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Docket Number 50-346

NP-33-05-005-00
10 CFR 50.73

License Number NPF-3

December 22, 2005

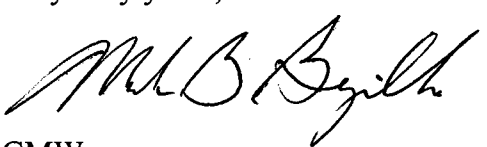
United States Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Ladies and Gentlemen:

LER 2005-005-00
Davis-Besse Nuclear Power Station, Unit No. 1
Date of Occurrence – November 3, 2005

Enclosed is Licensee Event Report (LER) 2005-005-00, which is being submitted to provide written notification of the discovery that the Boric Acid Pumps were incapable of meeting the rate of boration specified in the Technical Specifications without operator intervention. This event is being reported in accordance with 10 CFR 50.73(a)(2)(i)(B) as a condition prohibited by the Technical Specifications because the necessary operator actions were not captured in plant procedures, and because plant parameters existed in the past that would have prevented the pumps from attaining the necessary flow rate. Operating procedures have been modified to provide guidance in regards to the required plant configuration necessary to perform an emergency boration with these pumps. Commitments associated with this LER are listed in the Attachment.

Very truly yours,



GMW

Attachment
Enclosure

cc: Regional Administrator, USNRC Region III
DB-1 Project Manager, USNRC
DB-1 NRC Senior Resident Inspector
Utility Radiological Safety Board

IE22

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 Compliance (419-321-8585) at Davis-Besse of any questions regarding this document or associated regulatory commitments.

COMMITMENTS	DUE DATE
1. An extent of condition review will be performed to review the inputs and assumptions in design bases calculations for pumps that fulfill Technical Specification requirements. This review, which may credit reviews recently performed as part of or following the 2004 restart of the DBNPS, will focus on identification of non-conservative inputs.	1. April 30, 2006
2. The cause evaluation performed with respect to this issue will be reviewed with Design Engineering personnel, and will include a review of the causes and results of this issue.	2. March 15, 2006
3. Modify procedure DB-OP-06001, "Boron Concentration Control," to provide guidance in regards to the required plant configuration necessary to perform an emergency boration.	3. Completed November 18, 2005.

NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 6/30/2007

Estimated burden per response to comply with this mandatory 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 and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@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 reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Davis-Besse Unit Number 1	05000346	1 OF 5

4. TITLE

Boric Acid Addition System Unable To Meet Technical Specification Required Boration Rate

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
11	03	2005	2005	- 005 -	00	12	22	2005	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
☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER *(Include Area Code)*
Gerald M. Wolf, Staff Engineer, Regulatory 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

☐ 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 November 3, 2005, with the plant in Mode 1 at approximately 100 percent power, review of a calculation determined that non-conservative parameters were used to determine the performance requirements of the Boric Acid Pumps. Rather than assuming the most limiting conditions for the Makeup Filter differential pressure, Makeup Tank pressure, Reactor Coolant System Letdown flow rate, and Boric Acid Addition Tank levels permitted by plant procedures, the calculation utilized normal system operating parameters. This calculation was used to establish the original Technical Specification Limiting Condition for Operation value for pump flow rate.

This condition is being reported in accordance with 10 CFR 50.73(a)(2)(i)(B) as a condition prohibited by the Technical Specifications because plant parameters existed in the past three years that would have prevented the pumps from attaining the Technical Specification required flow rate without operator intervention, and the necessary operator actions were not captured in plant procedures. Operating procedures have been modified to provide guidance in regards to the required plant configuration necessary to perform an emergency boration with these pumps.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Davis-Besse Unit Number 1	05000346	2005	-- 005 --	00	2 OF 5

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

DESCRIPTION OF OCCURRENCE:

System Description:

The Chemical Addition System [CB] at the Davis-Besse Nuclear Power Station (DBNPS) is designed to add boric acid to the Reactor Coolant System (RCS) [AB] for reactivity control, lithium hydroxide for pH control, and hydrazine for oxygen control. The system contains two Boric Acid Addition Tanks [CB-TK], and the volume of these two tanks (approximately 7600 gallons) provides sufficient concentrated boric acid solution to increase the RCS boron concentration to that required for hot shutdown conditions at any time in core life, if needed. The system also contains two centrifugal Boric Acid Pumps [CB-P] to transfer the concentrated boric acid solution from the Boric Acid Addition Tanks to the Makeup Tank [CB-TK], the Borated Water Storage Tank [BP-TK], the Clean Waste Receiver Tanks [CA-TK], or the Spent Fuel Storage Pool. These pumps are sized with a capacity of approximately 25 gallons per minute (gpm) so that when both pumps are operating, one complete charge of concentrated boric acid solution may be injected into the reactor coolant system in 12 hours.

While the Chemical Addition System is not credited for mitigation of any design bases accidents (i.e., Updated Safety Analysis Report Chapter 15 accidents), the Boric Acid Addition System is credited for providing safe shutdown capability in the event the Borated Water Storage Tank is lost due to a tornado missile. While the Boric Acid Pump motors are powered from independent, essential sources, and independent boric acid addition lines are provided to guard against single component failure, the Boric Acid Addition System is manually actuated.

DBNPS Technical Specification (TS) Limiting Condition for Operation (LCO) 3.1.2.2.a requires a flow path from the concentrated Boric Acid Storage System via a Boric Acid Pump and Makeup or Decay Heat Removal Pump to the RCS be Operable while the plant is operating in Modes 1, 2, 3, and 4. Technical Specification LCO 3.1.2.7 requires at least one Boric Acid Pump in the boron injection flow path required by TS 3.1.2.2.a be operable and capable of being powered from an operable essential electrical bus while the plant is operating in Modes 1, 2, 3, and 4. These TS LCOs ensure the Boric Acid Addition System is available to permit boration at greater than or equal to 25 gpm of 7875 parts per million (ppm) boron or its equivalent as specified in TS LCO 3.1.1.1 when the Shutdown Margin is less than one percent delta-k/k. With the flow path from the concentrated Boric Acid Storage System inoperable or no boric acid pump operable, restoration to operable status is required within 72 hours or the plant must be in at least Hot Standby (Mode 3) and borated to a Shutdown Margin equivalent to one percent delta-k/k at 200 degrees Fahrenheit within the next six hours. Furthermore, the equipment (i.e., a flow path and a boric acid pump) must be restored to operable status within the next seven days or the plant must be in Cold Shutdown (Mode 5) within the next 30 hours.

Event Description:

On September 27, 2005, with the DBNPS operating at approximately 100 percent power, it was determined during review of Calculation 034.009, "Minimum Boric Acid Flow for Technical Specification 3.1.1.1," that the Boric Acid Pump acceptance criteria from the calculation were potentially non-conservative. The calculation did not assume the most limiting conditions permitted by plant operating procedures for Makeup Tank pressure, nor did the calculation account for the unusable level at the bottom of the Boric Acid Addition Tanks. In order for the Boric Acid Pumps to be able to inject concentrated boric acid into the Makeup System, the pumps must overcome Makeup System piping

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Davis-Besse Unit Number 1	05000346	2005	-- 005 --	00	3 OF 5

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

DESCRIPTION OF OCCURRENCE: (continued)

losses, which includes the Makeup Tank pressure. Based on plant operating conditions at the time, both Boric Acid Pumps remained capable of meeting the boric acid flow requirements of TS LCO 3.1.1.1.

On November 3, 2005, with the DBNPS operating at approximately 100 percent power, further review of the calculation determined that additional non-conservative parameters were used to determine the performance requirements of the pumps. These parameters included the differential pressure across the Makeup Filter [CB-FLT] corresponding to a clean filter and the RCS Letdown [CB] flow rate less than the maximum flow rate. Based on plant operating conditions at the time of this further review, Boric Acid Pump 2 was declared inoperable on November 3, 2005. Boric Acid Pump 1 remained capable of meeting the boric acid flow requirements of TS LCO 3.1.1.1.

Data was collected for the Boric Acid Addition Tank levels, Boric Acid Addition Tank boron concentrations, Makeup Tank pressure, Makeup Filter differential pressure, and RCS Letdown flow rate for the previous three years in order to determine past operability of the subject equipment. Due to the large impact the Makeup Tank pressure and Makeup Filter differential pressure have on the Boric Acid Pump flow rate, it was found that there were instances in the past three years where the pressure head of the system was up to approximately five pounds per square inch above either Boric Acid Pump's performance capacity. Therefore, the Boric Acid Pumps would not have been able to meet the rate of boration specified in TS 3.1.1.1, and should not have been considered operable per TS LCO 3.1.2.7. Since this condition existed for longer than the 72 hours permitted by TS LCO 3.1.2.7, the plant was operated in a condition prohibited by the Technical Specifications, which is reportable per 10 CFR 50.73(a)(2)(i)(B).

APPARENT CAUSE OF OCCURRENCE:

The cause of the Boric Acid Pumps not being able to meet the rate of boration specified in TS 3.1.1.1 was determined to be that the original calculation, performed in 1975 to determine the flow rate for minimum boric acid flow, used non-conservative parameters. The calculation was performed to determine the flow rate under the following conditions: a Makeup Filter differential pressure of 20 pounds per square inch (psi), a Makeup Tank pressure of 35 psi gauge, RCS Letdown flow of 45 gpm, and a Boric Acid Addition Tank level of 36 inches. While the boron concentration was not stated in the calculation, the pump flow rate of 18 gpm was used in the initial version of the Technical Specifications along with a boron concentration of 7875 ppm. The pump flow rate was increased to 25 gpm in 1994 via License Amendment 191 to allow flexibility in future core designs, but the non-conservative assumptions in the calculation were not identified.

Based upon review of historical information assembled during the investigation of this issue, a definitive root cause for this latent issue that occurred approximately 30 years ago could not be determined. The most probable causes for this event were determined to be: 1) inadequate or incomplete design aspects due to analysis deficiency, inadequate independent review of design analysis, or misapplication or interpretation of design inputs; and 2) program/process weakness in that there is no indication that standards, policies and administrative controls were available to ensure the proper rigor and consistency was applied to calculations and the design verification process during initial plant construction.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Davis-Besse Unit Number 1	05000346	2005	-- 005 --	00	4 OF 5

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

APPARENT CAUSE OF OCCURRENCE: (continued)

Normal system operating parameters had been selected as input data for a calculation that was used to establish a TS LCO value. Had this calculation been performed and reviewed/approved using current standards and procedures, the calculation would have been sufficiently challenged to discover the error. This is supported by the fact that the latent errors were discovered while revising and reviewing the calculation under the current process. There is no documentation available to demonstrate the calculation received a design verification review or a cross-discipline review, which is also a part of the current calculation process. Furthermore, the rigor applied to the calculations was less than adequate by current standards. If current policies, standards, procedures, controls, and programs were in place when this calculation was performed, the calculation preparer would have been less likely to use non-conservative assumptions, or these improper assumptions would have been more likely to be identified in a formal design verification process.

ANALYSIS OF OCCURRENCE:

As stated previously, while the Boric Acid Addition System is credited for providing safe shutdown capability in the event the Borated Water Storage Tank is lost due to a tornado missile, it is a manually operated system that is not credited for mitigation of any design bases accidents.

Corrective actions taken in response to this event were to change applicable procedures to provide operating guidance in regards to the required plant configuration necessary to perform an emergency boration. Interviews with plant operators revealed that they are sufficiently trained and knowledgeable to understand what actions would have been needed to be performed to ensure sufficient quantities of boric acid could have been injected into the RCS from the Boric Acid Addition Tanks if needed. However, the operating philosophy at the DBNPS is to not rely solely on operator knowledge to react to plant events or situations. The expectation is that equipment manipulations are reviewed, approved, and documented in procedures for guidance to minimize errors and prevent events.

Based on the above, the apparent inability of the Boric Acid Addition System to meet the rate of boration specified in TS 3.1.1.1 for all conditions in the past had minimal safety significance, as this condition would have been reasonably addressed by operator action to either decrease Makeup Tank pressure or to manually bypass the Letdown Filter to permit the system to attain the required flow rate.

CORRECTIVE ACTIONS:

Calculation 034.009, "Minimum Boric Acid Flow for Technical Specification 3.1.1.1," was revised to ensure that both boric acid pumps will meet the minimum TS 3.1.1.1 flow rate during an emergency boration event. Revision 03 of Calculation 034.009, completed on November 18, 2005, incorporates administrative limits associated with RCS Letdown flow rate, Makeup Tank pressure, and Boric Acid Addition Tank boron concentration. In addition, this calculation revision assumes operator actions associated with bypassing the Makeup Filters. These administrative limits ensure that both Boric Acid Pumps will meet the minimum TS 3.1.1.1 flow rate during an emergency boration event. Procedure DB-OP-06001, "Boron Concentration Control" (Revision 07), likewise became effective on November 18, 2005, to provide guidance in regards to the required plant configuration necessary to perform an emergency boration.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Davis-Besse Unit Number 1	05000346	2005	-- 005 --	00	5 OF 5

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

CORRECTIVE ACTIONS: (continued)

The cause of this event is that normal system operating parameters, instead of the most limiting system operating parameters, were selected as input data for a calculation that was used to establish a TS LCO value. Had this calculation been performed and reviewed/approved using current standards and procedures, the calculation would have been sufficiently challenged to discover the error. This is supported by the fact that the latent errors were discovered while revising and reviewing the calculation under the current process. There is no documentation available to demonstrate the original calculation received a design verification review or a cross-discipline review, which is also a part of the current calculation process. Furthermore, the rigor applied to the calculations was less than adequate by current standards. Therefore, no changes to the current calculation process are necessary with respect to this event.

An extent of condition review will be performed to review the inputs and assumptions in design bases calculations for pumps that fulfill Technical Specification requirements. This review, which may credit reviews recently performed as part of or following the 2004 restart of the DBNPS, will focus on identification of non-conservative inputs.

The cause evaluation performed with respect to this issue will also be reviewed with Design Engineering personnel, and will include a review of the causes and results of this issue.

FAILURE DATA:

There have been no Licensee Event Reports submitted by FENOC for the DBNPS in the last three years reporting an event associated with the Boric Acid Addition System. Because this event occurred approximately 30 years ago, no corrective actions taken in the past three years could have been expected to prevent this occurrence.

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

NP-33-05-005-00 CRs 05-05184, 05-05559