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Beaver Valley Power Station, Unit No. 1
Docket No. 50-334 License No. DPR-66
LER 2002-001-00

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 2002-001-00, 10 CFR 50.73(a)(2)(i)(B), "Silt Levels in Main Intake Structure Exceed Allowable Values."

Mark B. Bezilla

Attachment

c: Mr. D. S. Collins, Project Manager
Mr. D. M. Kern, Sr. Resident Inspector
Mr. H. J. Miller, NRC Region I Administrator
INPO Records Center (via electronic image)
Mr. L. E. Ryan (BRP/DEP)

NRC FORM 366 (7-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

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.

LICENSEE EVENT REPORT (LER)

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

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Beaver Valley Power Station Unit No. 1	05000334	1 OF 7

4. TITLE

Silt Levels In Main Intake Structure Exceed Allowable Values

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									Beaver Valley Unit 2	05000412
9	25	2002	2002	– 001	– 00	11	15	2002	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE	1
10. POWER LEVEL	100%

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

	20.2201(b)		20.2203(a)(3)(ii)	X	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)		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 Specify in Abstract below or in 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)		

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
L. R. Freeland, Manager Regulatory Affairs/Performance Improvement	(724) 682-5284

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED			15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

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

On September 25, 2002, it was determined that previously measured silt levels in three bays of the Beaver Valley Power Station (BVPS) Main Intake Structure had exceeded acceptable limits to assure adequate inflow from the Ohio River into the Intake Structure bays in order to provide sufficient ultimate heat sink cooling needs during the design basis / licensing basis bounding extreme low river water event. This was identified during follow-up evaluations of issues raised during a Latent Issues design review of the BVPS Service Water System. Even though the Ohio River has never approached the design basis / licensing basis extreme low water level, the BVPS Unit 1 safety related River Water System and the BVPS Unit 2 safety related Service Water System must have adequate ultimate heat sink capability to adequately support the bounding low probability low river water level design basis / licensing basis postulated scenario. Current BVPS design analyses show that adequate inflow to the suction of the River/Service Water System pumps may not be assured with greater than 22 inches of solid blockage in an Intake Structure bay. Previously identified as-found silt levels in Intake Structure bays have exceeded 22 inches. This represents a potential unanalyzed condition that could significantly degrade plant safety. Therefore, this is being reported pursuant to 10 CFR 50.73 (a)(2)(ii)(B).

The cause of this event was inadequate/incomplete design aspects. The accumulation of silt in the Intake Structure is only a potential concern during an extreme low river water level condition. The probability of an extreme low river water level is small. The silt is considered to form a completely solid dam as a conservative assumption. However, the silt is not qualitatively expected to be capable of forming a solid dam if an extreme low river water level condition were to occur. The safety significance of prior conditions where the Intake Structure silt levels exceeded 22 inches in the past was low.

PLANT AND SYSTEM IDENTIFICATION

Westinghouse-Pressurized Water Reactor (PWR)
Ultimate Heat Sink (BS)
Essential Service Water System (BI)
Nonessential Service Water System (KG)
Essential Service Water Pump Building (MK)

CONDITIONS PRIOR TO OCCURRENCE

Unit 1: Mode 1 at 100 % power
Unit 2: Mode 1 at 100 % power

There were no systems, structures, or components that were inoperable at the start of the event that contributed to the event.

DESCRIPTION OF EVENT

A Latent Issues design review identified that recently measured silt levels in three bays of the Beaver Valley Power Station (BVPS) Main Intake Structure had exceeded acceptable limits to assure adequate inflow from the Ohio River into the Intake Structure bays, which could have potentially affected the operability of the Intake Structure. Design Engineering determined on September 25, 2002 that silt levels greater than 22 inches could not assure adequate ultimate heat sink cooling capability via the inflow of water from the Ohio River into an Intake Structure bay. This design evaluation assumed that the accumulated silt was composed entirely of solid debris that completely blocks any water flow (i.e., a solid dam effect). Although this is acknowledged to be very conservative, quantification of the ability of deposited silt within a bay to not impede water flow was not readily calculated. It was, therefore, conservatively determined that silt level alone could now be a constraint that solely affects an Intake bay's operability since the compressibility or level of solid blockage could not readily be determined. The silt limit is based upon providing sufficient ultimate heat sink cooling needs during the design basis / licensing basis bounding extreme low river water event.

The following maximum silt levels in 2002 were identified during routine quarterly surveillance and cleaning of the four bays in the BVPS Main Intake Structure:

A Bay – 22 inches (6/3/2002)
B Bay – 32 inches (6/17/2002)
C Bay – 27 inches (5/28/2002)
D Bay – 32 inches (6/14/2002)

Silt levels in three bays exceeded the allowable limit of 22 inches.

BACKGROUND INFORMATION

The Main Intake Structure houses both the essential and non-essential service water cooling systems' pumps for both BVPS units.

The ultimate heat sink for both BVPS units is the Ohio River. The level of the Ohio River at the BVPS location is directly controlled by the river dams which are operated by the Army Corp of Engineers. Design basis information which originated with the Army Corp of Engineers at the time of initial BVPS licensing indicate that these dams are designed to withstand expected seismic events and that the river pool level at BVPS could be maintained at normal levels during the most severe postulated drought condition. Hence, there are no expected natural events which could result in a lower than normal river water level at the BVPS location. Any lower than normal river water level could only occur as a result of an abnormal event at the downstream dam in the Ohio River. The design / licensing basis dam failure is the loss of one gate or lock in the downstream dam (without repair) on the Ohio River during a drought, which results in a slowly falling river water level and culminates in an extreme low water level occurring approximately 72 hours following the lock/gate loss. This downstream dam has the design capability to rectify a dam gate failure by inserting an onsite emergency bulkhead into pre-available slots in the dam within a few hours, which would immediately stop any river water level decrease. Thus, the probability of an extreme low river water level occurring at BVPS is small.

The accumulation of silt in the Intake Structure is only a potential concern during an extreme low river water level condition when the silt could potentially act as a solid dam within an Intake bay. The systems that draw water from the Ohio River are designed to operate with water containing high turbidity levels and suspended silt. The Ohio River level at the BVPS location is normally maintained at 664.5 feet mean sea level (msl). BVPS Unit 1 and Unit 2 both have a Technical Specification which would require that the unit be shutdown when the Ohio River reaches 654 feet msl., which would be reached approximately 24 hours after the design basis loss of a dam gate. The bounding design / licensing basis extreme low river water level is 648.6 feet msl, which also assumes a concurrent drought condition. Normally, the water level in the Intake Structure bays is well above any accumulated silt in the bay. Neither BVPS unit has ever been forced to shutdown due to a low river water level.

During initial licensing of both BVPS Unit 1 and Unit 2, it was stated that semi-annual cleaning of the Main Intake Structure bays would be sufficient to maintain an adequate inflow of water from the Ohio River into the Intake Structure bays for ultimate heat sink cooling. BVPS Unit 2 Updated Final Safety Analysis Report (UFSAR) Section 2.4.11.6, entitled Heat Sink Dependability Requirements, states "It is anticipated that silt will collect in the main intake structure. Therefore, as a minimum, the depth of silt in the intake structure bays will be measured semi-annually by divers. Silt exceeding the 15-inch allowable level will be removed by a pumping operation so that a more than adequate water supply is ensured." It was expected at time of initial licensing that any silt level exceeding the UFSAR limit of 15 inches would be reasonably minor and not occur for a lengthy period of time. Thus, exceeding

the silt limit in an Intake Structure bay was not, by itself, considered to be cause for declaring an Intake bay inoperable.

The silt that is deposited in an Intake Structure bay has not been observed to be solid. Observations by personnel who regularly clean an Intake Structure bay after it has been drained is that the silt is a soft water-saturated muck which can be easily moved. A person often sinks directly to the Intake Structure concrete floor when they step into the silt. Thus, it is not expected that this silt would effectively act as a solid dam to prevent Ohio River water from entering into the bay during an extreme low river water level condition. However, the extent of the silt's capability to act as solid and prevent water from entering a bay (whose water level would be dropping well below the Ohio River water level if insufficient water was entering the bay to offset the water leaving the bay through pump suctions) is difficult to precisely quantify. Given these uncertainties, the silt is considered to act as completely solid debris as a conservative assumption. However, the silt is not qualitatively expected to be capable of forming a solid dam if an extreme low river water level condition were to occur. If the silt residing on the bottom of the Intake Structure bay were to be moved by water continuing to enter the Intake Structure bay at an extreme low river water level condition, as expected, then full ultimate heat sink capability is maintained regardless of the silt level.

The issue of silt limit in the Intake Structure bays was raised in 1984, but no actions were taken other than to continue to monitor the operating data, based upon the UFSAR statement that infers silt levels above 15 inches is not an operational issue. In the mid-1990s, BVPS was experiencing issues with Asiatic clams and later Zebra mussels in the safety-related River Water System at Unit 1 and the safety-related Service Water System at Unit 2. At this time, the Intake Structure cleaning and surveillance was changed from semi-annual to quarterly. This was done primarily to remove the silt, not due to a concern that the silt was building up at an unacceptable rate between cleanings, but because the silt provided a breeding environment for the Asiatic clams. The quarterly inspection was also implemented to increase inspection for any significant collection of Zebra mussels. A collateral effect of the increased inspection frequency was the more frequent removal of any deposition of silt that exceeded 15 inches. In response to another design review, a BVPS silt level limit of 28 inches was calculated in 2000 based upon safety analyses considerations, but the quarterly surveillance limit for initiating cleaning remained at 15 inches. However, silt level above 28 inches was not translated into site procedures as a site limit. Thus, silt levels, by itself, continued to not be considered an Intake bay operability issue. Following recent clarification of the bounding design basis / licensing basis extreme low river water level scenario, it was calculated on September 25, 2002 that silt levels greater than 22 inches could not assure adequate ultimate heat sink cooling capability via the inflow of water from the Ohio River into an Intake Structure bay.

A review of past empirical data shows a strong correlation between higher-than-normal silt levels and higher-than-normal Ohio River water levels. High river turbidity levels usually only occur when the river is higher than normal, which typically occurs in the Spring. The quarterly surveillance which inspects and cleans Intake Structure bays has previously predominately showed acceptable levels. However, each Intake Structure bay has exceeded the 22 inch limit at least twice in the last

three years. The most recent quarterly surveillance of the Intake Structure identified no as-found silt levels greater than 22 inches.

REPORTABILITY

Even though the Ohio River has not previously approached the design basis / licensing basis extreme low water level during plant operation, the BVPS Unit 1 safety related River Water System and the BVPS Unit 2 safety related Service Water System must have adequate ultimate heat sink capability to support the bounding low probability extreme low river water design basis / licensing basis postulated scenario. Current BVPS design analyses show that adequate inflow to the suction of the River/Service Water System pumps may not be assured with greater than 22 inches of solid blockage in an Intake Structure bay. Previously identified as-found silt levels in Intake Structure bays have exceeded 22 inches. This represents a potential unanalyzed condition that could significantly degrade plant safety. Therefore, this is being reported pursuant to 10 CFR 50.73 (a)(2)(ii)(B).

CAUSE OF EVENT

The cause of this event was inadequate/incomplete design aspects. This cause is attributed to instances where the overall quality of the design product and the supporting documents are incomplete; such as inadequate reviews and updates to associated design bases or licensing bases documents. The design bases information derived in a design calculation performed in 2000 was not translated into the implementing procedures' acceptance criteria. Additional design information also was not effectively incorporated into the implementing procedures such that the design bases/licensing bases was easily recognizable.

SAFETY IMPLICATIONS

The long term risk effects of having intake structure bay silt levels above the 22” acceptance criteria, coincident with a loss of a single dam gate during an extreme drought with the most severe reasonably possible instantaneous low flow condition, was evaluated at BVPS. This risk analysis also applies to conditions with the silt levels above the acceptance criteria and a complete failure of the downstream dam during an extreme drought condition comparable to the site record drought of 1930, which would lower the river level at the site to no less than the 648.6 feet design basis level. An annual delta Core Damage Frequency (CDF) was calculated and is applicable to both units, given that these silt level deficiencies exist during the extreme drought conditions.

The frequency of an extreme drought is estimated to be 0.5 occurrences per 100 years, based on BVPS Unit 2 UFSAR, Figure 2.4-16 “Drought Frequency Curve – Ohio River at Shippingport” and assuming that the most severe reasonably possible 800 cubic foot per second (cfs) instantaneous low flow drought condition (as analyzed in BVPS-2 UFSAR Section 2.4.11.1) also corresponds to the 4,000 cfs lowest continuous 7-day average, which would have occurred during the record drought in 1930. This equates to an extreme drought initiating event frequency of 5.0E-03 events

per year. The total failure rate for a concrete dam is about 3.0E-05 per year, based on an ABS/PLG study of dam failures as part of the external events PSA for the Swiss plant Beznau, which was based on European report: Goubet, A., "Risques Associes aux Barrages," La Houille Blanche/ N 8-1979.

Since it is not known exactly when the high silt level conditions existed, the exposure time is estimated as t/2, where t is taken to be the frequency at which the intake structure bays are cleaned (i.e., quarterly). To estimate the delta core damage frequency (ΔCDF) due to the high silt levels in the intake structure bays, it is assumed that the extreme drought condition also lasts for the entire exposure time of 1-1/2 months. Since the dam and gates must remain functionally operable and intact during this exposure time, the 1-1/2 months will also be used as the mission time for the dam. Furthermore, it is assumed that the conditional core damage probability (CCDP) due to a loss of the ultimate heat sink is 1.0. The resultant ΔCDF is estimated, as shown below:

$$\Delta CDF = \left(\begin{matrix}\text{frequency of low}\\ \text{flow condition}\end{matrix}\right) \times \left(\begin{matrix}\text{concrete dam}\\ \text{failure rate}\end{matrix}\right) \times \left(\begin{matrix}\text{mission}\\ \text{time}\end{matrix}\right) \times \left(\frac{1\text{ yr}}{12\text{ mo}}\right) \times CCDP$$

$$\Delta CDF = \left(\frac{5.0E-03}{\text{yr}}\right) \times \left(\frac{3.0E-05}{\text{yr}}\right) \times (1.5\text{ mo}) \times \left(\frac{1\text{ yr}}{12\text{ mo}}\right) \times 1$$

$$\Delta CDF = 1.88E-08\text{ /yr}$$

Based on this evaluation, the annual delta CDF to each Beaver Valley unit was calculated to be less than 1E-06, and is considered to be low safety significance. Moreover, this delta CDF is considered to be conservative in that it does not credit dam operators to install emergency bulkheads during a dam gate failure, which could be performed in about four hours, to terminate the uncontrolled drain down of the river.

Based on the above, the safety significance of prior conditions where the Intake Structure silt levels exceeded 22 inches in the past was low.

CORRECTIVE ACTIONS

1. A multi-discipline site team was formed to address immediate actions needed for the Intake Structure silt level concerns.

2. An operability basis was provided for the BVPS Intake Structure to address current and future expected silt deposition levels.

3. Plant operating logs have been modified to require a condition report be entered into the BVPS corrective action program if the Ohio River water level is above a pre-determined value for trending of potential silt loading so that the operability of the ultimate heat sink is not challenged.

4. The dual-unit quarterly surveillance procedure for the Intake Structure was revised to reflect current design and operating criteria. This included taking more silt depth measurement locations and identifying as-found silt levels greater than 15 inches in an Intake bay as an issue which should be input into the site corrective action program.

5. The dual-unit Abnormal Operating Procedure which would be used at either BVPS unit during a low river water level condition was revised to reflect current design and operating criteria. This included revised bay flow limits and operating instructions during an extreme low river water level condition, new restrictions on Alternate Intake Structure pump operation, and additional criteria for contacting the dam immediately downstream from BVPS on the Ohio River.

6. Various long term corrective actions are being pursued as enhancements to the immediate actions identified above to ensure future operability of Intake Structure bays.

7. The BVPS site criteria which currently define the Emergency Action Levels during low river water conditions as an emergency condition are being reviewed in the corrective action program.

Completion of the above and other corrective actions are 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 event involving the inadequate Intake Structure operation at BVPS Unit 1 or Unit 2.

LER 1-98-024, “Internal Flooding Discrepancy in the Intake Structure Pump Cubicles”

ATTACHMENT

Beaver Valley Power Station, Unit No. 1
License Event Report 2002-001-00

Commitment List

The following list identifies those actions committed to by FirstEnergy Nuclear Operating Company (FENOC) for Beaver Valley Power Station (BVPS) Unit Nos. 1 and 2 in this document. Any other actions discussed in the submittal represent intended or planned actions by Beaver Valley. These other actions are described only as information and are not regulatory commitments. Please notify Mr. Larry R. Freeland, Manager, Regulatory Affairs/Corrective Actions, at Beaver Valley on (724) 682-5284 of any questions regarding this document or associated regulatory commitments.

Commitment	Due Date
None	None