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June 17, 2011

L-11-011

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 2010-004, Revision 1

Enclosed is Revision 1 to Licensee Event Report (LER) 2010-004, "Spent Fuel Pool Rack Patterns Did Not Comply With Technical Specification 3.7.16." This LER is being reported in accordance with 10 CFR 50.73(a)(2)(i)(B), operation in a condition prohibited by the Technical Specifications. This LER is being revised to provide results of the completed Root Cause evaluation. These Revision 1 changes to the LER are indicated with a revision bar in the right hand margin.

There are no regulatory commitments contained in this letter or its enclosure. The actions described represent intended or planned actions, are captured in the DBNPS Corrective Action Program, 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,

Barry S. Allen

JCS

Enclosure: LER 2010-004-01

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

IE22
NRR

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 10/31/2013

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 Section (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.

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

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4. TITLE

Spent Fuel Pool Rack Patterns Did Not Comply With Technical Specification 3.7.16

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	26	2010	2010	- 004 -	01	06	17	2011		05000
									FACILITY NAME	DOCKET NUMBER
										05000

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)(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)
☐ 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)
☐ 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 Specify in Abstract below or in NRC Form 366A
☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Joseph C. Sturdavant, Senior Nuclear Specialist	(419) 321-8199

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

☐ YES (If yes, complete EXPECTED SUBMISSION DATE). ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On August 26, 2010, an issue with Technical Specification (TS) 3.7.16, "Spent Fuel Storage," Bases was identified. TS 3.7.16 requires fuel assemblies in the Spent Fuel Pool (SFP) to be placed in racks per the criteria of TS Figure 3.7.16-1, which references the TS Bases. The TS 3.7.16 Limiting Condition for Operation (LCO) Action requires initiation of action to move non-complying assemblies to an allowable location with an Action Completion Time of "Immediately."

On August 26, 2010, there were assemblies in the SFP that did not comply with TS. This condition existed since conversion to Improved Standard TS (ITS), which omitted a SFP rack storage patterns TS Bases sentence. Additionally, action to bring the assemblies into compliance with TSs was not initiated "immediately."

The root cause was an inadequate assessment of risks and consequences when making changes in the guidance for describing acceptable analyzed assembly storage patterns resulting in a TS change that omitted information or deferred an LCO to administrative procedures during the SFP re-rack in 2001. Because assemblies in the SFP were in an acceptable pattern per the criticality analysis, there was no safety significance. Corrective Actions include a TS Bases change to permit fuel storage in the SFP racks as analyzed.

This event is reported pursuant to 10 CFR 50.73(a)(2)(i)(B) as a condition prohibited by TS.

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NARRATIVE

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

Initial Plant Conditions:

On August 26, 2010, the Davis-Besse Nuclear Power Station (DBNPS) was operating in Mode 1 at approximately 100 percent power.

System Description:

The Spent Fuel Pool facility [DB] at the DBNPS is designed to assure the safe storage of irradiated fuel assemblies under normal and accident conditions. The Spent Fuel Pool structure provides for the containment and confinement of the fuel assemblies, and prevents significant reduction in coolant inventory under normal and accident conditions.

The 21 high density Spent Fuel Pool racks [DB-RK] store a maximum of 1,624 fuel assemblies. The rack cells are arranged in a rectangular array of parallel rows. Boral®, which is a neutron absorber, is attached to all four sides of each cell. Between individual racks, and between peripheral racks and the pool walls, there is a gap. This gap forms a "flux trap" which reduces neutron movement between fuel assemblies in adjacent racks. The criticality analysis for the Spent Fuel Pool (Holtec Report No. HI-2002359) concluded the combination of Boral and flux traps provides the option to position each fuel assembly in three different patterns within the racks – Mixed Zone Three Region, Checkerboard, and Homogeneous Loading. These loading patterns maintain k-effective less than 0.95 for fuel assemblies with initial nominal enrichments less than or equal to 5.05 weight percent Uranium-235, assuming the Spent Fuel Pool water is unborated. Fuel stored in the Spent Fuel Pool is administratively limited to a maximum nominal enrichment of 5.0 weight percent Uranium-235. This allows compliance with subsection "b" of 10 CFR 50.68, "Criticality Accident Requirements." The position of a fuel assembly within a pattern is dependent upon its "category". The category is based on the burnup/initial enrichment restrictions contained in the Technical Specifications. The detailed requirements for use of each pattern, or combination of patterns, are contained in administrative procedures.

During accident conditions, credit may be taken for the Boron in the Spent Fuel Pool water when showing k-effective is maintained less than or equal to 0.95. The criticality analysis determined a Boron concentration of approximately 630 parts per million (ppm) in the Spent Fuel Pool water is required to maintain k-effective at 0.945 for the worst-case fuel handling accident, (i.e., a 5.05 weight percent enriched assembly misloaded in a Checkerboard pattern).

Technical Specification(s):

Technical Specification (TS) 3.7.16, "Spent Fuel Storage," Limiting Condition for Operation (LCO) 3.7.16 requires the fuel assemblies stored in the Spent Fuel Pool be placed in the storage racks in accordance with the criteria shown in TS Figure 3.7.16-1. TS Figure 3.7.16-1 includes a NOTE that the approved loading patterns are specified in the TS Bases. In accordance with TS LCO 3.7.16, when the requirements of the LCO are not met, actions to move the non-complying fuel assembly to an allowable location shall be initiated "immediately" (pursued without delay and in a controlled manner per TS Definition 1.3).

Technical Specifications Bases Document:

The TS Bases Document (Revision 7 in effect at the time of discovery) stated "The restrictions delineated in Figure 3.7.16-1 and the Required Actions are consistent with the criticality safety analysis performed for the Spent Fuel Pool (Ref. 1)." Reference 1 is the DBNPS Updated Safety Analysis

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Technical Specifications Bases Document (continued):

Report (USAR) Section 9.1.2.1. The TS Bases Document goes on to state "the criticality analyses qualify the high density rack modules for storage of the fuel assemblies in one of three different loading patterns subject to certain restrictions: Mixed Zone Three Region (MZTR), Checkerboard (CB), and Homogeneous Loading (HL). Figure 3.7.16-1 provides the Category-specific burnup/enrichment limitations. Different loading patterns may be used in different rack modules, provided each rack module contains only one loading pattern. The loading pattern restrictions are maintained in fuel handling administrative procedures."

DESCRIPTION OF EVENT:

On August 26, 2010, a corrective action document was initiated to document an issue with the Bases for TS 3.7.16. The TS Bases in effect at the time described three acceptable fuel loading patterns within the Spent Fuel Pool (SFP). The TS 3.7.16 TS Bases stated that fuel stored within each individual rack module shall be the same pattern and that different loading patterns may be used in different rack modules, provided each rack module contains only one loading pattern.

Technical Specification Change - Spent Fuel Pool Re-Rack Project

In 2001, in support of the DBNPS SFP re-rack project, a License Amendment Request (LAR) was developed to revise the TS (TS 3.9.13 at the time) to reflect the design and safety analysis change supporting the re-racking of the SFP. As part of the LAR, it was requested that the specific fuel loading pattern restrictions be relocated to administration procedures. Additionally, the TS Bases did not specifically provide the criticality analysis as a reference. This change in essence took the specific fuel loading restrictions which were previously in the TSs and therefore could not be revised without prior NRC approval and relocated the requirements into an administrative procedure. The TS LCO was revised in accordance with the approved License Amendment 247 to refer to the TS Bases for fuel loading pattern considerations. The TS Bases was revised to state:

> "The criticality analyses qualify the high density rack modules for storage of fuel assemblies in one of three different loading patterns, subject to certain restrictions: Mixed Zone Three Region, Checkerboard, and Homogeneous Loading. Figure 3.9-3 provides the Category-specific burn up/enrichment limitations. Different loading patterns may be used in different rack modules, provided each rack module contains only one loading pattern. Two different loading patterns may be used in a single rack module, subject to certain additional restrictions. The loading pattern restrictions are maintained in fuel handling administrative procedures."

This LAR and the License Amendment 247 allowed the specific restrictions on the loading pattern for the high density racks to be located in an administrative procedure instead of a licensing basis document. Since the specific loading pattern restrictions were not listed in the TS Bases, this contributed to the confusion over what was required for TS LCO compliance after the sentence in question was omitted in 2006.

Improved Standard Technical Specification Change – Spent Fuel Pool TS

In 2006, during the Improved Standard Technical Specification (ITS) conversion, a sentence was omitted from the SFP Storage TS Bases that stated "Two different loading patterns may be used in a single rack module, subject to certain additional restrictions." The ITS packages did not highlight the difference between the Current Technical Specification (CTS) Bases and the ITS Bases, thus making it

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Description of Event (continued):

unlikely for a reviewer to discover the deleted sentence. Personnel involved in the ITS conversion process recall this sentence being deleted based upon the belief that the sentence was redundant and non-consequential. They believed this change had no impact on compliance with the TS LCO and was technically safe.

CAUSE OF EVENT:

The root cause for fuel assemblies being located in the spent fuel pool in a pattern prohibited by the Technical Specifications is less than adequate assessment of the risks and consequences when making changes in the guidance for describing acceptable analyzed fuel assembly storage patterns in support of the SFP re-rack project LAR. Relocating specific spent fuel pool loading pattern restrictions from the TS to administrative procedures eventually allowed other pertinent information to be eliminated from the TS Bases without the risks and consequences of the change to be realized.

A contributing cause for fuel assemblies located in the spent fuel pool in a pattern prohibited by the Technical Specifications is less than adequate accountability for literal compliance with Technical Specifications. The less than adequate accountability for literal compliance with Technical Specifications resulted in several organizations believing the problem was administrative in nature without discussing literal compliance with Technical Specifications.

ANALYSIS OF EVENT:

The use of the USAR-described "combination of patterns" or previous TS 3.9.13 Bases "Two different loading patterns may be used in a single rack module" is consistent with the criticality safety analysis performed for the high density spent fuel storage racks, as documented in Holtec report HI-2002359, and with the bases documented in the NRC Safety Evaluation Report for DBNPS License Amendment 247, which implemented the changes associated with the installation of the existing high density spent fuel storage racks. Because the fuel assemblies in the Spent Fuel Pool were always in an acceptable pattern per the criticality safety analysis, this issue had no safety significance.

REPORTABILITY DISCUSSION:

Technical Specification (TS) 3.7.16, "Spent Fuel Storage," Limiting Condition for Operation (LCO) requires fuel assemblies stored in the Spent Fuel Pool (SFP) to be placed in spent fuel pool storage racks in accordance with the criteria shown in Figure 3.7.16-1. The TS 3.7.16 LCO Action requires actions to move the non-complying fuel assembly to an allowable location with an Action Completion Time of "Immediately." On August 26, 2010, there were assemblies in the SFP that did not comply with TS 3.7.16 and this condition existed in the past since conversion to Improved Standard TS (ITS) in 2006. Additionally, action to bring the assemblies into compliance with TSs was not initiated in a timeframe commensurate with the required completion time. Therefore, this issue is being reported in accordance with 10 CFR 50.73(a)(2)(i)(B), as operation in a condition prohibited by the Technical Specifications.

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CORRECTIVE ACTIONS:

The TS 3.7.16 Bases was changed on August 27, 2010, to reflect the analyzed configuration of two (2) different loading patterns in a single rack module in the Spent Fuel Pool.

A guidance document has been developed for Senior Reactor Operators (SRO) to use when reviewing corrective action documents and determining operability. This document includes emphasis regarding literal compliance with the TS and the TS Bases, and the Shift Managers' (SRO) responsibility for ensuring the plant operates in compliance with license requirements and regulations.

The affected personnel in the organizations who had input into the decision that the Spent Fuel Pool configuration was in compliance with TS LCO 3.7.16 will review the root cause analysis of this event to understand the literal compliance and conservative decision-making lessons-learned from this event.

PREVIOUS SIMILAR EVENTS

No prior similar events were identified. The root cause evaluation found no other occurrence of information being deleted by ITS causing the plant to be in noncompliance with the TS. Additionally, no other similar instances were identified where TS LCOs referred to the TS Bases for additional guidance.