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October 12, 2015

L-15-300

10 CFR 50.73

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

SUBJECT:
Davis-Besse Nuclear Power Station
Docket Number 50-346, License Number NPF-3
Licensee Event Report 2015-004

Enclosed is Licensee Event Report (LER) 2015-004, "Operation During Previous Cycle with Axial Power Shaping Rod Fully Inserted." This LER is being reported in accordance with 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 provided 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,

Brian D. Boles

GMW

Enclosure: LER 2015-004

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

IE22
NRR

NRC FORM 366 (02-2014) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 01/31/2017

Estimated burden per response to comply with this mandatory collection request: 80 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet 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.

LICENSEE EVENT REPORT (LER)

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

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4. TITLE

Operation During Previous Cycle with Axial Power Shaping Rod Fully Inserted

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
08	12	2015	2015	004	00	10	12	2015		05000
									FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
100	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
	☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
Gerald M. Wolf, Supervisor, Nuclear Compliance	(419) 321-8001

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).* ☒ NO				

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

On August 12, 2015, with the Davis-Besse Nuclear Power Station (DBNPS) operating in Mode 1 at approximately 100 percent power, it was determined that the plant operated the previous operating cycle (Cycle 18) with an Axial Power Shaping Rod (APSR) fully inserted. This issue was identified by the DBNPS fuel vendor while reviewing the previous cycle's quadrant power tilt graph and comparing it to the current cycle's (Cycle 19) expected end of cycle graph, since the plant is currently operating with a known APSR fully inserted. The previous cycle operations started with initial criticality on June 11, 2012, and ended on February 1, 2014.

The most likely cause of the APSR being disconnected during the previous operating cycle is an inadvertent work practice error during the coupling process. Corrective actions include a revision to the APSR coupling procedure to require positive verification of APSR coupling (such as verifying the weight addition of the APSR to the lead screw after the coupling is completed) since visual verification is not practicable.

This issue is being reported in accordance with 10 CFR 50.73(a)(2)(i)(B) as operation of the plant in a condition prohibited by the Technical Specifications (TS) because the necessary TS actions were not taken last cycle with the APSR fully inserted.

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NARRATIVE

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

System Description:

The Davis-Besse Nuclear Power Station (DBNPS) uses eight Axial Power Shaping Rods (APSRs) [AA-ADJ] with an Inconel alloy absorber to allow operators to control the axial power profile in the core. The APSRs are typically maintained at approximately 30 percent withdrawn for most of the operating cycle, and then fully withdrawn (100 percent) near the end of the operating cycle to extend the full power capability of the core. While an APSR drive mechanism [AA-75] is similar to a control rod drive mechanism, the APSRs have no trip function, and the drive is modified so the APSR roller nuts cannot disengage from the leadscrew on a loss of power to the drive motor stator.

Technical Specifications:

Technical Specification (TS) Limiting Condition for Operation (LCO) 3.1.6 requires each Axial Power Shaping Rod (APSR) be Operable, unless fully withdrawn, and shall be aligned within 6.5% of its group average height in Modes 1 and 2. With one APSR inoperable, not aligned within its limits, or both, Condition A requires Surveillance Requirement 3.2.3.1 be performed within 2 hours and 2 hours after each APSR movement. If the Required Action and associated Completion Time of Condition A is not met, Condition B requires the unit be in Mode 3 within 6 hours.

TS LCO 3.1.7 requires the absolute position indicator channel and the relative position indicator channel for each Control Rod and APSR be Operable in Modes 1 and 2. With both the relative position indicator channel and the absolute position indicator channel inoperable for one or more rods, Condition C requires rod to be declared inoperable immediately, and for an APSR the limits of TS LCO 3.1.6 would then be applied.

DESCRIPTION OF EVENT:

On May 9, 2014, during the start of the current DBNPS operating cycle (Cycle 19), an uncoupled APSR was identified during the beginning of cycle Power Imbalance Detector Correlation (PIDC) test, which is performed each cycle to determine the relationship between the indicated out-of-core axial power distribution and the measured in-core axial power distribution. This test is performed during the initial power escalation between 40 and 80 percent full power by moving the APSRs to create a core flux imbalance. The Incore Detector response as reported by the Fixed Incore Detector Monitoring System (FIDMS) [JD] during the test indicated that the APSR for core location D-10 was not responding as expected. The uncoupled APSR was declared inoperable and the appropriate actions were taken in accordance with the TS, and the reload licensing analysis was updated by the DBNPS fuel vendor.

On August 12, 2015, while reviewing a quadrant power tilt graph sent for another purpose, the DBNPS fuel vendor identified a change in the DBNPS quadrant power tilt on the graph. The change was near the end of the previous operating cycle (Cycle 18) when the APSRs were withdrawn as part of the end of cycle planned activities. DBNPS Cycle 18 operations started with initial criticality on June 11, 2012, and ended on February 1, 2014. The change in quadrant power tilt looked familiar because it was similar to the behavior predicted for the current DBNPS cycle (Cycle 19) for when the APSRs will be withdrawn near the end of the operating cycle. Further investigation of the Cycle 18 axial power distributions for core locations D10 and F12 (both instrumented and both APSR locations) revealed that core location F12 had a fully inserted APSR since initial Cycle 18 power operation, and therefore is

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DESCRIPTION OF EVENT: (continued):

suspected to not have been latched for all of Cycle 18 operation. FirstEnergy and the DBNPS fuel vendor staff subsequently confirmed this suspect condition using measured power distributions. The uncoupled APSRs in Cycle 18 and Cycle 19 involve two different core locations and two different APSRs. APSR A092 was uncoupled in Cycle 18 at core location F12 and APSR A08Y is currently uncoupled in Cycle 19 at core location D10. Both of these locations are in the same core quadrant.

The plant computer indicated that all eight APSRs were aligned at approximately 30 percent withdrawn for Cycle 18 (and 100 percent withdrawn following APSR withdrawal) because the APSR position is obtained with respect to lead screw position. In this situation the lead screw is attached but the APSR is not attached to the lead screw. This uncoupled condition resulted in no indication of an actual APSR misalignment available to the operators. Since the misalignment situation was unknown, plant operators did not identify that the plant was not in Technical Specification compliance; thus, no action was taken during Cycle 18 to accommodate the condition by entry into the appropriate TS Action Statements.

The APSRs contain less poison material than normal control rods and they only contain poison material in the lower portion of the rods. Because of these facts, a disconnected APSR would not be able to be detected unless APSR movement was initiated. The beginning of cycle PIDC test for Cycle 19 moved the APSRs from 30 percent withdrawn to zero (0) percent withdrawn then to 50 percent withdrawn. It was the APSR movement to 50 percent withdrawn that enhanced the ability to discover the uncoupled APSR for Cycle 19. The beginning of cycle PIDC test for Cycle 18 moved the APSRs from 30 percent withdrawn to zero percent withdrawn and then to 30 percent withdrawn, which limited the ability to discover the uncoupled APSR in Cycle 18.

CAUSE OF EVENT:

The most likely cause of the APSR at location F12 being disconnected during Cycle 18 is a work practice error during the coupling process. The coupling procedure lacks positive verification of APSR coupling (such as the weight addition of the APSR to the leadscrew after coupling is completed) since visual verification is not practicable.

This condition was not detected during the conduct of Surveillance Requirements associated with Technical Specification 3.1.6 and 3.1.7 (APSR alignment and Absolute Position Indication/Relative Position Indication Operability) due to the method used to determine APSR position.

ANALYSIS OF EVENT:

Power peaking and shutdown margin impacts are small for this type of APSR misalignment. Since the APSR absorber material is a relatively light neutron absorber compared to a control rod, the power distribution distortion with an uncoupled APSR is significantly less than for a dropped control rod. The largest effects for an uncoupled APSR are seen for the period late in the cycle when seven of the APSRs are fully withdrawn and the uncoupled APSR remains fully inserted. Throughout the cycle, the global reactivity effects are very small. The evaluation of the uncoupled APSR for Cycle 19 included a full core neutronics simulation model in which the uncoupled APSR was fully inserted (zero percent withdrawn) for the entire cycle. Based on using the Cycle 19 results and the similarities of the two fuel cycles (18 and 19) it was concluded that the misaligned APSR condition in Cycle 18 was

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ANALYSIS OF EVENT: (continued)

accommodated through existing power peaking and shutdown analysis conservatisms such that normal operating limits and plant trip set points were preserved, other safety criteria and limits were acceptable, and the uncoupled APSR did not pose a lift risk. Based upon this evaluation, this event had very low safety significance.

Reportability Discussion:

During Cycle 18, seven APSRs were at approximately thirty percent withdrawn and one was at zero percent withdrawn (fully inserted) for most of the cycle. While the APSR misalignment was not known due to indication limitations, the plant did not perform the required actions of TS LCO 3.1.6 Condition A and TS LCO 3.1.7 Condition C, and continued to operate instead of shutting down to Mode 3 as required by TS LCO 3.1.6 Condition B. This represents operation of the plant in a condition prohibited by the TS, which is reportable per 10 CFR 50.73(a)(2)(i)(B). Per the guidance of NUREG-1022, even though the condition was not discovered until after allowable time had elapsed and the condition was rectified prior to discovery, the issue is required to be reported as a Licensee Event Report (LER).

CORRECTIVE ACTIONS:

During the upcoming refueling outage scheduled for Spring 2016, APSRs A092 (at core location F12 during Cycle 18) and A08Y (at core location D10 during Cycle 19) will be inspected to check for unusual wear or damage.

The fuel assembly that was in core location F12 in Cycle18 (NJ0DMW), was discharged at the conclusion of Cycle 18 and is not planned to be re-inserted in the core. The fuel assembly that is currently in core location D10 for Cycle 19 (UDDA20) is scheduled for discharge at the end of the cycle and also is not planned for reinsertion. These assemblies will be tracked to require inspection for unusual wear or damage in the event they need to be reinserted for some future core design.

The procedure for Control Rod Drive Mechanism (CRDM) lead screw uncoupling / coupling parking and replacement will be revised to require positive verification of APSR coupling. The procedure will use a modified tool to ensure successful coupling of the APSR by verifying that additional weight (the coupled APSR) was added as a result of coupling the APSR to the lead screw (since visual verification is not practicable).

PREVIOUS SIMILAR EVENTS:

There have been no Licensee Event Reports (LERs) at the DBNPS involving uncoupled APSRs in the past three years.

As described previously, the DBNPS is currently operating with an uncoupled APSR. This uncoupled APSR was identified during power ascension testing and the appropriate TS Actions taken. The uncoupled APSR for the previous operating cycle was identified during review of that cycle's data and comparing it to the expected data for the end of the current operating cycle. The corrective actions being taken for the current operating cycle's uncoupled APSR could not have prevented the unknown event from the previous operating cycle.