October 8, 2003

EA-03-172

Mr. Lew Myers
Chief Operating Officer
FirstEnergy Nuclear Operating Company
Davis-Besse Nuclear Power Station
5501 North State Route 2
Oak Harbor, OH 43449-9760

SUBJECT: PRELIMINARY SIGNIFICANCE DETERMINATION FOR A GREATER THAN GREEN FINDING (NRC INSPECTION REPORT 50-346/2003-21) - DAVIS-BESSE HIGH PRESSURE INJECTION PUMP DESIGN ISSUE

Dear Mr. Myers:

The purpose of this letter is to provide you with the Nuclear Regulatory Commission's (NRC's) preliminary significance determination for the performance deficiency involving the failure of FirstEnergy Nuclear Operating Company (FirstEnergy) to correctly design the high pressure injection (HPI) pumps for accident mitigation during the recirculation mode of emergency core cooling. This preliminary significance determination revealed that this finding appears to have greater than very low safety significance and is being considered for escalated enforcement action in accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions" (Enforcement Policy), NUREG-1600. The current Enforcement Policy is on NRC's website at http://www.nrc.gov/what-we-do/regulatory/enforcement/enforce-pol.html.

On October 22, 2002, with the reactor defueled and in an extended outage, your staff identified a design deficiency regarding internal clearances in the HPI pumps. Specifically, the HPI pumps are required to be capable of operating during the recirculation mode of emergency core cooling. During this mode, the water source for the HPI pumps is the containment emergency sump which may contain debris, including fibrous insulation, paint, concrete and containment floor dirt. That material would enter the HPI pumps and block lubricating water to the hydrostatic bearing in the pump. The internal openings that provide lubricating flow to the hydrostatic bearing and the internal bearing clearances were smaller than the debris potentially resulting in a failure of the HPI pumps due to excessive vibration, overheating or both. The small internal openings for the hydrostatic bearing were determined to be design flaws that had existed since initial plant operation. On April 7, 2003, your staff reported this issue to NRC in a non-emergency eight-hour notification in accordance with 10 CFR 50.72. Subsequently, on May 5, 2003, your staff submitted a Licensee Event Report 2003-02 describing the issue.

As discussed in detail in the enclosure, the significance of the finding was assessed using the NRC Significance Determination Process (SDP). The preliminary safety significance of the inspection finding based on the change in core damage frequency (CDF) due to internal, external and large early release frequency (LERF) considerations is Greater than Green. Preliminary significance analyses varied greatly depending on assumptions regarding the impact of sump debris on the reliability of the HPI pumps. Additional information from FirstEnergy would facilitate more refined risk analyses, including: (1) failure probability of the HPI pumps when operating in the high pressure recirculation mode, including the impact of unqualified coatings in containment, the as-found degraded condition of peeling coatings, and transfer of those coatings and all other debris through containment and the sump to the HPI pumps during the high pressure recirculation mode of operation; and (2) the contribution to risk due to fires.

Be advised that this significance assessment is preliminary. The final significance assessment will include consideration of any further information or perspectives you provide that may warrant reconsideration of the methodology or assumptions used during the preliminary significance assessment.

The finding is also an apparent violation of 10 CFR 50, Appendix B, Criterion III, for failure to implement design control measures for verifying that the original design of the pump would mitigate all postulated accidents, and is being considered for escalated enforcement action in accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions" (Enforcement Policy), NUREG-1600. The current Enforcement Policy is included on the NRC's Web site at http://www.nrc.gov/reading-rm/adams.html.

This finding does not present an immediate safety concern because a License Amendment Request on September 5, 2003, to allow entry was granted into Mode 3 operation during this outage without the HPI pumps being operable during the high pressure recirculation mode of operation (reference ADAMS Accession No. ML032330438). The exception cannot be used for entry into Mode 2 (startup) or Mode 1 (power operation). The HPI pumps are being modified to be fully operable prior to Mode 2.

Before the NRC finalizes this significance determination, we are providing you an opportunity (1) to present to the NRC your perspectives on the facts and assumptions used by the NRC to arrive at the finding and its significance at a Regulatory Conference; or (2) submit your position on the finding to the NRC in writing.

If you request a Regulatory Conference, it should be held within 30 days of the receipt of this letter and we encourage you to submit supporting documentation at least one week prior to the conference in an effort to make the conference more effective. If a Regulatory Conference is held, it will be open for public observation. If you decide to submit only a written response, such submittal should be sent to the NRC within 30 days of the receipt of this letter.

Please contact Christine Lipa at 630-829-9619 within 10 business days of the date of receipt of this letter to notify the NRC of your intentions. If we have not heard from you within 10 days, we will continue with our significance determination and enforcement decision and you will be advised by separate correspondence of the results of our deliberations on this matter.

Since the NRC has not made a final determination in this matter, no Notice of Violation is being issued for the inspection finding at this time. In addition, please be advised that the characterization of the apparent violation described in this letter may change as a result of further NRC review.

For administrative purposes, this letter is issued as a separate NRC Inspection Report, No. 50-346/03-21. Accordingly, Unresolved Item 50-346/03-015-04, "Potential Inability for HPI Pumps to Perform Safety Related Function," is closed; and Apparent Violation 50-346/03-21-01, corresponding to Unresolved Item 50-346/03-015-04, is open.

The results of the NRC's review of this issue as described in this letter were presented to you and other members of your staff during a meeting on September 9, 2003.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA by Christine Lipa acting for/

John A. Grobe, Chairman
Davis-Besse Oversight Panel

Enclosure: Significance Determination Process and
Enforcement Review Panel Background Information

See Attached Distribution

See Previous Concurrences

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cc w/encl: The Honorable Dennis Kucinich
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SIGNIFICANCE DETERMINATION PROCESS (SDP) AND
ENFORCEMENT REVIEW PANEL
BACKGROUND INFORMATION

The significance of the finding was assessed using the SDP. Based on the initial results of the NRC Phase 2 SDP assessment, the finding was determined to be of high importance to safety (RED). The Phase 2 analysis results were dominated by accident scenarios resulting in the need for high pressure recirculation due to depletion of the borated water storage tank and the need for feed and bleed operation due to the loss of secondary cooling. The dominant accident sequence involved a small break loss of coolant accident. Other important contributors to the Phase 2 result were scenarios involving the loss of the instrument air system and the failure of the auxiliary feedwater system.

A more refined assessment of the increase in risk was performed using Revision 3i of the Davis-Besse Standardized Plant Analysis Risk (SPAR) model. In performing the Phase 3 analysis, the logic for the high pressure recirculation function was modified to account for the increased likelihood of failure of the High Pressure Injection (HPI) pumps to continue to operate while taking suction from the containment sump. Once the logic was modified, the failure to run basic events for both HPI pumps was changed assuming complete failure of the pumps during their required operating mission time. The nominal failure to run probability of 8.4E-4 is based on a mission time of 24-hours. The actual mission time is 30 days for the HPI pumps to run in the high pressure recirculation mode following a loss of coolant accident.

The failure to run probability in the model for the HPI pumps was set to 1.0. The NRC conservatively selected this failure probability due to the large degree of uncertainty associated with the ability of the HPI pumps to operate in the high pressure recirculation mode of operation. FirstEnergy has conducted experimental mockups of critical HPI pump components, taking suction from a simulated containment sump debris mix with various debris that would be expected during a large break loss of coolant accident. These results indicated that the HPI pumps would likely fail as a result of the deficient design during the assumed 24-hour mission time due to fibrous insulation and coatings accumulation. Although the most appropriate failure probability is not known, it is likely that the probability is significantly higher than the nominal probability. Additional information would assist in refining the failure to run probability.

No credit was given for recovery of the HPI pumps because if the pumps failed to run during sump recirculation; there would likely be sufficient damage to prevent them from being repaired. Although a single pump may be operating at the time of failure, because both pumps would be exposed to the same sump conditions, recovery credit for the second pump is not appropriate. In addition, no credit was given for refilling the borated water storage tank based on low flow rates from makeup systems and the lack of guidance in the emergency operating procedures to perform this action.

The SPAR analysis resulted in an increase in the core damage frequency of 4 per 10,000 reactor years of operation. This is reasonably consistent with the Phase 2 results and represents a finding of high importance to safety (RED). The dominant scenario involved the initiation of a loss of coolant accident due to failure of seals in the reactor coolant pumps. In addition, independent calculations using the risk achievement worth value of 13.0 provided by

FirstEnergy staff for failure of the HPI pumps to run during high pressure recirculation, also resulted in significance being of high importance to safety (RED).

Regarding internal flooding, because your probabilistic risk model includes internal flooding, the bounding risk of the finding from an internal flooding perspective is already captured in your risk achievement calculation. Therefore, no additional analysis was needed when assuming complete failure of the high pressure recirculation function.

The impact of loss of high pressure recirculation was not a significant contributor to the large early release frequency (LERF). The postulated accident scenarios involving loss of high pressure recirculation were not among those scenarios important to LERF for large dry containments. Therefore, the overall contribution of loss of high pressure recirculation to large early release frequency is of very low safety significance.

Regarding the potential risk contribution due to external events, NRC Inspection Manual Chapter 0609, Appendix A, Attachment 1, requires that when any Phase 2 sequence result is greater than 1E-7 per year, the finding be evaluated for additional risk due to external event contribution. We determined qualitatively that the increase in risk due to seismic events, high winds, external floods, and other accidents did not contribute significantly to the overall importance of the finding. For the fire risk analysis, fire scenarios requiring high pressure recirculation upon loss of secondary plant cooling or scenarios resulting in a reactor coolant pump seal failure are potentially important. For example, if a fire affected the auxiliary feedwater system rendering it unavailable, the need for high pressure recirculation for reactor coolant system cooling could result in increased importance of the finding. However, while we concluded that an increase in risk from fire was likely, we were unable to quantify the increase in risk from fire due to the lack of detailed fire risk information.

In conclusion, the preliminary safety significance of the inspection finding based on the change in core damage frequency due to internal, external and LERF considerations could be of high importance to safety (RED), but due to the potential variability in the outcome of the analysis based on various failure to run probabilities of the HPI pumps, preliminary significance of this performance deficiency is characterized as Greater than Green. Additional information from FirstEnergy would facilitate more refined risk analysis, including: (1) failure probability of the HPI pumps when operating in the high pressure recirculation mode, including the impact of unqualified coatings in containment, the as-found degraded condition of peeling coatings, and transfer of those coatings and other debris through containment and the sump to the HPI pumps during the high pressure recirculation mode of operation; and (2) the contribution of risk due to fires. Should additional information be provided, analysis assumptions for debris generation, debris transport inside containment, sump debris characterization and impact of debris on the reliability of the HPI pumps should be clearly articulated and effectively supported.