June 17, 2003

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

SUBJECT: DAVIS-BESSE NUCLEAR POWER STATION
NRC SPECIAL INSPECTION - EMERGENCY CORE COOLING SYSTEM AND CONTAINMENT SPRAY SYSTEM SUMP INSPECTION - REPORT NO. 50-346/03-06(DRS)

Dear Mr. Myers:

On April 11, 2003, the NRC completed onsite work for a special inspection at your Davis-Besse Nuclear Power Station. This inspection reviewed your actions to resolve Restart Checklist Item No. 2.c.1, associated with the adequacy of recent modifications to the containment recirculation sump. Our review of this modification included evaluation of your staff's recirculation sump design, field implementation of the sump modifications, and compliance with regulatory requirements. The enclosed report presents the results of our review which were discussed with you and your staff at the conclusion of the onsite work and during an exit meeting on June 16, 2003.

Based on the design analyses we evaluated, we concluded that the recirculation sump design modification was consistent with design and licensing basis requirements and based on field walkdowns the modification installation was adequately implemented consistent with the design. However, the inspector identified one finding of very low safety significance (Green) that was determined to involve a violation of NRC requirements. The finding is associated with the failure to adequately verify or check the accuracy of certain sump modification design calculations which contained errors. This issue negatively reflected on the adequacy of your staff's oversight of the engineering contractor performing the calculations. Because of the very low safety significance of this finding and because this issue has been entered into your corrective action program, the NRC is treating this issue as a Non-Cited Violation in accordance with Section VI.A.1 of the NRC's Enforcement Policy. If you deny this Non-Cited Violation, you should provide a response with a basis for your denial, within 30 days of the date of this inspection report, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with copies to the Regional Administrator, Region III; the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at the Davis-Besse Nuclear Power Station.

Because the errors substantially affected the design calculations associated with net positive suction head (NPSH) of the emergency core cooling system (ECCS) pumps, the NRC staff was unable to close Restart Checklist Item No. 2.c.1. We understand that as part of your corrective action for this design control issue, your staff intends to re-evaluate the available NPSH for the

ECCS pumps during alignment to the recirculation sump. We plan to review the results of your staff's re-evaluation of the recirculation sump NPSH availability including supporting calculations in order to support closure of Restart Checklist Item No. 2.c.1.

In accordance with 10 CFR Part 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/

John A. Grobe, Chairman
Davis-Besse Oversight Panel

Docket No. 50-346
License No. NPF-3

Enclosure: NRC Special Inspection Report
No. 50-346/03-06(DRS)

cc w/encl: The Honorable Dennis Kucinich
B. Saunders, President - FENOC
Plant Manager
Manager - Regulatory Affairs
M. O'Reilly, FirstEnergy
Ohio State Liaison Officer
R. Owen, Ohio Department of Health
Public Utilities Commission of Ohio
President, Board of County Commissioners
Of Lucas County
President, Ottawa County Board of Commissioners
D. Lochbaum, Union of Concerned Scientists

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President, Board of County Commissioners
Of Lucas County
Steve Arndt, President, Ottawa County Board of Commissioners
D. Lochbaum, Union Of Concerned Scientists

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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No:	50-346
License No:	NPF-3
Report No:	50-346/03-06(DRS)
Licensee:	FirstEnergy Nuclear Operating Company
Facility:	Davis-Besse Nuclear Power Station
Location:	5501 North State Route 2 Oak Harbor, OH 43449
Dates:	March 31, 2003 through April 11, 2003
Inspector:	Kevin Coyne, NRR Operations Engineer
Approved by:	David E. Hills, Chief Mechanical Engineering Branch Division of Reactor Safety

SUMMARY OF FINDINGS

IR 05000346-03-006(DRS); FirstEnergy Nuclear Operating Company; on 03/31 - 04/11/2003; Davis-Besse Nuclear Power Station. Special Inspection.

The special inspection was conducted by a headquarters based inspector to review recent modifications to the containment recirculation sump. The inspector identified one Green finding. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter 0609, "Significance Determination Process" (SDP). Findings for which the SDP does not apply are indicated by "No Color" or by the severity level of the applicable violations. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

A. Inspector Identified Findings

Cornerstone: Mitigating Systems

Green. The inspector identified a Non-Cited Violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for the failure to adequately verify or check the accuracy of certain design calculations. Specifically, one calculation used an incorrect water volume for the core flood tank when determining minimum containment water level and another calculation failed to incorporate head loss terms for several components when determining the available net positive suction head for the low pressure injection and containment spray pumps.

The inspector concluded that, if left uncorrected, this finding could have become a more significant safety concern. Specifically, lack of effective measures for verifying and checking the accuracy of design for safety-related structures, systems, or components (SSCs) could result in the failure to identify conditions that could render SSCs incapable of performing their safety function. However, the inspector concluded that this issue did not: (1) result in an increase in reactor coolant system (RCS) temperature or a loss of reactor coolant system inventory; (2) increase the likelihood of a loss of RCS inventory; (3) degrade the ability to terminate a leak path or add RCS inventory when needed; or (4) degrade the licensee's ability to recover decay heat removal once it was lost. Based on the screening criteria of IMC 0609, Appendix G, "Shutdown Operations Significance Determination Process," the inspector determined that this issue did not require a quantitative shutdown risk assessment. Therefore this issue was determined to be of very low risk significance (Section 4OA3.1.b.2).

B. Licensee Identified Violations

None

REPORT DETAILS

Summary of Plant Status

The plant was in Mode 5 (Cold Shutdown) for the duration of this inspection period.

4. OTHER ACTITIVIES

4OA3 Event Followup (93812)

.1 Adequacy of Emergency Sump Modification Design

a. Inspection Scope

The inspector reviewed the modifications to the containment emergency sump to verify that the design and licensing bases were met and that the capability of the emergency recirculation sump was not degraded by the modifications. The inspector reviewed Engineering Change Request (ECR) 02-512, "Emergency Sump Strainer Modification," the associated 10 CFR 50.59 evaluation, and current licensing basis requirements for emergency sump performance. The inspector also reviewed calculations, engineering evaluations, and drawings supporting the modification.

b. Findings

The inspector's general findings related to the emergency sump modification design review and an inspector identified issue concerning the adequacy of design control methods for the review and approval of safety-related calculations are described in the following sections.

b.1 General Findings

The inspector determined that the design considered appropriate emergency core cooling system (ECCS) structural and hydraulic performance design requirements in the licensing basis. The inspector determined that the emergency sump strainer and trash rack structural design considered seismic and hydraulic loads. Additionally, construction materials used to modify the recirculation sump were compatible with the containment environment. The inspector concluded that the licensee appropriately evaluated the impact of installation of the strainer modifications in the containment incore tunnel on the reactor cavity subcompartment pressurization analysis described in USAR Section 6.2.1.3.3.b. Although the licensee considered the impact of the sump modification on ECCS hydraulic performance, the inspector identified that the licensee's design control measures failed to ensure the accuracy of certain calculations supporting the sump modification. This design control issue is described in further detail in Section 4OA3.1.b.2, below. With the exception of this design control issue, the inspector did not identify any significant design and licensing basis impacts resulting from the sump modification that were not adequately addressed in the licensee's evaluation conducted pursuant to the requirements of 10 CFR 50.59, "Changes, tests, and experiments."

In addition, the licensee performed an assessment to evaluate the impact of debris that could pass through the emergency sump strainer on ECCS components. The results of this evaluation were documented in Enercon Services Report No. DBE004-RPT-004, "Assessment of Debris Size Acceptance on ECCS Components." The inspector noted that this report considered potential debris blockage points in the flow paths associated with the low pressure injection (LPI) pumps, the high pressure injection pumps, containment spray (CS) system, and fuel assemblies. The evaluation methodology included consideration of flow paths through piping, instrumentation, valves, and components. The inspector concluded that the licensee's approach to evaluating potential debris blockage locations in the ECCS systems was reasonable. Based on this evaluation, the licensee identified two potential debris blockage locations in the ECCS that required further evaluation: the high pressure injection pump hydrostatic bearing clearance and the low pressure injection pump mechanical seal and cyclone separator. The licensee initiated CR 02-08492 and CR 03-02439 to evaluate these issues. The inspector determined that this analysis was consistent with regulatory position 1.11 of Revision 2 to Regulatory Guide (RG) 1.82, "Water Sources for Long-Term Recirculation Cooling Following a Loss of Coolant Accident," which stated that the size of the openings in the debris screens should be based on the minimum restriction found in the ECCS pumps performing the recirculation function.

b.2 Failure to Adequately Verify the Accuracy of Design Calculations

Introduction

Green. The inspector identified a Non-Cited Violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for the licensee failing to adequately verify or check the adequacy of design calculations associated with net positive suction head requirements for the ECCS and containment spray systems pumps. The inspector concluded that if left uncorrected, this finding could have become a more significant safety concern. Specifically, lack of effective measures for verifying and checking the accuracy of design for safety-related SSCs could result in the failure to identify conditions that could render SSCs incapable of performing their safety function.

Description

The inspector reviewed design calculations associated with the determination of available net positive suction head (NPSH) for the LPI and CS pumps to ensure that modifications to the recirculation sump did not adversely affect NPSH availability. In calculation C-NSA-049.02-26, the licensee calculated the net available NPSH for the LPI pumps and the CS pumps by subtracting suction piping frictional head losses from the elevation difference between the minimum containment water level and the associated ECCS pump centerline elevation. As discussed in USAR Section 6.3.2.14, "Net Positive Suction Head Requirement," the bases for the NPSH calculation included as-built drawings and pipe and fitting losses calculated using the information in Crane Technical Paper 410, "Flow of Fluids Through Valves, Fittings, and Pipe." The inspector noted that the minimum difference between the available and required ECCS pump NPSH, when aligned to the emergency sump, was approximately 3.4 feet of water. This NPSH margin did not include any head loss through the emergency sump strainer

assembly. In reviewing the NPSH calculation C-NSA-049.02-26, the inspector identified several non-conservative calculational errors:

- The licensee used an entrance head loss term for the ECCS recirculation sump inlet that was approximately 15 percent of the head loss recommended by Crane Technical Paper 410 for the actual piping configuration. The entrance head loss term used in C-NSA-049.02-26 was consistent with a rounded pipe entrance flush with the wall of the emergency sump. However, the inspector determined that the actual ECCS suction piping configuration was an inward projecting pipe with a sharp edged flange. The licensee stated that the lower entrance loss factor was based on piping isometric drawing M-233B, "Emergency Core Cooling System," Revision 19, which showed anti-vortex cruciforms with a rounded pipe entrance installed on the ECCS pipe suction. The inspector concluded that the licensee failed to recognize that the sump modification changed the configuration of the ECCS suction from that shown in drawing M-233B. Specifically, the ECCS anti-vortex cruciforms were removed from the ECCS emergency sump suction piping by the sump design modification under Work Orders 02-006002-007 and 02-006002-008. In response to this issue, the licensee issued a Revision to ECR-0512 to install a rounded flange on the emergency sump ECCS suction pipe to reduce entrance head loss.

- Calculation C-NSA-049.02-26 did not include head loss associated with the piping tee located where recirculated suction flow splits to supply the train 2 LPI and CS pumps. Based on information from Crane Technical Paper 410, this component represents a head loss of approximately 0.2 feet of water.

- Calculation C-NSA-049.02-26 did not consider any head loss from the LPI pump startup suction strainer housing. Although the licensee stated that the strainer housing did not have an internal strainer element installed, the inspector questioned if the strainer housing would result in additional head loss. The licensee stated that the potential head loss for the strainer housing would be evaluated under CR 03-02840.

- Calculation C-NSA-049.02-26 did not consistently apply design assumptions regarding the head loss for the twelve inch diameter LPI suction piping. As discussed in Section 6 of C-NSA-049.02-26, the licensee increased the friction factor of the twelve inch LPI suction piping based on the assumption that the piping was carbon steel and would experience more internal corrosion than stainless steel piping used elsewhere in the system. Although this assumption was applied to the straight runs of twelve inch suction piping, the licensee used a friction factor consistent with the smoother stainless piping to calculate the head loss from pipe elbows included within the assumed carbon steel piping. Although the failure to consistently apply this assumption could have resulted in underestimating the net head loss, the inspector concluded that the licensee incorrectly assumed that carbon steel piping was used in the LPI suction piping. Based on a review of ECCS piping material specifications, the inspector determined that the entire length of ECCS suction piping between the recirculation sump and the LPI pump was stainless steel. Therefore, the failure to account for the assumed higher friction factor in the twelve inch suction piping

elbows did not result in a non-conservative calculation of NPSH availability. However, the inspector determined that the licensee's failure to identify inconsistencies in the calculation methodology and the use of an incorrect piping material for calculation of piping friction factor were related to weaknesses in the calculation review and approval process.

- Calculation C-NSA-059.01-019, non-conservatively calculated the minimum containment water level. Specifically, the calculation assumed the total volume of water available from the core flood tanks was 2,820 cubic feet, based on the total volume of the core flood tanks. However, USAR section 6.3.2.6 stated that each of the two core flood tanks contained a nominal water volume of 1,040 cubic feet. Therefore, the licensee overestimated the core flood tank water volume by 740 cubic feet. The inspector noted that use of the correct core flood tank water volume would reduce the calculated sump strainer submergence margin from 3.4 inches to approximately 2.6 inches of water. Although this reduction in containment water level had a negligible impact to the NPSH calculation, it non-conservatively impacted the submergence margin for the upper strainer assembly.

The inspector noted that each of these issues was associated with a safety-related design calculation performed by a vendor. The inspector determined that the licensee failed to identify these issues during the review and approval process for the design calculations.

In addition to the calculation errors described above, the inspector identified several calculation assumptions that lacked technical rigor. Although these issues did not necessarily constitute calculational errors, the inspector determined that the lack of a sufficient basis to support design related assumptions was related to the thoroughness of the licensee's review and approval methods for safety-related calculations. These issues are described below:

- Calculation C-NSA-049.02-26 used pump performance curves developed from original vendor test data to determine the NPSH margin. Because the licensee replaced the LPI pump 2 impeller since this testing was performed, the inspector questioned the bases for use of the original NPSH requirement for this pump. Although the licensee could not provide a detailed technical basis for use of the original pump test data, the licensee had previously initiated a corrective action in CR 03-01318 to determine if the assumptions used in design basis calculations bound the LPI pump 2 performance following the impeller change. Because this corrective was not complete at the time of the inspection, the inspector could not determine if use of the original LPI pump 2 NPSH requirement was conservative.

- RG 1.82, Revision 2, Table A-5, "PWR Design Guidelines for Interceptors and Cover Plate," recommends that sump trash racks grid spacing should be 1 to $1^1/_2$ inches. The inspector noted that the upper emergency sump front trash rack had a grid spacing of approximately 4 inches. The licensee stated that the wider grid spacing design was intended to prevent debris accumulation on the trash racks from blocking flow to the upper strainer elements. Although the wider

trash rack spacing would reduce the potential for debris flow blockage, the inspector noted that debris may be able to pass through the wider grid spacing of the trash rack and potentially damage the upper strainer elements. The inspector determined that the licensee lacked a sufficient basis to conclude that the trash rack design was consistent with intent of the recommendations in Regulatory Guide 1.82, "Water Sources for Long Term Recirculation Cooling Following a Loss of Coolant Accident." However, because the modified sump trash rack grid spacing was consistent with the previous sump design, the inspectors concluded that the use of a wider trash rack grid spacing than recommended by RG 1.82 did not degrade the original licensing basis sump capability. In response to this issue, the licensee wrote CR 03-02843 to evaluate and document the basis for the sump trash rack grid spacing.

- To support installation of the lower sump strainer assembly in the incore tunnel, the licensee cut a hole in the wall between the incore tunnel and the emergency sump. Because the hole permitted fluid flow between the incore tunnel and the emergency sump, the steam blowdown from a high energy line break in the reactor cavity, located adjacent to the incore tunnel, could subject emergency sump components to elevated differential pressures. Although the licensee evaluated this condition in calculation C-CSS-049.01-020, the inspector questioned the conservatism of the analysis methodology. Specifically, the analysis method assumed that steam entered the lower sump strainer assembly near the top of the incore tunnel through an opening approximately 14 square feet in area. Steam that entered the lower strainer assembly was then assumed to flow to the emergency sump and cause elevated differential pressures across sump components. The inspector noted that this method did not account for steam entering the lower strainer assembly through the entire 800 square foot surface area of the lower strainer. Consequently, the licensee may have underestimated the total differential pressure of emergency sump components due to a high energy line break. In discussions with the inspector, the licensee was unable to provide a basis that their calculational approach was conservative. The licensee initiated CR 03-02841 to evaluate the basis for this modeling assumption. At the time of the inspection, the sump had not been declared operable following the opening of the emergency sump wall; therefore, this issue did not affect the operablility of the ECCS system.

Overall, based on a review of calculations supporting the sump modification, the inspector concluded that the licensee's calculation review and approval process did not ensure that design documents were adequately verified. Specifically, the inspector identified several examples of calculation errors that were associated with determination of ECCS pump NPSH availability, in addition to several examples of design assumptions that lacked a rigorous technical basis.

Analysis

Because this finding was associated with design calculations for the ECCS system, the inspector determined that this issue was associated with the mitigating systems cornerstone. The inspector determined that this issue was more than a minor concern because, if left uncorrected, it could have become a more significant safety concern.

The failure to adequately verify and check the accuracy of design calculations could result in the failure to identify inadequate engineering designs and potentially render the associated equipment incapable of performing its design functions. This finding has greater significance than a similar issue described in NRC Manual Chapter 0612, Appendix E, Section 3.a and 3.i. Specifically, the calculation errors were significant enough to warrant a revision to the sump modification design package and require re-performance of the associated calculations to assure that accident analysis requirements were met.

Because the reactor plant was in a shutdown condition when the finding was identified, the inspector evaluated the significance of this issue using IMC 0609, Appendix G, "Shutdown Operations Significance Determination Process." The inspector concluded that this issue did not result in an increase in reactor coolant system temperature or a loss of reactor coolant system inventory and therefore did not constitute a loss of decay heat removal control. Furthermore, this finding did not: (1) increase the likelihood of a loss of reactor coolant system (RCS) inventory, (2) degrade the licensee's ability to terminate a leak path or add RCS inventory when needed, or (3) degrade the licensee's ability to recover decay heat removal once it was lost. Additionally, the inspector noted that the licensee's evaluation for sump availability during shutdown conditions, documented in CR 03-00440, stated there was no accident evaluated in the USAR that credited the recirculation sump. Consequently, the inspector determined that this issue did not require a quantitative assessment and therefore was determined to be of very low risk significance (Green).

Enforcement

10 CFR 50, Appendix B, Criteria III, "Design Control," requires, in part, that measures shall 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, Criteria III requires that the design control measures shall provide for verifying and checking the adequacy of design. Contrary to the above, the licensee failed to adequately implement design control measures for verifying and checking the adequacy of two safety-related design calculations. Specifically, calculation C-NSA-059.01-019 used an incorrect water volume for the core flood tank water volume when determining the minimum containment water level, and calculation C-NSA-049.02-26 failed to incorporate correct head loss terms for several components when determining the available NPSH for the LPI and CS pumps. Because of the very low safety significance, this violation is being treated as a Non-Cited Violation (NCV 50-346/03-06-01) consistent with Section VI.A.1 of the NRC Enforcement Policy. The issues identified in this violation are documented in the corrective action program in CR 03-02824, CR 03-02840, and CR 03-02842.

.2 Evaluation of Debris Transport and Strainer Debris Fouling

a. Inspection Scope

The inspector reviewed the licensee's methodology for evaluating the transport of debris to the emergency sump during postulated accidents. The inspector reviewed debris transport and fouling calculations, walked down portions of the emergency sump

strainer and containment debris transport paths, and discussed the debris transport evaluation methodology with members of the licensee's engineering staff. Because the licensee intended the sump modification to address eventual resolution of Generic Safety Issue (GSI)-191, "Assessment of Debris Accumulation on PWR Sump Performance," the inspector also considered the proposed staff regulatory positions contained in Draft Regulatory Guide (DG)-1107, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident," during this review.

b. Findings

The inspector concluded that the modifications to emergency sump strainer significantly increased the available strainer screen area and were consistent with current licensing basis requirements. Specifically, USAR Section 6.2.2.6.2 stated that adequate free flow area was provided in the sump screen so that there was negligible flow resistance even if 50 percent of the screen was clogged with debris. In calculation C-NSA-049.02-31, "Clean Strainer Head Loss for Davis-Besse Large Passive Strainer," the licensee determined that if all ECCS flow was routed through the upper portion of the sump strainer, which represents approximately one third of the total available strainer area, the head loss was less than 2 inches of water. Therefore, the inspector determined that the modified strainer design met the current USAR design requirements

The inspector noted that the licensee also considered strainer debris loadings significantly in excess of current licensing basis requirements. The licensee calculated postulated strainer debris loadings based on an assessment of potential debris generation due to high energy line breaks at several locations within containment and the potential for transport from the break location to the emergency sump. The methodology consisted of development of debris transport logic trees with transport probabilities derived, in part, from a computational fluid dynamic debris transport model of containment. Although the inspector did not attempt to verify that the licensee's debris transport evaluation would adequately address eventual resolution of GSI-191, the inspector concluded that the licensee's debris transport methodology, in general, appeared to be reasonable.

The inspector noted one modeling assumption that the licensee used in determining strainer head loss that appeared to be potentially non-conservative. When calculating strainer differential pressure, the licensee assumed that the fluid approach velocity (i.e., the velocity of the fluid passing through the strainer) was uniform over the entire strainer surface area. The inspector concluded that this approach did not represent an accurate analytical model since fluid approach velocity would be driven predominantly by the differential pressure across the strainer element. Since the differential pressure across the strainer element would tend to increase near the ECCS suction inlet, the approach velocity would be expected to vary over the strainer surface area. The inspector determined that use of a uniform approach velocity may result in underestimating the pressure drop across the strainer elements in certain regions of the sump strainer. Additionally, the inspector noted that proposed regulatory position 1.3.4.5 in DG-1107, states, in part, that estimates of head loss caused by debris blockage should be developed from empirical data based on the sump screen design, postulated combinations of debris distribution, and approach velocity. The licensee was unable to provide a sufficient basis to demonstrate that the use of a uniform approach

velocity would result in a conservative estimate of strainer head loss. The licensee initiated CR 03-02843 to document the basis for use of a uniform approach velocity when determining strainer head loss. Because the strainer head loss evaluation was intended to determine the impact of strainer debris loading beyond the current design and licensing basis, the inspector concluded that this issue did not impact current emergency sump operablility.

.3 Implementation Review

a. Inspection Scope

The inspector reviewed work instructions associated with the emergency sump modification and discussed overall project control with the maintenance project manager. The inspector also reviewed a sampling of quality control records associated with the installation of concrete anchor bolts and weld inspection to verify that these activities were appropriately controlled. The inspector performed a field walkdown of the sump strainer modification installation to verify that the field installation was consistent with design requirements.

b. Findings

At the time of the inspection, modifications to the emergency sump were not complete, but the major portions of the sump were installed in containment. The inspector determined that, overall, the emergency sump modification was well controlled and implemented consistent with design requirements. Additionally, the inspector did not identify any significant deviations between the as-built strainer and the design requirements during a field walkdown on April 7, 2003. The inspector noted that the licensee maintained effective management oversight of contractor personnel responsible for field installation of the sump modification.

.4 Post Installation Testing and Inspection Review

a. Inspection Scope

The inspector reviewed the post installation test and inspection requirements for the sump modification to verify that emergency sump performance characteristics, which could have been affected by the modification, continued to meet the design bases requirements. In particular, the inspector evaluated if the inspection requirements included verification that the sump strainer installation eliminated gaps greater than 3/16 of an inch. Because the sump modification was not completed at the time of the installation, the inspector was unable to observe performance of post-installation inspections or assess the effectiveness of the implementation of test and inspection requirements.

b. Findings

The inspector concluded that post modification testing requirements described in ECR 02-512 included verification that critical attributes of the sump strainer design were met, including verification that the installation did not leave gaps or openings greater

than 3/16 of an inch. Although the ECR specified appropriate post modification inspections, the inspector noted that the licensee had not established work instructions for execution of the post modification inspection that included a quality control inspection of the final sump installation. In response to the inspector's questions, the licensee initiated Work Order 02-007249-010 to perform the final inspections of the emergency sump strainer, including verification by quality control of work area cleanliness and lack of gaps or openings greater than 3/16 inch. Because the field installation of the modification was not completed at the time of the inspection, this issue was of minor significance and was adequately addressed by the licensee. No other issues of significance were identified during this review.

4OA6 Exit Meeting

The inspector presented the inspection results to Mr. L. Myers and other members of licensee management and staff on April 11, 2003. Following an internal discussion of the inspection's results with the NRC MC 0350 Panel for Davis-Besse, an exit meeting was conducted with Mr. L. Myers on June 16, 2003. The inspector asked whether any materials examined during the inspection should be considered proprietary. Identified proprietary information is not discussed within the report.

KEY POINTS OF CONTACT

Licensee
D. Blakely, Staff Engineer, Nuclear
R. Fast, Plant Manager
S. Fox, Project Manager
P. Haworth, Project Manager, Day & Zimmermann NPS
W. Marini, Regulatory Interface Team
L. Myers, Chief Operating Officer
J. Powers, Director, Engineering

NRC
S. Thomas, Senior Resident Inspector
R. Architzel, NRR

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-346/03006-01	NCV	Failure to adequately verify the accuracy of ECCS design calculations

Closed

50-346/03006-01	NCV	Failure to adequately verify the accuracy of ECCS design calculations

Discussed

None

LIST OF DOCUMENTS REVIEWED

4OA3 Event Followup

Condition Reports

CR 02-02846	Lack of methodology to address impact on the emergency sump posed by potential debris (GSI-191)	June 27, 2002
CR 02-06270	Design basis validation issues for RFA-00-0424 associated with maximum LPI pump flow and containment water level	September 19, 2002
CR 03-00440	Evaluate availability and operability requirements for emergency sump strainer	January 18, 2003
CR 03-01318	Decay heat pump 2 needs evaluation to determine impact of recent impeller replacement on design bases	February 15, 2003
CR 03-02717	Operations noted gaps in perforated pipe flanges during walkdown of emergency sump strainer.	April 6, 2003
CR 03-02797	NRC identified that signoffs for QC verification of weld inspections were inconsistent with procedural requirements	April 9, 2003
CR 03-02824	During review of calculation C-NSA-0459.01.19, “Containment Water Level,” the NRC inspector noted several potential errors	April 9, 2003
CR 03-02840	Several Issues identified by NRC inspector while reviewing C-NSA-049.02-026, NPSH licensing basis analysis for Davis-Besse LPI and CS pumps	April 9, 2003
CR 03-02841	During NRC inspection of ECR 02-512 a question was raised regarding the conservatism of the modeling used to evaluate cutting open a hole in the emergency sump south west wall	April 10, 2003
CR 03-02842	NRC identified potential concern with the adequacy of the owner acceptance process of vendor calculations supporting sump modification.	April 10, 2003

CR 03-02843	NRC noted documentation weaknesses associated with basis for acceptability of use of uniform strainer inlet flow for strainer pressure drop evaluation and use of a larger grid spacing for sump trash rack	April 10, 2003
Calculations		
C-CSS-049.01-021	Emergency Sump Strainer Support	Revision 1
C-CSS-49.01-020	Evaluation of Emergency Sump Southwest Wall	Revision 0
C-CSS-49.01-023	Incore Tunnel Strainer Supports C & D Design	Revision 0
C-CSS-49.01-025	Emergency Sump Trash Racks Structural Design	Revision 0
C-NSA-04.02-032	Davis-Besse Emergency Sump Strainer Head Loss	Revision 0
C-NSA-049.02-028	Davis-Besse Debris Transport Logic Trees for Emergency Sump Strainer Loadings	Revision 0
C-NSA-049.02-029	Davis-Besse Containment Pool CFD Debris Transport	Revision 0
C-NSA-049.02-030	Davis-Besse Containment In-Core Tunnel Debris Transport	Revision 0
C-NSA-049.02-26	NPSH Licensing Basis Analysis for Davis-Besse LPI & CS Pumps	Revision 0
C-NSA-049.02-31	Clean Strainer Head Loss for Davis-Besse Large Passive Strainer	Revision 0
C-NSA-059.01-019	Water Level Inside Containment Post LOCA	Revision 2
Framatome Calculation 32-5005058	DB-1 Reactor Vessel Asymmetric Cavity Pressure LOCA Analysis	Revision 1
Drawings		
C-0903	Emergency Sump Plan & Sections	Revision 0
C-0904	Emergency Sump Sections	
C-0905	Emergency Sump Details	Revision 0
C-0906	Perforated Plate Details	Revision 0

C-0907	Incore Tunnel Strainer Layout - Arrangement	Revision 0
C-0909	Incore Strainer Perforated Pipe Details	Revision 0
C-0930	Emergency Sump Structural Steel Plan & Sections	Revision 0
C-0931	Emergency Sump Trash Rack Grating Details	Revision 0
M-033A	Piping and Instrument Diagram - High Pressure Injection	Revision 30
M-033B	Piping and Instrument Diagram - Decay Heat Train 1	Revision 39
M-033C	Piping and Instrument Diagram - Decay Heat Train 2	Revision 16
M-034	Piping and Instrument Diagram - Emergency Core Cooling System Ctmt. Spray & Core Flooding Systems	Revision 55
M-040A	Piping and Instrument Diagram - Reactor Coolant System Details	Revision 73
M-0601	Plant Design Standard Piping Class Sheet	Revision 20
M-233B	Piping Isometric Emergency Core Cooling System	Revision 19

Work Orders

02-006002-010	Install supports inside upper sump
02-006002-014	Install HILTI bolts in upper sump
02-007249-007	ARC 02-0512N - Install sump strainer incore tunnel support “C”
03-007249-10	ECR 02-512 Post Modification Test Requirements

Miscellaneous

	10 CFR 50.59 Evaluation - Emergency Sump Strainer Modification ECR 02-512-00 Rev 0 and UNC 03-002
Crane Technical Paper No. 410	Flow of Fluids Through Valves, Fittings, and Pipe

Draft Regulatory Guide DG-1107	Water Sources for Long Term Recirculation Cooling Following a Loss of Coolant Accident	January 2003
Enercon Report No. DBE004-RPT-004	Assessment of Debris Size Acceptance on ECCS Components	March 27, 2003
Enercon Report No. DBE004-RPT-001	Determination of Post-LOCA Debris Generation for Design of Emergency Sump Strainer	January 20, 2003
Engineering Change Request 02-0512-00	Replace Containment Emergency Sump Strainer	
Letter from First Energy to US NRC Document Control Desk	Response to NRC Generic Letter 97-04. "Assurance of Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal Pumps"	December 29, 1997
Licensee Event Report 2002-005-01	Potential Clogging of the Emergency Sump Due to Debris in Containment	December 12, 2002
Regulatory Guide 1.82	Water Sources for Long Term Recirculation Cooling Following a Loss of Coolant Accident	Revision 2, May 1996
Safety Guide 1	Net Positive Suction Head For Emergency Core Cooling and Containment Heat Removal System Pumps	November 2, 1970
Test Number DB-PF-03237	Decay Heat Pump 2 Baseline Test	February 15, 2003

LIST OF ACRONYMS USED

CFR	Code of Federal Regulations
CR	Condition Report
CS	Containment Spray
DHR	Decay Heat Removal
ECCS	Emergency Core Cooling System
ECR	Engineering Change Request
FENOC	First Energy Nuclear Operating Company
LPI	Low Pressure Injection
NCV	Non-Cited Violation
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
QA	Quality Assurance
QC	Quality Control
RCS	Reactor Coolant System
RG	Regulatory Guide
SDP	Significance Determination Process
SSCs	Structure, System, and Components
USAR	Updated Safety Analysis Report