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February 8, 1994
ND3MNO:3542


Beaver Valley Power Station, Unit No. 1
Docket No. 50-334, Licensee No. DPR-66
LER 94-001-00

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

Gentlemen:

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

LER 94-001-00, 10 CFR 50.73.a.2.i.A, "Required Plant Shutdown Due To An Inoperable Train of Recirculation Spray Heat Exchangers."


L. R. Freeland
General Manager
Nuclear Operations

JHK/ke

Attachment

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cc: Mr. T. T. Martin, Regional Administrator
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LICENSEE EVENT REPORT (LER)

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

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)

Beaver Valley Power Station Unit 1

DOCKET NUMBER (2)

05000 3 3 4

PAGE (3)

1 OF 06

TITLE (4)

Required Plant Shutdown Due to An Inoperable Train of Recirculation Spray Heat Exchangers

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
01	09	94	94	001	00	02	08	94	N/A	05000
									FACILITY NAME	DOCKET NUMBER
										05000

OPERATING MODE (9)	POWER LEVEL (10)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
1	100	<input type="checkbox"/> 20.402(b)	<input type="checkbox"/> 20.405(c)	<input type="checkbox"/> 50.73(a)(2)(iv)	<input type="checkbox"/> 73.71(b)	<input type="checkbox"/> 20.405(a)(1)(i)	<input type="checkbox"/> 50.36(c)(1)	<input type="checkbox"/> 50.73(a)(2)(v)	<input type="checkbox"/> 73.71(c)
		<input type="checkbox"/> 20.405(a)(1)(ii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(vi)	<input type="checkbox"/> OTHER	<input type="checkbox"/> 20.405(a)(1)(iii)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)	<input type="checkbox"/> 50.73(a)(2)(vii)	
		<input type="checkbox"/> 20.405(a)(1)(iv)	<input type="checkbox"/> 50.73(a)(2)(ii)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	(Specify in Abstract below and in Text, NRC Form 366A)	<input type="checkbox"/> 20.405(a)(1)(v)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)	
				<input type="checkbox"/> 50.73(a)(2)(x)					

LICENSEE CONTACT FOR THIS LER (12)

NAME

L. R. Freeland, General Manager Nuclear Operations

TELEPHONE NUMBER (include Area Code)

4 1 2 6 4 3 - 1 2 5 8

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPPDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPPDS
B	BE	XXXX	XXXX	N					

SUPPLEMENTAL REPORT EXPECTED (14)

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

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

A Technical Specification (TS) required shutdown was commenced on 1/9/94 at 1100 hours, in response to a low flow condition through the A Train of the Recirculation Spray Heat Exchangers (RSHX). During testing of the A Train River Water Pump, WR-P-1A, total river water flow through the system was 6100 gpm. TS 3.6.2.2 requires a minimum flowrate of 8000 gpm per train. A determination was made that the low flow condition was due to fouling of the heat exchangers and that cleaning of the heat exchangers was necessary. The plant cooldown was initiated and an Unusual Event was declared in accordance with the Emergency Preparedness Plan at 1118 hours due to the required plant shutdown. The Unusual Event was terminated when the Unit reached Operational Mode 5 (Cold Shutdown) at 1317 hours on 1/10/94. Following heat exchanger cleaning, total flowrate through the A Train RSHXs was 9700 gpm. The heat exchangers were declared operable on 1/15/94. The majority of the debris in the heat exchangers consisted of approximately 30% clam shells and 70% ferrous corrosion products and turbucles. All of the clams were dead due to a recent Clamicide treatment of the Unit 1 river water system. The source of the corrosion products is the mild steel river water system piping. The B Train RSHXs and river water pump remained operable throughout this event.

REQUIRED NUMBER OF DIGITS/CHARACTERS
FOR EACH BLOCK

BLOCK NUMBER	NUMBER OF DIGITS/CHARACTERS	TITLE
1	UP TO 46	FACILITY NAME
2	8 TOTAL 3 IN ADDITION TO 05000	DOCKET NUMBER
3	VARIES	PAGE NUMBER
4	UP TO 76	TITLE
5	6 TOTAL 2 PER BLOCK	EVENT DATE
6	7 TOTAL 2 FOR YEAR 3 FOR SEQUENTIAL NUMBER 2 FOR REVISION NUMBER	LER NUMBER
7	6 TOTAL 2 PER BLOCK	REPORT DATE
8	UP TO 18 -- FACILITY NAME 8 TOTAL -- DOCKET NUMBER 3 IN ADDITION TO 05000	OTHER FACILITIES INVOLVED
9	1	OPERATING MODE
10	3	POWER LEVEL
11	1 CHECK BOX THAT APPLIES	REQUIREMENTS OF 10 CFR
12	UP TO 50 FOR NAME 14 FOR TELEPHONE	LICENSEE CONTACT
13	CAUSE VARIES 2 FOR SYSTEM 4 FOR COMPONENT 4 FOR MANUFACTURER NPRDS VARIES	EACH COMPONENT FAILURE
14	1 CHECK BOX THAT APPLIES	SUPPLEMENTAL REPORT EXPECTED
15	6 TOTAL 2 PER BLOCK	EXPECTED SUBMISSION DATE

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0011, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (4)			PAGE (3)
Beaver Valley Power Station Unit 1	05000 3 3 4	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	OF 02 06
		9 4	- 0 0 1 -	0 0	

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

DESCRIPTION OF EVENT

A Technical Specification required shutdown was commenced on January 9, 1994 at 1100 hours, in response to a low flow condition through the A Train of the Recirculation Spray Heat Exchangers, RS-E-1A and RS-E-1C. On 1/7/94 at 1940 hours, during testing of the A River Water Pump, WR-P-1A, total river water flow through the A Train was 6100 gpm. Since Technical Specification 3.6.2.2 requires a minimum flowrate of 8000 gpm per train, a 72 hour action statement was entered. Several attempts were made to increase flow through the heat exchangers without success. A determination was made that the low flow condition was due to fouling of the heat exchangers and that opening and cleaning of the tubesheet and tubes was necessary. The Recirculation Spray Heat Exchangers are located in the subatmospheric reactor containment building and a cooldown to Operational Mode 5 (Cold Shutdown) is necessary to clean the heat exchangers. The plant cooldown was initiated and an Unusual Event was declared at 1118 hours due to the required plant shutdown in accordance with the Emergency Preparedness Plan. The Unusual Event was terminated when the Unit reached Operational Mode 5 at 1317 hours on 1/10/94.

Fouling of the A Train Recirculation Spray Heat Exchangers (RSHX) occurred during testing of WR-P-1A to determine the cause of a pump flow performance anomaly. Following a pump overhaul on 12/31/93, the pump would not develop expected discharge head at high flowrates, and the pump was drawing more power than expected at a given flowrate. The swing river water pump, WR-P-1C, was tested on the A header with marginal results.

System flowrate was being measured with an ultrasonic flow instrument on the A header in the Primary Auxiliary Building (PAB). A second ultrasonic instrument was installed on the discharge piping of WR-P-1A which indicated approximately 1500 gpm higher. Analysis of the motor data concluded the pump discharge data matched the manufacturer's generated pump curve. Verification of the ultrasonic instrument at the pump discharge was made by substituting the transducers from the PAB to the pump discharge. The instruments agreed within 2.5%. An investigation was initiated to determine if leakage was occurring between the A and B river water headers, or if the ultrasonic instrument readings were erroneous.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
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Beaver Valley Power Station Unit 1	05000 3 3 4	9 4	- 0 0 1 -	0 0	03 OF 06

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

A systematic elimination of possible leakage paths lead to the conclusion that the A header was not leaking and the ultrasonic instrument measurements were suspect. Measurement of flow through the A river water header was performed next by initiating flow through the Recirculation Spray Heat Exchangers and utilizing the installed A Train RSHX restricting orifice flow element, FT-RW-102A. It was during this testing on 1/7/94 that the reduced flow was observed through RS-E-1A and RS-E-1C. Testing of WR-P-1A and WR-P-1C continued in an effort to obtain additional data on the heat exchanger pressure differentials and on pump performance characteristics. The data collected using FT-RW-102A for WR-P-1C concluded pump performance was satisfactory. The data collected for WR-P-1A indicated that the pump was performing as expected for a rebuilt pump. WR-P-1A was not declared operable at this time, since verification of proper operation at higher flowrates could not be obtained due to the reduced flow through the Recirculation Spray Heat Exchangers. Since reactor containment building pressure must be raised to atmospheric conditions to facilitate opening and cleaning of the heat exchangers, a plant cooldown was initiated on 1/9/94 to Mode 5.

The A Train RSHXs were opened and cleaned between 1/10/94 and 1/15/94. On 1/15/94, flow was initiated through the heat exchangers using WR-P-1A. Combined total flowrate was 9700 gpm, which was above the Technical Specification requirement of 8000 gpm. The heat exchangers and WR-P-1A were declared operable on 1/15/94 and a plant heatup was commenced. The reactor was taken critical on 1/19/94 at 1010 hours, and the unit was synchronized to the grid at 1451 hours.

CAUSE OF THE EVENT

The cause of the inaccurate indication from the ultrasonic flow instrument is due to the application of the ultrasonic detector on the river water header in the Primary Auxiliary Building. The 24 inch header is constructed of carbon steel which is susceptible to corrosion and microbiological deposition. This is confirmed by the low signal strength and signal fluctuations observed during the flow measurements. The velocity profile is skewed at the PAB location because of the interior roughness of the river water piping and proximity to upstream flow disturbances. The flow measuring device installed in the header to the RSHXs, FT-RW-102A, measures flow based upon a pressure loss across an orifice plate, and has been proven through experience to be reliable.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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

A comparison of the data obtained following the Ninth Refueling Outage on 5/30/93, and the flow data obtained on 1/8/94, indicated a significant increase in the differential pressure through the RSHXs with a reduction in total flow, indicating tube fouling or blockage on the inlet tubesheet. The 1/8/94 test performance was the first time flow was initiated through the heat exchangers since the refueling outage. The majority of the debris in RS-E-1A and RS-E-1C consisted of approximately 30% clam shells and 70% ferrous corrosion products and turbucles.

All of the clams were dead due to a recent Clamicide treatment of the Unit 1 river water system. The clams were determined to be relatively new since the shells were not worn and the edges were sharp. Some partially opened shells still contained some clam tissue, indicating they were not in the heat exchanger for a long time. Due to the geometry of the A river water header at a tee fitting which supplies the Component Cooling Water heat exchangers in one direction, and the RSHXs in the other direction, a dead leg exists between the tee and normally closed RSHX inlet valves, MOV-RW-103A and B. This dead leg accumulated the dead clams following the Clamicide treatment. In addition, some clams were likely to have been deposited in the dead leg during normal plant operations, and contributed to the fouling when the flow was initiated through the RSHXs.

The source of the corrosion products is from the plant's mild steel river water system which is an ongoing, continuous process. The A river water header geometry also resulted in an accumulation of corrosion products and turbucles in the dead leg that contributed to the RSHX fouling.

CORRECTIVE ACTIONS

The following corrective actions have or will be taken as a result of this event:

- 1). The unit was shutdown and the A Train heat exchangers were cleaned.

LICENSEE EVENT REPORT (LER)
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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

CORRECTIVE ACTIONS (CONT.)

- 2). During the plant shutdown, the B Train RSHXs were placed in service to determine the B Train condition. Although B Train performance was acceptable, RS-E-1B was partially fouled and therefore cleaned. RS-E-1B contained mostly ferrous corrosion products and turbucles with less than 10% of the total volume being clams. RS-E-1D was not opened as it was capable of passing 8000 gpm by itself, indicative of a clean heat exchanger.
- 3). The surveillance test procedures for the river water pumps will be rewritten to utilize the installed RSHX restricting orifice flow element, FT-RW-102A (and FT-RW-102B for the B header), until reliable alternate flow indication capability is established.
- 4). Flushing of the A and B Train RSHXs will be performed on a monthly frequency, until longer term corrective actions are completed.
- 5). Periodic Clamicide treatments will continue to be evaluated to eliminate any immature clams that migrate into plant systems during normal operations and to prevent them from growing to a size that may cause blockages.
- 6). Intake Bay cleaning will continue to be coordinated with clam spawning and migration data so that mature clams that migrate into the low flow, high silt areas in the intake structure are removed before they can be drawn into the plant.
- 7). A review is being performed to determine long term corrective actions to prevent recurrence. The corrective actions may include plant modifications to facilitate periodic on line cleaning of the heat exchanger inlet piping, debris intrusion blocking devices, and alternate flow rate sensing.
- 8). The station is also evaluating the overall affects of the corrosion rate on the mild steel river water system.

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

SAFETY IMPLICATIONS

There were minimal safety implications as a result of this event. The B Train RSHXs and river water pumps remained operable throughout this event. The Unit was cooled down to Operational Mode 5 within the time permitted by Technical Specifications.

REPORTABILITY

This event was reported to the Nuclear Regulatory Commission at 1118 hours on 1/9/94 in accordance with 10 CFR 50.72.a.1.i and 10 CFR 50.72.b.1.i.A, as the declaration of an Emergency Class provided in the Emergency Plan, and the initiation of a nuclear plant shutdown required by Technical Specifications. This written report is being submitted in accordance with 10 CFR 50.73.a.2.i.A, as the completion of a plant shutdown required by Technical Specifications.

PREVIOUS OCCURRENCES

There are no previously reported events involving a plant shutdown due to low flow conditions through the recirculation spray heat exchangers. The plant has had previous experience with recirculation spray heat exchanger fouling as documented in station records.