energy harbor

Davis-Besse Nuclear Power Station
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Terry J. Brown
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August 16, 2022

L-22-158

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 2022-001-00

Enclosed is Licensee Event Report (LER) 2022-001-00, "*Plant Heatup with Inoperable Decay Heat Pump due to Oil Leak Induced by Constant Level Oiler.*" This event is being reported pursuant to 10 CFR 50.73(a)(2)(i)(B).

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. Robert W. Oesterle, Manager, Site Regulatory Compliance and Emergency Response, at (419) 321-7462.

Sincerely,

Terry J. Brown

GMW

Enclosure: LER 2022-001-00

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

NRC FORM 366 (08-2020) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

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

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/

1. Facility Name	2. Docket Number	3. Page
Davis-Besse Nuclear Power Station, Unit 1	05000 346	1 OF 5

4. Title:

Plant Heatup with Inoperable Decay Heat Pump due to Oil Leak Induced by Constant Level Oiler

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
										05000
04	04	2022	2022	- 001 -	00	08	16	2022	Facility Name	Docket Number
										05000

9. Operating Mode	10. Power Level
3	0

11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)*

10 CFR Part 20	☐ 20.2203(a)(2)(vi)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(A)	**10 CFR Part 73**
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.69(g)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(4)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(i)	**10 CFR Part 21**	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(1)
☐ 20.2203(a)(2)(ii)	☐ 21.2(c)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(i)
☐ 20.2203(a)(2)(iii)	**10 CFR Part 50**	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)	☐ 73.77(a)(2)(ii)
☐ 20.2203(a)(2)(iv)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)	
☐ 20.2203(a)(2)(v)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)	

☐ **OTHER** (Specify here, in abstract, or in NRC Form 366A).

12. Licensee Contact for this LER

Licensee Contact	Phone Number (Include area code)
Gerald M. Wolf, Supervisor – Regulatory Compliance	(419) 321-8001

13. Complete One Line for Each Component Failure Described in this Report

Cause	System	Component	Manufacturer	Reportable to IRIS		Cause	System	Component	Manufacturer	Reportable to IRIS
B	BP	P	H127	Y						

14. Supplemental Report Expected		15. Expected Submission Date	Month	Day	Year
☒ No	☐ Yes (If yes, complete 15. Expected Submission Date)				

16. Abstract (Limit to 1400 spaces, i.e., approximately 14 single-spaced typewritten lines)

During a scheduled refueling outage at the Davis-Besse Nuclear Power Station, an oil leak was discovered on Decay Heat/Low Pressure Injection Pump 2 outboard bearing on March 23, 2022. The leak was repaired prior to the unit entering Mode 3 on April 4. On April 6 the pump was placed in service to support the unit returning to Mode 5 for an unrelated equipment issue, and on April 10 an oil leak was again identified on the pump outboard bearing. While the cause of the oil leak could not be definitively determined, the pump bearing was rebuilt with new bearings, oil sleeve, oil slinger ring, and v-ring seal to correct the leakage. The outboard bearing constant level oiler is being maintained empty to prevent overfeeding the bearing and possibly initiating a new oil leak.

A past operability review of this issue completed on June 17, 2022 was not able to conclude the pump would have been able to operate for its required 30-day mission time following a design basis event due to the oil leak rate. This event is being reported pursuant to 10 CFR 50.73(a)(2)(i)(B) as operation of the plant in a condition prohibited by the Technical Specifications, since Decay Heat Pump 2 was considered not Operable as required when the unit entered Mode 3 on April 4, 2022.

NARRATIVE

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

System Description:

The Decay Heat Removal System [BP] at the Davis-Besse Nuclear Power Station (DBNPS) has two main functions that are dependent on the plant's mode of operation. During Power Operation through Hot Standby Conditions (Modes 1 through 3), both trains of the Decay Heat Removal System are aligned for Low Pressure Injection (LPI), in which the function is to provide water from the Borated Water Storage Tank (BWST) [BP-T] to the reactor pressure vessel [AB-T] for Emergency Core Cooling following a Loss of Coolant Accident (LOCA). Following depletion of the BWST volume, the suction of the Low Pressure Injection/Decay Heat Removal Pumps [BP-P] (hereafter referred to as the Decay Heat Pumps) is transferred to the Containment Emergency Sump [BP-V] for long-term recirculation cooling of the reactor pressure vessel following a LOCA. The Decay Heat Pumps may also be used for Boric Acid Precipitation Control during the post-accident cooling period.

During plant shutdowns, the suctions of the Decay Heat Pumps are aligned to the Reactor Coolant System to provide for a controlled cooldown during the latter stages of plant shutdown and to maintain the Reactor Coolant System temperature during shutdown/refueling operations.

Following a postulated LOCA, recirculation of water from the Containment Emergency Sump via the Emergency Core Cooling Systems (ECCS) could result in radiation levels that would render the equipment in the ECCS Rooms, including the Decay Heat and High Pressure Injection Pumps and Motors, inaccessible for a considerable period of time. An analysis has been performed to establish a maximum leakage rate of 2 drops of oil per hour for the Decay Heat Pumps to ensure the pump operates for thirty (30) days following a design-basis LOCA event.

Technical Specifications:

DBNPS Technical Specification (TS) Limiting Condition for Operation (LCO) 3.5.2, "Emergency Core Cooling Systems," requires two independent ECCS subsystems be Operable while the plant is operating in Modes 1, 2, and 3. Each ECCS subsystem is comprised of one Operable High Pressure Injection (HPI) Pump, one Operable Low Pressure Injection (LPI) Pump, one Operable Decay Heat Removal Cooler, and an Operable suction flow path from the BWST that can be manually transferred to the Containment Emergency Sump during the recirculation phase of operation. With one LPI Train inoperable, TS LCO 3.5.2 Action A requires the inoperable train be restored to Operable status within 7 days or a plant shutdown initiated. TS LCO 3.5.3 requires only one of the above ECCS subsystems be Operable while in Mode 4 (Hot Shutdown), and there are no ECCS subsystem operability requirements in Mode 5 (Cold Shutdown).

Technical Specification LCO 3.9.4, "Decay Heat Removal (DHR) and Coolant Circulation – High Water Level," requires one Decay Heat Removal loop be Operable and in operation while the plant is in Mode 6 with the water level greater than or equal to 23 feet above the top of the reactor vessel flange. With the Decay Heat Removal loop requirements not met, TS LCO 3.9.4 Action A.1 requires immediate suspension of operations that could dilute the Reactor Coolant System boron concentration, Action A.2 requires immediate suspension of loading irradiated fuel assemblies in the reactor core, and Action A.3 requires immediate initiation of actions to satisfy the Decay Heat Removal loop requirements. Additionally, Actions A.4 through A.6 require closure of open containment penetrations within four hours.

NARRATIVE

DESCRIPTION OF EVENT:

On March 23, 2022, with the DBNPS shutdown for a scheduled refueling outage and in Mode 6, an oil leak was discovered in the form of a fine mist from Decay Heat Pump 2 outboard bearing with the pump in service. The constant level oiler installed on the pump bearing was also discovered empty. The pump was declared inoperable per TS LCO 3.9.4, resulting in ongoing fuel handling activities being suspended until Decay Heat Pump 1 could be placed in service. Following completion of repairs on April 4, 2022, at 0016 hours the unit entered Mode 3, requiring both trains of LPI to be Operable per TS LCO 3.5.2.

On April 6, 2022, at 2010 hours the unit returned to Mode 4 for an unrelated equipment issue, and Decay Heat Pump 2 was placed in service at 2114 hours to support entry into Mode 5. At 2212 hours the Decay Heat Pump 2 outboard bearing constant level oiler reservoir was noted to be nearly empty, but no oil leakage from the bearing was noted at the time, so the pump remained in service. On April 10 an oil leak was again identified at the interface between the shaft and the inside bearing cover in the same location as previously identified. The pump was shutdown at 2056 hours for repairs, which were completed on April 16.

On June 17, 2022, a past operability review for the Decay Heat Pump 2 outboard oil leakage was completed, which concluded the pump was inoperable while the unit was in Mode 3 for approximately 2.8 days from April 4 to April 6.

CAUSE OF EVENT:

The Decay Heat Pumps have had a history of bearing oil leaks. To increase operating margin and support the pumps' 30-day mission time for a design-basis LOCA event, constant level oilers were installed on the pumps in 2020. Constant level oilers feed oil as needed from a separate reservoir to the bearing housing using differential pressure created by elevation differences to maintain the oil level at a predetermined elevation. The most likely cause of the Decay Heat Pump 2 outboard bearing oil leakage was the constant level oiler overfeeding the bearing housing. The constant level oiler reservoir was found empty several times during this event, which preceded each discovery of oil leakage from the bearing. The most likely cause of the constant level oiler overfeeding was the dynamic conditions inside the bearing housing. Fluctuations of the oil level in the sight glass were observed with the pump in operation, and such fluctuations would create a demand on the constant level oiler to release oil from its reservoir into the bearing housing.

The Decay Heat Pumps utilize a slinger ring within each bearing assembly to distribute oil to the bearing. The slinger ring rides on the pump shaft within the bearing assembly so that during pump operation the ring rotates on the shaft and through the oil contained in the oil reservoir sump. The oil adheres to the slinger ring surfaces and is deposited on the pump shaft near the bearing. The cause of the unfavorable dynamic conditions inside the Decay Heat Pump 2 outboard bearing housing was not identified with certainty but is most likely due to erratic oil slinger ring operation. Erratic oil ring operation was evident from the oil level fluctuations observed during troubleshooting of this issue. Additionally, while there was no indication of excessive wear present on the oil ring, there was copper identified in the oil, which would be expected if the oil ring was operating erratically. Both bearings of both Decay Heat Pumps were monitored after the leak on Decay Heat Pump 2 outboard bearing was identified, and no oil leaks or bearing oil level fluctuations were observed on the other three bearings while the respective pump was in service.

NARRATIVE

CAUSE OF EVENT: (continued)

A contributing cause to the Decay Heat Pump oil leakage is that once the oil leak from the bearing was initiated due to the high oil level, the tight clearances of the leak path would cause a wicking effect that would continue the leak via capillary action.

ANALYSIS OF EVENT:

Between the start of the refueling outage on March 5, 2022, and the first discovery of the oil leak on March 23, Decay Heat Pump 2 was placed in service an additional six times for a total of 168 operating hours. Although operation of the Decay Heat Pump 2 following the initial discovery demonstrated the constant level oiler was likely to drain, the bearing housing leakage did not occur immediately, and there was sufficient oil in the bearing housing to keep the oil slinger ring submerged to support pump operation for a period of time. Therefore, it was determined that no functional failure of Decay Heat Pump 2 occurred, and it remained available during the 2.8 days the unit was in Mode 3 (April 4, 2022 at 0016 hours to April 6, 2022 at 2010 hours). Additionally, the unit did not enter Mode 2 and the reactor was not taken critical following replacement of approximately one-third of the core as part of refueling outage activities. As a result, the plant risk associated with this event was qualitatively determined to be of very low safety significance.

Reportability Discussion:

A past operability review for the Decay Heat Pump 2 outboard oil leakage was completed on June 17, 2022, in conjunction with the causal evaluation of the issue. Because the length of time the oil leakage would last or how low the leakage would drain the bearing housing due to suspected wicking was not definitively known, this past operability review was not able to definitively conclude Decay Heat Pump 2 would have been able to operate for its 30-day mission following a design-basis LOCA event. Therefore, Decay Heat Pump 2 was concluded to be inoperable when the unit entered Mode 3 at 0016 hours on April 4, 2022.

Technical Specification LCO 3.5.2 requires two ECCS Trains be Operable in Modes 1, 2, and 3. With one LPI subsystem inoperable, Required Action A.1 requires the LPI subsystem be restored to Operable status in 7 days. Since the unit was only in Mode 3 from April 4, 2022 at 0016 hours to April 6, 2022 at 2010 hours (2.8 days), this action was met. However, TS LCO 3.0.4.b states that when an LCO is not met, entry into a Mode or other specified condition shall only be made after performance of a risk assessment addressing inoperable systems and components, consideration of the results, determination of the acceptability of entering the Mode or other specified condition in the Applicability, and establishment of risk management actions, if appropriate (exceptions to this Specification are stated in the individual Specifications). When the unit progressed into Mode 3 on April 4, 2022 at 0016 hours, two LPI trains were not Operable, so TS LCO 3.5.2 was not met at that time, and the actions for LCO 3.0.4.b were not met. Therefore, the station was in a condition that was prohibited by the Technical Specifications, which is reportable as a Licensee Event Report per 10 CFR 50.73(a)(2)(i)(b). Low Pressure Injection Train 1/Decay Heat Pump 1 remained Operable during the time period in question with Decay Heat Pump 2 inoperable, so no loss of safety function occurred.

NARRATIVE

CORRECTIVE ACTIONS:

Completed Actions:

The Decay Heat Pump 2 outboard bearing was rebuilt with new bearings, oil sleeve, oil slinger ring, and v-ring seal. The wetted leak path was also cleaned to terminate any potential wicking effects. Following successful post-maintenance testing, Decay Heat Pump 2 was declared Operable on April 16, 2022.

The Lubrication Data Sheet for Decay Heat Pump 2 was revised to keep the constant level oiler empty. This eliminates the possibility for the constant level oiler to overfeed the bearing housing and initiate oil leakage.

Scheduled Actions:

The Decay Heat Pump 2 outboard bearing constant level oiler will be marked with the new oil levels to match the Lubrication Data Sheet.

PREVIOUS SIMILAR EVENTS:

There have been no Licensee Event Reports at the DBNPS in the past three years related to the Decay Heat Pumps.