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Docket Number 50-346

License Number NPF-3

Serial Number 1-1356

April 5, 2004

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001Subject: Reply to a Notice of Violation from Davis-Besse Nuclear Power Station NRC
Inspection Report No. 50-346/04-05; EA-03-0172

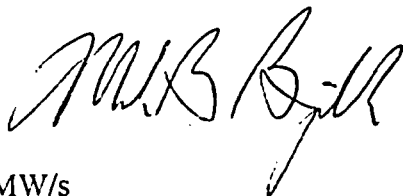
Ladies and Gentlemen:

The FirstEnergy Nuclear Operating Company (FENOC) received the subject Inspection Report dated March 5, 2004 (Log Letter 1-4522), documenting the final results of the significance determination of the finding involving the incorrect design of the High Pressure Injection (HPI) pumps at the Davis-Besse Nuclear Power Station (DBNPS). The overall significance of the finding was in the White range of importance, representing a low to moderate increased importance to safety.

The failure to adequately implement design control measures for verifying the adequacy of the design of the HPI pumps to mitigate all postulated accidents has been determined by the NRC to be a violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control." Attachment 1 to this letter provides the FENOC written response to this violation.

There are no new regulatory commitments contained in this letter. If there are any questions concerning this matter, please contact Mr. Gregory A. Dunn, Manager – Regulatory Affairs at 419-321-8450.

Very truly yours,



GMW/s

Attachment 1: Response to Violation
Attachment 2: Commitment Listing

JEO1

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

STATEMENT OF VIOLATION (EA-03-172)

10 CFR Part 50, Appendix B, Criterion III, "Design Control," requires, in part, that measures be established to assure that the design basis for safety-related functions of structures, systems, and components are correctly translated into specifications, drawings, procedures, and instructions. Further, Criterion III requires that the design control measures shall provide for verifying or checking the adequacy of designs.

Contrary to the above, the licensee failed to adequately implement design control measures for verifying and checking the adequacy of the original design of the high pressure injection pumps (HPI) to mitigate all postulated accidents. Specifically, on October 22, 2002, with the reactor defueled and in an extended outage, the licensee identified a design deficiency regarding internal clearances of the HPI pumps. The safety related function of the HPI pumps is to inject water into the reactor coolant system from the containment emergency sump (via the low pressure injection pumps) during the recirculation phase of a loss of coolant accident. During this mode of operation the HPI pumps were susceptible to failure since the potential existed for debris from the sump to be transported to the HPI pumps and cause blockage of lubricating water to the pumps' hydrostatic bearing resulting in a loss of the HPI pumps due to excessive vibration, overheating, or both. This was an original design flaw that had existed since plant construction.

This violation is associated with a White Significance Determination Process finding.

REASON FOR THE VIOLATION

On May 5, 2003, FENOC submitted DBNPS Licensee Event Report (LER) 2003-002, "Potential Degradation of High Pressure Injection Pumps Due to Debris in Emergency Sump Fluid Post Accident." Revision 1 to this LER was submitted on January 29, 2004, to provide supplemental information on the apparent cause of occurrence as well as information regarding the safety significance of this occurrence. As stated in this LER, the apparent cause of the design deficiency regarding internal clearances of the HPI pumps is that the original specification for the HPI pumps did not fully consider debris entrained in the pumped fluid. This design deficiency is related to errors that occurred during the design and construction of the DBNPS in the late 1960s and early 1970s. When the plant design was developed, the design of the HPI pumps and the use of a hydrostatic bearing was apparently not adequately evaluated for the potential impact of post-Loss of Coolant Accident (LOCA) debris that was smaller than the containment emergency sump screen openings.

A contributing cause as documented in LER 2003-002 Revision 1 was determined to be that the nuclear steam supply system supplier failed to consider effects of debris on internal components

within the HPI pumps when questioned in the mid-1970s. The HPI pump configuration includes a "piggyback" arrangement to receive containment sump inventory from the discharge of the Low Pressure Injection pumps. Because the HPI pumps were not originally designed to receive containment sump water laden with debris, the nuclear steam supply system supplier reviewed the impact of debris in the water in the size range of 0.004 to 0.015 inches and incorrectly concluded that this debris would not affect the capability of the HPI pumps to successfully continue operation.

CORRECTIVE STEPS TAKEN AND RESULTS ACHIEVED

As documented in LER 2003-002 Revision 1, FENOC has taken the following corrective actions with respect to the potential degradation of the HPI pumps due to debris in the Emergency Sump fluid:

- The following modifications were implemented for the HPI Pumps:
 - Self-flushing plates with approximately 0.050-inch diameter holes were installed on the water supply take-offs to the hydrostatic bearings to prevent debris that could plug the bearing orifices from entering the supply lines.
 - The locations of the hydrostatic bearing supply take-offs were moved from the periphery of the pump fourth stage volute to a new location on the side of the fifth stage volute across from the impeller and adjacent to the discharge wear ring, which is closer to the shaft.
 - A new hydrostatic bearing design was installed that was based on a "figure 8" pocket configuration. Relief grooves were added to the hydrostatic bearing pockets to provide an "escape" path for the debris that gets into the bearing.
 - The parts with wear surfaces that are subject to debris that were not already hard-faced were replaced with hard-faced parts.
 - The original cyclone separators in the pump seal water supply line were replaced with new model with larger internal clearances (smallest clearance is 0.230 inches).
- As part of corrective actions for the Containment emergency sump issues documented in DBNPS LER 2002-005 Revision 02, "Potential Clogging of the Emergency Sump Due to Debris in Containment," the Containment emergency sump strainer was replaced. The new strainer decreased the individual opening size and shape from approximately 1/4 inch square openings (5/16 inches diagonal) to 3/16 inch circular openings while increasing the screen surface area from 50 square feet to approximately 1200 square feet.
- Where possible, fibrous insulation was removed from Containment. The fibrous insulation and unqualified coatings left in the Containment have been identified and

evaluated (in conjunction with other potential debris) for effect on the Emergency Core Cooling System and Containment Spray System. The evaluation included debris generation, debris transport, and head loss analysis to verify there is adequate margin for net positive suction head at the affected pumps. Additionally, as described in LER 2002-005 Revision 02, controls have been established for potential debris sources to ensure adequate net positive suction head requirements are met.

- Evaluations were performed in conjunction with the modifications implemented on the containment emergency sump, which examined the Low Pressure Injection System, the HPI System, the Containment Spray System, and the Boron Precipitation Control System.

Qualification testing was performed to confirm proper function of the design modifications to the HPI pumps and to determine the wear rates for close clearances within the pumps. This qualification testing, which used full scale mock-up fixtures of the critical components of the HPI pumps, consisted of a series of tests with clean and debris-laden water. Each component was initially tested with clean water to obtain baseline data. Following the clean water tests, the components were subject to a series of tests with debris-laden water intended to represent the important characteristics of the debris that might be present in the containment emergency sump fluid following a LOCA at the DBNPS. Following the debris testing, all of the test articles with close running clearances were tested again on clean water to assess the effects of wear on their flow characteristics. This qualification testing demonstrated that the modified HPI pumps are able to function properly with a debris-laden water source. Post-modification testing was also performed to demonstrate the pumps operate properly following re-assembly, and the final pump assembly installation was satisfactory.

CORRECTIVE STEPS TAKEN TO AVOID FURTHER VIOLATIONS

As documented in LER 2003-002 Revision 1, programs currently in place at the DBNPS will help to prevent occurrence of this type of issue in the future. FENOC Policy NOPL-CC-0001, "Engineering Principles and Expectations" documents the fundamental principles and expectations for technical and engineering work at FENOC. Also, detailed design reviews are required to be completed as part of the Engineering Change process. The design review process utilized today is more stringent and rigorous than the design reviews that were done during original plant construction. This process provides adequate rigor to ensure the type of concerns that have been identified with the HPI pumps from original construction will not occur today.

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DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

The DBNPS achieved full compliance with the requirements 10 CFR Part 50, Appendix B, Criterion III, "Design Control," on December 5, 2003, with completion of the engineering changes to the HPI pumps as described above.

COMMITMENT LIST

The following list identifies those new actions committed to by the Davis-Besse Nuclear Power Station in this document.

COMMITMENTS

DUE DATE

None

N/A

The following list identifies those actions previously committed to by the Davis-Besse Nuclear Power Station in Licensee Event Report 2003-002 Revision 1. 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 Affairs (419-321-8450) at Davis-Besse of any questions regarding this document or associated regulatory commitments.

COMMITMENTS

DUE DATE

To prevent debris that could plug the hydrostatic bearing orifices from entering the supply lines, self-flushing plates with approximately 0.050-inch diameter holes were installed on the water supply take-offs to the hydrostatic bearing.

Complete

The locations of the hydrostatic bearing supply take-offs were moved from the periphery of the pump fourth stage volute to a new location on the side of the fifth stage volute across from the impeller and adjacent to the discharge wear ring, which is closer to the shaft.

Complete

A new hydrostatic bearing design was installed that was based on a "figure 8" pocket configuration. Relief grooves were added to the hydrostatic bearing pockets to provide an "escape" path for the debris that gets into the bearing.

Complete

The parts with wear surfaces that are subject to debris that were not already hardfaced were replaced with hardfaced parts. These parts are wear rings, central volute bushing (rotating and stationary parts), and the hydrostatic bearing (rotating and stationary parts).

Complete

Replaced original cyclone separators with new model (with smallest clearance of 0.230-inches).

Complete

| <u>COMMITMENTS</u> | <u>DUE DATE</u> |
|--|-----------------|
| Scope of work was expanded to remove as much as possible of the remaining fibrous insulation from containment. | Complete |
| Evaluations were performed, in conjunction with the modifications performed on the containment emergency sump, which examined the Low Pressure Injection System, the High Pressure Injection System, the Containment Spray System, and the Boron Precipitation Control System. | Complete |
| Evaluations were performed, in conjunction with the modifications performed on the containment emergency sump, which examined the Low Pressure Injection System, the High Pressure Injection System, the Containment Spray System, and the Boron Precipitation Control System. | Complete |
| As part of the Engineering Change Process (NOP-CC-2003), continue to perform detailed design reviews in accordance with NOP-CC-2004, Design Interface Reviews and Evaluations, to ensure rigorous design reviews are performed. | N/A |

The following list identifies those actions previously committed to by the Davis-Besse Nuclear Power Station in Licensee Event Report 2002-005 Revision 2:

| <u>COMMITMENTS</u> | <u>DUE DATE</u> |
|---|-----------------|
| The Containment emergency sump strainer was replaced with a new strainer having 3/16 inch circular openings and a greater surface area. | Complete |
| Controls have been established for potential debris sources to ensure adequate NPSH requirements are met. | N/A |

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 Affairs (419-321-8450) at Davis-Besse of any questions regarding this document or associated regulatory commitments.