



FirstEnergy Nuclear Operating Company

5501 North State Route 2
Oak Harbor, Ohio 43449

Mark B. Bezilla
Vice President, Nuclear

419-321-7676

June 29, 2018

L-18-106

10 CFR 50.73

ATTN: Document Control Desk
United States Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Subject:
Davis-Besse Nuclear Power Station, Unit 1
Docket Number 50-346, License Number NPF-3
Licensee Event Report 2017-002-01

Enclosed is Revision 01 to Licensee Event Report (LER) 2017-002-00, "Auxiliary Feed Water Pump Turbine Bearing Damaged due to Improperly Marked Lubricating Oil Sight Glass." This event is being reported pursuant to 10 CFR 50.73(a)(2)(i)(B) and 10 CFR 50.73(a)(2)(v)(B).

Additional evaluation of the Auxiliary Feedwater Pump Turbine functionality in the as-found condition was performed to support industry reporting of this issue. However, this evaluation was not used to update the Analysis of Occurrence section of this LER. As documented by letter dated March 16, 2018 (ADAMS Accession Number ML18093A461), the FirstEnergy Nuclear Operating Company did not contest the significance of this issue as documented in Nuclear Regulatory Commission (NRC) Inspection Report 05000346/2018010.

There are no regulatory commitments contained in this letter or its enclosure. The actions described represent intended or planned actions and are described for information only. If there are any questions or if additional information is required, please contact Mr. Patrick J. McCloskey, Manager – Site Regulatory Compliance, at (419) 321-7274.

Sincerely,

Mark B. Bezilla

GMW

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NR

Davis-Besse Nuclear Power Station, Unit 1
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Enclosure: LER 2017-002-01

cc: NRC Region III Administrator
NRC Resident Inspector
NRR Project Manager
Utility Radiological Safety Board

**LICENSEE EVENT REPORT (LER)**

(See Page 2 for required number of digits/characters for each block)

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<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/>)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@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 an 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.

1. Facility Name Davis-Besse Nuclear Power Station, Unit 1					2. Docket Number 05000 346			3. Page 1 OF 5				
4. Title: Auxiliary Feed Water Pump Turbine Bearing Damaged due to Improperly Marked Lubricating Oil Sight Glass												
5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved			
Month	Day	Year	Year	Sequential Number	Rev No.	Month	Day	Year	Facility Name	Docket Number		
09	13	2017	2017	002	01	06	29	2018	Facility Name	Docket Number		
										05000		
										05000		
9. Operating Mode			11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: (Check all that apply)									
1			<input type="checkbox"/> 20.2201(b)			<input type="checkbox"/> 20.2203(a)(3)(i)			<input type="checkbox"/> 50.73(a)(2)(ii)(A)		<input type="checkbox"/> 50.73(a)(2)(viii)(A)	
			<input type="checkbox"/> 20.2201(d)			<input type="checkbox"/> 20.2203(a)(3)(ii)			<input type="checkbox"/> 50.73(a)(2)(ii)(B)		<input type="checkbox"/> 50.73(a)(2)(viii)(B)	
			<input type="checkbox"/> 20.2203(a)(1)			<input type="checkbox"/> 20.2203(a)(4)			<input type="checkbox"/> 50.73(a)(2)(iii)		<input type="checkbox"/> 50.73(a)(2)(ix)(A)	
			<input type="checkbox"/> 20.2203(a)(2)(i)			<input type="checkbox"/> 50.36(c)(1)(i)(A)			<input type="checkbox"/> 50.73(a)(2)(iv)(A)		<input type="checkbox"/> 50.73(a)(2)(x)	
10. Power Level			<input type="checkbox"/> 20.2203(a)(2)(ii)			<input type="checkbox"/> 50.36(c)(1)(ii)(A)			<input type="checkbox"/> 50.73(a)(2)(v)(A)		<input type="checkbox"/> 73.71(a)(4)	
100			<input type="checkbox"/> 20.2203(a)(2)(iii)			<input type="checkbox"/> 50.36(c)(2)			<input checked="" type="checkbox"/> 50.73(a)(2)(v)(B)		<input type="checkbox"/> 73.71(a)(5)	
			<input type="checkbox"/> 20.2203(a)(2)(iv)			<input type="checkbox"/> 50.46(a)(3)(ii)			<input type="checkbox"/> 50.73(a)(2)(v)(C)		<input type="checkbox"/> 73.77(a)(1)	
			<input type="checkbox"/> 20.2203(a)(2)(v)			<input type="checkbox"/> 50.73(a)(2)(i)(A)			<input type="checkbox"/> 50.73(a)(2)(v)(D)		<input type="checkbox"/> 73.77(a)(2)(i)	
			<input type="checkbox"/> 20.2203(a)(2)(vi)			<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)			<input type="checkbox"/> 50.73(a)(2)(vii)		<input type="checkbox"/> 73.77(a)(2)(ii)	
						<input type="checkbox"/> 50.73(a)(2)(i)(C)			<input type="checkbox"/> Other (Specify in Abstract below or in NRC Form 366A)			
12. Licensee Contact for this LER												
Licensee Contact Gerald M. Wolf, Supervisor – Regulatory Compliance								Telephone Number (Include Area Code) (419) 321-8001				
13. Complete One Line for Each Component Failure Described in this Report												
Cause	System	Component	Manufacturer	Reportable to ICES	Cause	System	Component	Manufacturer	Reportable to ICES			
14. Supplemental Report Expected					15. Expected Submission Date					Month	Day	Year
<input type="checkbox"/> Yes (If yes, complete 15. Expected Submission Date) <input checked="" type="checkbox"/> No												
Abstract (Limit to 1400 spaces, i.e., approximately 14 single-spaced typewritten lines)												
<p>On September 13, 2017, with the Davis-Besse Nuclear Power Station operating at approximately 100 percent power, Auxiliary Feed Water (AFW) Pump Turbine 1 experienced high inboard bearing temperature during performance of quarterly Surveillance Testing. The turbine was tripped, and disassembly revealed damage to the journal bearing. The bearing was replaced, and following successful post maintenance testing, AFW Train 1 was declared Operable on September 16. The cause of the bearing damage was an improperly marked oil sight glass, which allowed operation with improper bearing lubrication. The improper markings were due to the maintenance work instruction for replacing the sight glass not including dimensions or guidance for setting required operational bands.</p> <p>On September 26, 2017, it was identified that low inboard bearing oil level had likely existed since completion of the previous quarterly surveillance test on June 21, when an oil sample was taken following testing but the bearing was not refilled due to the improperly marked sight glass. This issue is being reported in accordance with 10 CFR 50.73(a)(2)(v)(B) as a condition that could have prevented the fulfillment of the safety function, and in accordance with 10 CFR 50.73(a)(2)(i)(B) as a condition prohibited by Technical Specifications.</p>												

**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

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Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@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 an 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.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Davis-Besse Nuclear Power Station Unit 1	05000 - 346	2017	- 002	- 01

NARRATIVE

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

System Description:

The Davis-Besse Nuclear Power Station (DBNPS) Emergency Feedwater (EFW) System [BA] consists of two Auxiliary Feedwater (AFW) trains and the Motor Driven Feedwater Pump (MDFP) [BA-P]. The AFW System provides a safety-related source of feedwater to the secondary side of the Steam Generators [AB-SG] in the event of a loss of normal feedwater flow to remove reactor decay heat. The AFW pumps [BA-P] take suction from the condensate storage tanks [KA-T] and pump to the Steam Generator secondary side through the AFW nozzles. The Steam Generators function as a heat sink for core decay heat. The heat load is dissipated by releasing steam to the atmosphere from the Steam Generators via the Main Steam Safety Valves [SB-RV] or Atmospheric Vent Valves [SB-VTV].

The AFW System consists of two steam turbine driven AFW pumps, each of which provides a nominal 100% capacity. The steam turbine driven AFW pumps receive steam from either of the two main steam headers, upstream of the main steam isolation valves. The AFW System supplies water via two headers, each capable of feeding either steam generator. The 100% capacity is sufficient to remove decay heat and cool the unit to Decay Heat Removal System [BP] entry conditions. The AFW System normally receives a supply of water from the Condensate Storage Tanks. A safety grade source of water is also supplied by the Service Water System [BI].

The MDFP train provides feedwater to the steam generators during normal plant startup and shutdown. The non-safety related MDFP train is also designed to provide a backup supply of feedwater to the steam generators in the event of a total loss of both AFW and main feedwater.

Technical Specifications:

Technical Specification (TS) Limiting Condition for Operation (LCO) 3.7.5 requires three EFW trains be Operable in Modes 1 through 3, and in Mode 4 when a Steam Generator is relied upon for heat removal. In Mode 1 with one EFW train inoperable for reasons other than an inoperable steam supply, LCO 3.7.5 Condition B requires the inoperable EFW train be restored to Operable status in 72 hours. If these actions and associated completion times cannot be met, or if two EFW trains are inoperable, then LCO 3.7.5 Condition D requires the plant be placed in Mode 3 in 6 hours and in Mode 4 in 12 hours.

DESCRIPTION OF EVENT:

On September 13, 2017, AFW Train 1 was declared inoperable at 1007 hours to perform scheduled quarterly Surveillance Testing to meet TS Surveillance Requirement 3.7.5.2. At 1044 hours AFW Pump 1 was started, and at 1120 the pump achieved full flow (at least 600 gallons per minute) through the flow test line. Shortly after achieving full pump flow, the turbine inboard bearing temperature began to rapidly increase, and exceeded the bearing metal temperature computer alarm setpoint of 220 degrees F at 1126 hours. After the operating crew investigated the possibility of a faulted temperature instrument, the turbine was tripped locally at 1155 hours. The inboard turbine bearing oil was then sampled, which showed discoloration indicative of bearing degradation. The journal bearing was then disassembled to reveal damage to the journal bearing. The bearing was replaced, and following successful post maintenance testing, AFW Train 1 was declared Operable on September 16, 2017, at 0540 hours.

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NARRATIVE**CAUSE OF EVENT:**

The direct cause of the damaged AFW Pump Turbine 1 inboard bearing was due to operation with insufficient lubrication oil. The AFW Pump Turbine journal bearings are lubricated by slinger rings that ride on the turbine shaft located within the bearing assembly. During operation, the slinger rings rotate on the turbine shaft and rotate through the oil contained in the oil reservoir sump. The oil adheres to the slinger ring surfaces and is deposited on the turbine shaft near the bearing as the shaft rotates to provide bearing lubrication. During investigation and disassembly of the damaged inboard bearing, it was identified the existing oil level in the bearing was below the vendor recommended level, but was within the marked acceptable band of the oil level sight glass. The AFW Pump Turbine 1 inboard bearing oil sight glass operational band was marked too low to ensure proper bearing lubrication.

The root cause of the damaged AFW Pump Turbine 1 inboard bearing was that the preventive maintenance work instruction for replacing the sight glass did not include dimensions or guidance for setting required operational bands, and did not contain a requirement to reference the vendor manual to ensure the appropriate operational bands are established. The lack of detail in the work instruction resulted in Maintenance personnel setting the sight glass narrow operational band (minimum and maximum acceptable levels) via skill-of-the-craft when replacing the inboard bearing oil level sight glass.

ANALYSIS OF EVENT:

During investigation into the reasons for the damaged AFW Pump Turbine 1 inboard bearing, it was identified on September 26, 2017, that low inboard bearing oil level had likely existed since completion of the previous quarterly surveillance test on June 21, 2017. Bearing oil samples are taken routinely following the quarterly surveillance test for analysis, and the investigation revealed the inboard bearing was not refilled after sampling on June 21, 2017, because the inboard bearing oil level was within the acceptable band indicated on the sight glass.

A risk assessment was performed for the approximately 86 days AFW Pump Turbine 1 was unavailable until the bearing was repaired on September 15, 2017. The assessment considered there was reasonable assurance AFW Train 1 would have successfully completed the first total hour of operation, but may have failed sometime during the latter 23 hours of the 24-hour Probabilistic Risk Assessment (PRA) mission time. The plant risk associated with the extended unavailability for AFW Train 1 was determined to be very low, with a delta Core Damage Frequency (CDF) of $7.90\text{E-}07$ and a delta Large Early Release Frequency (LERF) of $2.22\text{E-}08$ for internal events. A sensitivity study to include the impact of a common cause failure was performed, resulting in a delta CDF of $8.09\text{E-}07$, which is still below the threshold to be considered very low plant risk. However, when qualitatively evaluated for External Events (Seismic, Fire), this event is overall considered to be of low safety significance.

Reportability Discussion:

Because AFW Train 1 was inoperable for approximately 87 days with the plant operating in Mode 1, and Technical Specification 3.7.5 allows operation to continue only for 3 days for this condition, this issue represents a condition prohibited by the plant's Technical Specifications, which is reportable in accordance with 10 CFR 50.73(a)(2)(i)(B). This Licensee Event Report is being submitted 60 days from the discovery of this reportable issue on September 26, 2017, in accordance with 10 CFR 50.73(a)(1) and 10 CFR 50.4(a)).

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NARRATIVE**Reportability Discussion: (Continued)**

Additionally, during the time AFW Train 1 was inoperable, AFW Train 2 was inoperable for maintenance and testing on multiple occasions. Therefore, this issue is also reportable as an event or condition that could have prevented fulfillment of a safety function of system needed to remove residual heat per 10 CFR 50.73(a)(2)(v)(B). At the time of the AFW Train 1 bearing damage on September 13, 2017, AFW Train 2 was Operable; therefore, no loss of safety function existed at the time of discovery, and no immediate notification to the NRC per 10 CFR 50.72 was required.

CORRECTIVE ACTIONS:**Completed Actions:**

AFW Pump Turbine 1 inboard bearing was replaced, and following successful post maintenance testing, declared Operable on September 16, 2017, at 0540 hours. As part of this maintenance work, the AFW Pump Turbine 1 inboard bearing oil level sight glass minimum and maximum dimensions were properly marked based on slinger ring submergence in accordance with the turbine vendor manual.

The AFW Pump Turbine 2 inboard bearing sight glass minimum and maximum dimensions have been verified to be consistent with the as-left AFW Pump Turbine 1 inboard bearing dimensions, and the AFW Pump Turbine 1 and 2 outboard bearing sight glasses have been re-marked to the appropriate levels based on measurements made external to the bearing.

The Lubrication Manual Data Sheets for the AFW Pump Turbines have been revised to include bearing oil sight glass minimum and maximum level dimensions, and the AFW Pump Turbine Preventive Maintenance Activities have been revised to reference the Lubrication Manual for marking the minimum and maximum dimensions on the bearing oil sight glasses.

The AFW Pump Turbine outboard bearing sight glass level markings were verified to be correct by direct observation of AFW Pump Turbine 1 oil slinger rings submergence during the recent refueling outage concluding March 27, 2018.

For Safety-Related and critical equipment, the basis for oil sight glass markings has been validated and captured in the Lubrication Manual, and field sight glass markings have been verified to be in accordance with the information captured in the Lubrication Manual for equipment not requiring intrusive verifications (i.e., equipment disassembly). Additionally, Preventive Maintenance Activities that implement sight glass replacements for Safety-Related and critical equipment have been revised as necessary to include guidance to mark the new sight glass in accordance with the Lubrication Manual.

Scheduled Actions:

Maintenance activities have been scheduled or are otherwise tracked within the Corrective Action Program for the remaining Safety-Related and critical equipment that require intrusive verification of the oil sight glass markings.



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NARRATIVE

PREVIOUS SIMILAR EVENTS:

There have been no Licensee Event Reports (LERs) at the DBNPS in the past three years related to inoperability of the Auxiliary Feedwater System or low bearing oil level.