FENOC
FirstEnergy Nuclear Operating Company

5501 North State Route 2
Oak Harbor, Ohio 43449

Lew W. Myers
Chief Operating Officer

419-321-7599
Fax: 419-321-7582

NP-33-03-002-00

Docket No. 50-346

License No. NPF-3

May 5, 2003

United States Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Ladies and Gentlemen:

LER 2003-002
Davis-Besse Nuclear Power Station, Unit No. 1
Date of Occurrence – October 22, 2002

Enclosed please find Licensee Event Report 2003-002, which is being submitted to provide written notification of an issue with the High Pressure Injection pumps. The issue concerns the potential for debris from the Containment Emergency Sump impacting the High Pressure Injection pumps following a design-basis accident whereby the pump internals may be damaged to the extent they would not be able to complete their intended safety function. This issue was identified as part of the Davis-Besse Return to Service Plan inspections. This LER is being submitted in accordance with 10CFR50.73(a)(2)(i)(B), 10CFR50.73(a)(2)(ii)(B), 10CFR50.73(a)(2)(v) and 10CFR50.73(a)(2)(vii).

Evaluation continues with respect to determining the final corrective action. Additional information as a result of the evaluation and final decision described herein will be provided in a supplement to this report within 30 days following restoration of High Pressure Injection Pumps operability.

Very truly yours,

Lew W Myers

JSP/s

Enclosures

cc: Mr. J. E. Dyer, Regional Administrator, USNRC Region III
Mr. C. S. Thomas, DB-1 NRC Senior Resident Inspector
Utility Radiological Safety Board

IE22

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COMMITMENT LIST

The following list identifies those actions committed to by the Davis-Besse Nuclear Power Station in this document. Any other actions discussed in the submittal represent intended or planned actions by Davis-Besse. They are described only as information and are not regulatory commitments. Please notify the Manager - Regulatory Affairs (419-321-8450) at Davis-Besse of any questions regarding this document or associated regulatory commitments.

COMMITMENTS	DUE DATE
Submit supplemental information regarding the apparent cause and safety significance of this occurrence.	30 days following restoration of HPI Pump operability

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 hrs. 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
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4. TITLE

Potential Degradation of High Pressure Injection Pumps Due to Debris in Emergency Sump Fluid Post Accident

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
10	22	2002	2003	-- 002 --	00	05	05	2003		05000
									FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE	D
10. POWER LEVEL	000

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)	X	50.73(a)(2)(v)(A)		73.71(a)(5)
	20.2203(a)(2)(ii)		50.36(c)(2)	X	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)	X	50.73(a)(2)(i)(B)	X	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)
Gerald M. Wolf, Staff Engineer - Licensing	(419) 321-8114

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
X	YES (If yes, complete EXPECTED SUBMISSION DATE).	No		07	04	2003

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

On October 22, 2002, with the reactor defueled, a potential deficiency was identified for the High Pressure Injection (HPI) pumps during the recirculation phase of postulated loss of coolant accidents (LOCA) and when the HPI pumps are used for post-LOCA boron precipitation control. The HPI pumps may be damaged due to potential debris generated by certain postulated LOCAs and entrained in the pumped fluid. The HPI pumps may be subject to this debris after the pump suctions are switched over from the borated water storage tank to the discharge of the Low Pressure Injection Pumps, which are taking suction on the containment emergency sump.

The HPI pumps use a process-fluid lubricated hydrostatic radial bearing on the outboard end of the pump shaft. The hydrostatic bearing, an inter-stage bearing, and wear rings may be damaged by debris or particles in the pumped fluid. An evaluation is being performed to determine pump operability during postulated accidents. In parallel with the evaluation, modifications to the system design to mitigate the effects of debris are being considered.

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

DESCRIPTION OF OCCURRENCE:

As part of detailed system health reviews being conducted at the Davis-Besse Nuclear Power Station (DBNPS) to assure that plant systems can perform their safety functions, the High Pressure Injection (HPI) System was reviewed. On October 22, 2002, with the reactor defueled, a deficiency was identified whereby internal clearances of the HPI pumps [BQ-P] may not be sufficient to pass debris or particles contained in the fluid being drawn from the containment emergency sump during postulated loss of coolant accidents (LOCAs). As a part of the Emergency Core Cooling System (ECCS), the HPI pumps are required to provide cooling following a break or transient in the Reactor Coolant System (RCS) [AB] and are initially aligned to take suction from the Borated Water Storage Tank (BWST) [BP-TK]. In the event the BWST inventory becomes depleted, and HPI pump flow is still required, pump suction is switched to the containment emergency sump via the Low Pressure Injection (LPI) pumps [BP-P].

The HPI pumps, constructed by Babcock and Wilcox (B&W) Canada, Ltd. as part of the originally licensed plant design, were built from designs furnished by Pompe Guinard (Guinard Pumps, Annecy, France). The pumps are multi-stage horizontal centrifugal pumps. Per original equipment manufacturer records, DBNPS is the only domestic operational licensee supplied with these type pumps. The pump casing consists of a one-piece barrel or pressure case. On the driven end of the pump, an oil-lubricated bearing supports the shaft. The outboard end bearing is a process-fluid lubricated hydrostatic radial bearing within the pump casing. The shaft is also supported by a process-fluid lubricated inter-stage bushing.

The containment emergency sump originally incorporated screens with 1/4 inch square openings to prevent debris or particles (greater than approximately 5/16 inches diagonally) from entering the system and blocking flow. These screens have been replaced with a design utilizing 3/16 inch round openings during the current outage (Refer to DBNPS LER 2002-005 for further details). The pump internal openings that provide lubricating flow to the hydrostatic bearing are smaller than the original screen openings. Debris from the containment emergency sump could potentially block the pump internal openings, which could result in damage of the hydrostatic bearing. The HPI pumps were declared inoperable since the ability to maintain long-term core cooling while taking suction through the original sump screens was in question.

Investigation into this issue initially considered that debris introduced to the HPI pump via the containment emergency sump would be reduced in size after passage through the LPI Pump and the first four stages of the HPI Pump. Lubricating water, in the form of process fluid, is provided to the hydrostatic bearing via two radial ports in the fourth stage volute of the pump and enters the bearing through five ports. The fluid, after flowing past the bearing surface, is returned to the suction of the third stage of the pump. If the debris or particles were of sufficient size and hardness, they could potentially damage the bearing shaft sleeve. Initial investigation also theorized that debris or particles of size and structural strength capable of

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

DESCRIPTION OF OCCURRENCE (continued):

blocking internal lubricating ports would be too dense to be transported to the sump. Documentation provided in 1975 by the nuclear steam system supplier addressed the acceptability of the pump design to function when provided with fluid supplied from the containment emergency sump. It was noted that "... particles which could deteriorate the pump are in the range of 0.004 in. to 0.015 in. These particles can pass through the mechanical seals and wear rings. However, if the mechanical seals failed from these particles, it will not prevent the pump from performing its intended function of supplying fluid to the system at the required pressures. The only other possible effect would be increased wear on the wear rings, which could result in a minor loss of efficiency (approximately 5% if the wear ring clearance is doubled), and a slight decrease in discharge pressure. Again, this will not prevent the HPI pump from performing its intended function." The effect of these particles on the hydrostatic bearing was not addressed.

Communications with the current vendor for the HPI pumps identified clearances of various rotating parts and noted that debris that is small enough to pass through the bearing may cause localized erosion of mating material surfaces, but would not lead to imminent failure of the bearing. The pump vendor also noted larger debris could block flow to the hydrostatic bearing, resulting in bearing damage.

On March 4, 2003, review of a spare hydrostatic bearing assembly revealed the existence of a threaded plug with a 0.11 inch diameter hole in each of the five feed holes (0.315 inch in diameter) to the bearing that was not documented in the vendor manual. Since these openings are smaller than the sump screen openings, they may become clogged with debris. It was also identified that the radial clearances on the impeller wear rings could be eroded by the debris, resulting in a reduction in pump efficiency and capacity.

Thus, although not quantified, a range of debris or particles was recognized that could possibly result in degradation of the HPI pumps. The complete extent of potential HPI pump degradation due to debris in the pumped fluid has not yet been determined.

APPARENT CAUSE OF OCCURRENCE:

When the plant design was developed, the design of the HPI pump and the use of a hydrostatic bearing was apparently not adequately evaluated for the potential impact of post-LOCA debris that was smaller than the containment emergency sump screen openings. Evaluation continues with respect to the apparent cause(s) of this issue, and pertinent additional information that may be developed will be provided in a revision to this report.

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

ANALYSIS OF OCCURRENCE:

The HPI pumps are automatically started upon receipt of a Safety Features Actuation System (SFAS) [JE] signal with suction aligned to BWST to provide flow to the RCS. Depending on the size of the postulated break, HPI Pump suction may switched over from the BWST to the LPI Pump discharge in order to maintain flow from the containment emergency sump to the RCS. While the LPI pumps are utilized to mitigate the largest of RCS piping breaks, the HPI pumps are utilized on smaller breaks. Additionally, the HPI pumps are utilized to control boron concentration post-LOCA that may result from boiling heat transfer within the core.

Technical Specification 3.5.2 requires that two independent ECCS subsystems be operable during Modes 1, 2, and 3. Each subsystem includes one Operable HPI pump with an Operable flow path initially from the BWST with suction transferred to the containment emergency sump during the recirculation phase of operation. This condition is being reported under 10 CFR 50.73 (a)(2)(i)(B) as operation or condition prohibited by the plant's technical specifications since the condition existed for a time longer than permitted by the DBNPS Technical Specifications.

This condition is also being reported under 10 CFR 50.73 (a)(2)(v) as a condition that could have prevented the fulfillment of the safety function of a system needed to maintain the reactor in a safe shutdown condition and remove residual heat. Likewise, this condition is being reported under 10 CFR 50.73(a)(2)(vii)(B) as a single condition that caused two independent trains to become inoperable in a single system designed to remove residual heat, and under 10 CFR 50.73 (a)(2)(ii)(B) as a condition that resulted in the nuclear power plant being in an unanalyzed condition that significantly degraded plant safety. A non-emergency eight hour notification per 10 CFR 50.72 (b)(3)(ii)(B) was provided to the NRC as Event Number 39740 on April 7, 2003.

Evaluation into the safety significance of this issue is ongoing, and the results of the evaluation will be provided in a revision to this report.

CORRECTIVE ACTIONS:

An evaluation is being performed to determine pump operability during postulated accidents. Additionally, modifications to the system design to mitigate the effects of debris are being formulated, which may result in incorporation of strainers to eliminate debris or particles of concern, replacement of the bearing with a new design, or replacement of the entire pump. The results of this evaluation, and the resultant modifications performed to restore operability of the HPI pumps will be provided in a revision to this report.

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

PREVIOUS SIMILAR EVENTS:

There have been no LERs in the previous two years involving similar deficiencies associated potential damage of hydrostatic bearings or other pump internals due to debris entrained in the pumped fluid.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

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NP-33-03-002-00

CR 2002-08492,
CR 2003-01738