hours (same day).

The degraded Main Condenser parameters resulted from elevated air in-leakage through the valve seat of the closed outlet isolation valve of V Main Condenser waterbox and into the Cooling Tower pumps' suction piping. This resulted from eliminating the water seal over the waterbox outlet valve seat during routine waterbox maintenance due to failure of the on-shift operating crew to maintain adequate awareness of changes which altered level in the waterbox, with a direct contributor of procedure inadequacy. As part of corrective actions to this event, Operations Shift briefings were conducted, an Operations communication and written instructions to Maintenance were provided, and the procedure for isolating waterboxes was revised.

PLANT AND SYSTEM IDENTIFICATION

Westinghouse Pressurized Water Reactor (PWR)

Circulating Water (CW) System {SG}*_/

CW Waterbox 'C' Isolation Valves MOV-CW-106C and MOV-CW-100C {SG/ISV}*_/

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*_/Energy Industry Identification System (EIIS), system and component

function identifier codes appear in the text as {XX/XX}.

DESCRIPTION OF THE EVENT

At approximately 1024 hours on January 23, 1999, the Unit 1 Reactor was

manually tripped from approximately 73% power. This action was taken as a

proactive and conservative step in response to continuing degradation of

Main Condenser {SG/COND} parameters (i.e., increasing condenser hotwell

{SG/SUMP} temperatures, backpressure, circulation water (CW) waterbox

{SG/HX} delta temperatures, decreasing condenser vacuum, and cavitation of

Cooling Tower (CT) pumps {SG/P}). The Reactor control rods {AA/JC} fully

inserted and systems operated as expected. Both motor-driven auxiliary

feedwater pumps {BA/P} and the turbine-driven auxiliary feedwater pump {BA/P} automatically started due to expected low steam generator (SG) {SB/SG} level and level was returned to within the program value. The Emergency Operating Procedures (EOPs) were entered and the Unit was stabilized. The EOPS were exited and station recovery from the Reactor trip was satisfactorily completed. NRC four-hour notification of this occurrence was made at approximately 1251 hours (same day), in accordance with the reporting criteria of 10 CFR 50.72 (b)(2)(ii).

The following provides a chronology of occurrences, with approximate times, regarding this event:

January 23, 1999

0621 hours Reactor power had been reduced to approximately 91%, CT pump CT-P-1D was stopped, and Waterbox 'C' of Main Condenser CN-SC-1B was removed from service for scheduled tube cleaning. Stable conditions were visually determined to exist on the outlet side of the waterbox, the procedure for removing the waterbox from service was

DESCRIPTION OF THE EVENT (continued)

exited, a safety clearance was posted, and the waterbox was turned over to maintenance.

0830 hours At the request of maintenance, Operations made a closing adjustment to Waterbox 'C' inlet isolation valve MOV-CW--

106C. This was done to improve the boundary of the safety clearance and reduce condenser circulation water (CW) in-leakage through the waterbox inlet causing a higher than desired water level on the inlet side of the waterbox.

0912 hours In response to increasing main condenser hotwell temperatures (129 degrees Fahrenheit), Reactor power reduction to approximately 90% was commenced.

0916 hours Main Condenser low vacuum alarm (approximately 4.5" mercury) was received and further Reactor power reduction was commenced in accordance with the alarm response procedure (ARP) to lower hotwell temperature.

1005 hours Received CW Vacuum Priming (keepfull) System {SG} Low vacuum annunciator and the system standby vacuum priming pump was started, in accordance with the ARP, to restore water level in the in-service waterboxes.

1007 hours Reactor power reduction was stopped at approximately 77% power to assess Main Condenser parameters.

1010 hours Operations detected audible indication of air being drawn past the 'C' Main Condenser waterbox outlet isolation valve, MOV-CW-100C, into the CW suction to the CT pumps. minimum suction pressure was indicated on the operating CT pumps. The Turbine Building operator was dispatched to establish a water seal on the valve using a fire hose {KP/HOSE}.

1017 hours The 'C' Main Condenser waterbox manways {SG/PEN} were closed in an attempt to eliminate the air in-leakage into the valve seat of MOV-CW-106C in response to degrading main condenser parameters.

1019 hours Indication of CT pump cavitation and CT pump discharge pressure high were received for the operating CT pumps.

Reactor power reduction continued.

DESCRIPTION OF THE EVENT (continued

1023 hours Reactor power reduction was stopped at approximately 73%.

1024 hours An Operations supervisory decision was made to initiate a manual Reactor trip signal. This action was taken as a conservative and proactive step in response to the degrading Main Condenser parameters.

1027 hours CT-P-1C was shutdown due to cavitation.

1032 hours CT-P-1B was shutdown and CT-P-1A remained in service.

The reduced Main Condenser capacity and sustained CT pump cavitation had resulted from elevated air in-leakage and entrainment in the CT pumps' suction piping. This in-leakage occurred past the valve seat of the closed waterbox outlet isolation MOV-CW-100C. Due to the design and application of waterbox inlet/outlet isolation valves, leak-tight seating of these valves is not considered practical. Therefore, during waterbox maintenance it is sometimes necessary to establish and maintain a sufficient water

column over the waterbox outlet valve seat to prevent air from being entrained into the CT suction piping. This water column (level) is measured by a standpipe level indication on the outlet side of the waterbox. It was established by maintaining sufficient water level on the outlet side of the waterbox through adjustments to the closing positions of the waterbox inlet/outlet isolation valves. A stable level in the waterbox is maintained by establishing a leakage equilibrium through the waterbox tubes that accounts for leakage past the closed seats of the waterbox inlet/outlet isolation valves. During waterbox maintenance, adjustments to the inlet/outlet valves can therefore directly affect water level in the waterbox. Following the closing adjustment to MOV-CV-106C, at approximately 0830 hours, an unanticipated change in this leakage equilibrium through the waterbox occurred. This reduced water level in the waterbox and removed the water seal over the valve seat which then allowed air to be drawn into the CT pump suction piping.

CAUSE OF THE EVENT

Investigation determined the loss of the water seal on MOV-CW-100C resulted from failure of the on-shift operating crew (utility licensed and utility non-licensed personnel) to maintain adequate awareness of changes affecting the dynamics of the leakage equilibrium in the 'C' waterbox. This occurred when the crew did not properly recognize the

CAUSE OF THE EVENT (continued)

potential effect of the closing adjustment to MOV-CW-106C. After the closing adjustment, a waterbox standpipe water level indication was observed for a brief period (approximately 10 seconds) and incorrectly deemed to be stable. In fact, waterbox level was unknowingly decreasing which resulted in the loss of water seal over MOV-CW-100C.

A direct contributor to this event was inadequacy in procedure 1OM31.4.G, "Isolating One Half of a Condenser." In accordance with instruction of the procedure, the procedure was exited following removal of the waterbox from service. As such, a requirement did not exist for periodic local monitoring and logging to help ensure a stable standpipe water level within the waterbox following removal of the waterbox from service. The procedure did not provide a reference to the potential impact of air induction into the CT pumps suction and include a caution of the importance of a water seal on the CW waterbox outlet MOVS. In addition, the procedure did not require an assessment of the current status of the CW Vacuum Priming System (other than the impact of the out-of-service waterbox on its air separator tank), and how the system will react to inadvertent air induction. Furthermore, the procedure did not reference the importance of the interrelationship of the water seal with the CW Vacuum Priming System.

At the time of the event, the CW Vacuum Priming System was not 100% capable of mitigating air induction into the Main Condenser CW outlet lines. Prior to the 'C' waterbox maintenance, the portion of the system that services the condenser CW outlet lines, LCV-VP-103A {SH/LCV}, Masoneilan

International, Incorporated, Model No. 12819, had previously been failed open due to a broken controller linkage (feedback arm) valve positioner. When CT-P-1D was secured to support the 'C' waterbox maintenance, water was drawn through the failed open LCV-103A and into the Vacuum Priming System priming tank {SG/TK}. The operations shift responded to this by throttling the LCV-VP-103A manual isolation valve, VP-1 {SG/ISV}. Due to the throttling of VP-1, when air was drawn into the CW system through the uncovered seat of MOV-CW-100C, LCV-VP-103A was unable to properly function and open fully to remove the air. In addition, this prevented the actuation of LCV-VP-103A from initiating a vacuum priming low pressure alarm, which could have alerted the Control Room to an air induction event. VP-1 remained throttled shut until approximately 1022 hours, at which time it was opened fully in response to the degrading conditions in the Main Condenser.

CAUSE OF THE EVENT (continued)

At the time of the occurrence there was no preventive maintenance frequency for the CW waterbox inlet/outlet valves that would indicate valve inspection, seat cleaning, limit adjustment, etc.

CORRECTIVE ACTIONS

(Actions Prior to Unit Restart)

1. Shift Briefings were provided to the on-schedule Unit I Shift Operating crews on the importance of maintaining a water seal on the

condenser waterbox outlet valve during waterbox maintenance activities. These briefings included a review of applicable Nuclear Power Division Administrative Procedures (NPDAPs) for infrequently performed test and evolutions, regarding isolating Main Condenser waterboxes.

2. 1OM-31.4.G was appropriately revised to address the procedure concerns identified in the "CAUSE OF EVENT" section of this report. This revision included a requirement for periodic monitoring for stable waterbox level indication for the first four hours following drain down and to document each waterbox valve manipulation and the results of each valve manipulation.

3. Written instructions were provided to Maintenance Department personnel regarding maintenance actions during waterbox maintenance activities that will facilitate maintaining a water seal on the outlet valve of the involved waterbox.

4. An evaluation was conducted to determine the effect of the incurred cavitation on the CT pump discharge piping during this occurrence, which found no apparent damage to the piping. In addition, vibration data was collected on CT-P-1C prior to subsequent Unit restart, which showed acceptability of the pump for operation.

(Actions Following Unit Restart)

1. An Operations Department communications detailing this occurrence has been issued for lessons learned from this event to be shared with

Operations shift members.

2. Review of the Main Condenser waterbox recovery procedures for both Units was conducted which found these procedures to be

CORRECTIVE ACTIONS (continued)

adequate. Procedural enhancements to some of these procedures were identified and these enhancements have been implemented.

(Actions to Be Taken)

1. Shift briefings will be conducted for Unit 1 Shift Operating crew personnel not having received the subject shift briefings conducted prior to the subsequent Unit 1 startup. These briefings will be conducted prior to these personnel assuming onshift activities and will stress adherence to 1OM-31.4.G and expectations of applicable NPDAPs. This action will be completed by March 31, 1999.

2. More comprehensive review of 1OM-31.4.G and a similar review of the corresponding Unit 2 procedure, 2OM-31.4.E., will be conducted. Additional improvements and enhancements, identified from these reviews, will be implemented in a revision to each procedure. In addition, shift briefings will be conducted with the Unit 2 shift operating crews on this occurrence and the procedure changes to 2OM-31.4.E. This action will be completed by April 29, 1999.

3. A preventive maintenance (PM) frequency for the Unit 1 CW waterbox inlet/outlet MOVs (e.g. valve inspection, seat cleaning, Open/Closed

limit adjustment, etc.) will be implemented. This action will be,completed by April 30, 1999. A corresponding Unit 2 PM frequency for these MOVs was previously in place.

4. This event will be covered in Licensed Operator retraining as well as in non-licensed Operator retraining as Plant Status Update Training. This action will be completed by June 30, 1999.

5. An independent evaluation of recent plant events involving procedures that have been determined to be less than adequate will be conducted. This action will be completed by June 30, 1999.

6. A work request has been initiated to resolve the operation problem affecting LCV-VP-103A. Completion of this action will be tracked and accomplished through the Corrective Action Program.

REPORTABILITY

Performance of a manually-initiated reactor trip constitutes a manual actuation of an engineered safety feature (e.g., the Reactor Protection System). This requires NRC reporting within four hours of the occurrence, per the reporting criteria of 10 CFR 50.72(b)(2)(ii), and LER reporting within 30 days of the occurrence, per the reporting criteria of 10 CFR 50.73(a)(2)(iv).

SAFETY IMPLICATIONS

In response to the degrading Main Condenser parameters prior to this event, an Operations supervisory decision was made to initiate a manual Reactor

trip signal. This action was a conservative and proactive step prior to reaching an anticipated Reactor automatic trip signal. Following the Reactor trip, plant systems functioned as designed, parameters in the Main Condenser returned to normal, and the Main Condenser remained available as a heat sink. The three auxiliary feedwater pumps {BA/P} automatically started on low level in the steam generators {SB/SG} due to expected level shrinkage from rise in secondary pressure. The transfer to off-site power occurred normally and without need for starting of the emergency diesel generators {EK/DG}. The Unit was stabilized and a station recovery was satisfactorily completed. As such, there were minimal implications to the health and safety of the public, due to this event.

SIMILAR EVENTS

Review of BVPS Licensee Event Reports for the past two years did not reveal prior similar occurrences, involving degraded Main Condenser vacuum conditions.

 ATTACHMENT 1 TO 9903050070 PAGE 1 OF 2

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February 19, 1999

L-99-031

Beaver Valley Power Station, Unit No. 1

Docket No. 50-334 License No. DPR-66

LER 99-001-00

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 99-001-00, 10 CFR 50.73(a)(2)(iv), "Manual Reactor Trip Due to

Continuing Degradation of Main Condenser Parameters."

K. L. Ostrowski

Division Vice President

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Attachment

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