December 5, 2003

Mr. Lew W. Myers
Chief Operating Officer
FirstEnergy 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 - REACTOR COOLANT SYSTEM LEAK TEST -
REPORT NO. 05000346/2003023

Dear Mr. Myers:

On November 6, 2003, the NRC completed a special inspection at your Davis-Besse Nuclear Power Station. This inspection reviewed your actions to resolve Restart Checklist Item No. 2.a, associated with reactor vessel head replacement, and Item No. 3.c associated with self assessment of programs. The inspection included review of a sample of activities as described in the "Davis-Besse Return to Service Plan". The focus of this inspection was your reactor coolant system leak testing activities. This included inspection of the reactor vessel lower penetration nozzles in accordance with NRC Temporary Instruction 2515/152, issued September 5, 2003. The enclosed report presents the results of our review.

The inspection included walkdowns of the reactor coolant system while at normal operating pressure as well as detailed evaluation of your inspections of the reactor vessel bottom head and closure head penetrations, and control rod drive mechanism flange connections following the 7 day pressure holding period. As a result of these pressure test activities, we have reasonable assurance that there are no pressure boundary leaks in the reactor coolant system. Also noted, were your efforts to minimize non-pressure boundary leakage.

In addition to documenting the results of the leak test inspection activities, this inspection report will be used to document the closure of Davis-Besse Restart Checklist Item 3.c "Quality Audits and Self Assessment of Programs". The Davis-Besse Oversight Panel has reviewed and discussed this Checklist item and approved closure. Closure of this Checklist item is documented in Section 40A5. Restart Checklist Item 2.a "Reactor Vessel Head Replacement" will remain open pending successful control rod drop testing.

Based on our inspection, one finding of very low safety significance involved a violation of NRC requirements. However, because the violation was of very low safety significance and because the issue was entered into your corrective action program, the NRC is treating this finding as a Non-Cited Violation in accordance with Section VI.A.1 of the NRC's Enforcement Policy.

If you contest the Non-Cited Violation in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator Region III, 801 Warrenville Road, Lisle, IL 60532-4351; the Director, Office of Enforcement, U. S. Nuclear Regulatory Commission, Washington DC 20555-001; and the NRC Resident Inspector at Davis-Besse.

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 by Christine A. Lipa Acting for /
John A. Grobe, Chairman
Davis-Besse Oversight Panel

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

Enclosure: NRC Special Inspection Report
No. 05000346/2003023

See Attached Distribution

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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No:	50-346
License No:	NPF-3
Report No:	50-346/03-23
Licensee:	FirstEnergy Nuclear Operating Company
Facility:	Davis-Besse Nuclear Power Station
Location:	5501 North State Route 2 Oak Harbor, OH 43449
Dates:	September 15, 2003 through November 6, 2003
Inspectors:	J. Jacobson, Senior Reactor Inspector J. Rutkowski, Resident Inspector M. Salter-Williams, Resident Inspector
Approved by:	Christine Lipa, Chief Branch 4 Division of Reactor Projects

Enclosure

SUMMARY OF FINDINGS

IR 05000346-03-23; FirstEnergy Nuclear Operating Company; on 09/15/03 - 11/6/03, Davis-Besse Nuclear Power Station. Special Inspection.

Special inspection of licensee activities associated with leak testing of the reactor coolant system and inspection of the lower head penetrations and replacement head. This inspection was conducted by Region III based and resident inspectors. One Green Non-Cited Violation was identified. 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 may be "Green" or be assigned a severity level after NRC management review. 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. Inspection Findings

Cornerstone: Barrier Integrity

- Green. The inspectors identified a Non-Cited Violation of 10 CFR 50, Appendix B. During leak testing of the reactor coolant system, licensee staff failed to identify an active steam leak through a seal weld on a pressurizer level transmitter source valve.

  This finding was considered more than minor because steam leaking from the seal weld, past the valve body to bonnet threads, could degrade the Code pressure boundary (i.e., the threaded connection) during plant operation. Had the inspectors not identified this issue, it could have resulted in RCS pressure boundary degradation. The inspectors concluded that this finding did not result in an actual degradation of the reactor coolant system barrier as the steam leak lasted only a few days during the leak test. Therefore, the inspectors determined that this issue was a finding of very low safety significance.

B. Licensee-Identified Findings

No findings of significance were identified.

REPORT DETAILS

Background and Event Overview

On March 6, 2002, Davis-Besse personnel notified the NRC of degradation (corrosion) of the reactor vessel head material adjacent to a control rod drive mechanism (CRDM) nozzle. This condition was caused by coolant leakage and boric acid corrosion of the head material induced by an undetected crack in the adjacent CRDM nozzle. The degraded area covered in excess of 20 square inches where the low-alloy structural steel was corroded away, leaving the thin stainless steel cladding layer. This condition represented a loss of the reactor vessel's pressure retaining design function, since the cladding was not considered as pressure boundary material in the structural design of the reactor pressure vessel. While the cladding did provide a pressure retaining capability during reactor operations, the identified degradation represented an unacceptable reduction in the margin of safety of one of the three principal fission product barriers at the Davis-Besse Nuclear Power Station (reference NRC report 05000346/2002003).

As a part of the corrective actions resulting from the vessel head degradation, the licensee established a Restart Action Plan to identify, monitor, and control all actions necessary for the safe and reliable return to service of Davis-Besse. This process chartered six Building Block Teams to identify those actions to be completed prior to restart. When viewed collectively, the Building Blocks address the causal factors identified in the Davis-Besse Root Cause Analysis Report.

One of the Building Block Teams, the Restart and Post Restart Test Plan, was tasked with verifying that the reactor coolant system (RCS) and associated piping exposed to RCS pressure was in a condition to support sustained operation. The focus of this inspection was the activities conducted during and after a nominal 7 day period of normal operating pressure (2155 psig) and unloaded temperature (532 ^{o}F). This included inspection of the reactor vessel lower penetration nozzles in accordance with NRC Temporary Instruction 2515/152, issued September 5, 2003. The inspectors also reviewed the licensee's program for performing self assessments of their safety significant programs. Given the high public interest in this subject area at Davis-Besse, and therefore the need to clearly communicate the rationale for NRC staff conclusions regarding the effectiveness of licensee safety significant programs, this report documents the inspectors' observations.

4. OTHER ACTIVITIES

4OA3 Event Follow-up (93812)

.1 RCS Leak Test

a. Inspection Scope

Inspection of the licensee's activities included review of Implementation Action Plans RTP-IAP-5d-01, Revision 0, "Restart Test Plan" and RH-IAP-2a-01, Revision 1, "Reactor Pressure Vessel Head Replacement". These documents outlined plans to test the RCS, including components and associated piping exposed to RCS pressure, to ensure integrity following replacement of the reactor head and maintenance of RCS piping and components. Procedures DB-PF-3010, Revision 4, "RCS Leakage Test" and

DB-PF-00204, Revision 4, "ASME Section XI Pressure Testing" were reviewed to verify adequate scope and ASME Code compliance. These procedures described the requirements for plant conditions, walkdowns and inspection of RCS components at normal operating pressure, qualifications for inspection personnel, and identified the components to be inspected. Finally, the inspectors participated in the system walkdowns at pressure to assess procedure compliance and thoroughness of licensee inspection activities. The operational aspects of the RCS heat up, 7 day hold period (Mode 3), and subsequent cool down are discussed in NRC inspection report 05000346/2003018.

b. Observations

Procedure DB-PF-00204 defined the requirements and described the implementation of the ASME Code, Section XI 1995 Edition, through the 1996 Addenda for the conduct of system leakage test activities. The procedure implemented the Third Inservice Inspection Interval requirements for the Pressure Testing Program at Davis-Besse. The procedure was found to be in accordance with Code requirements and appropriately included attributes such as test conditions (2155 ± 50 psig), hold time requirements, visual examination and acceptance criteria (VT-2) for Class 1, 2, and 3 components, the requirement to identify the source of any observed leakage, and the qualification of examination personnel.

Surveillance Test Procedure DB-PF-3010 provided a checklist with detailed steps and lists of components to be examined during conduct of the pressure test. The procedure also provided for an effective interface with the Boric Acid Corrosion Control Program as described in procedure NOP-ER-2001, Revision 2. This surveillance procedure was found to be thorough and implemented the ASME requirements as defined in the procedure discussed above.

The inspectors selected four individuals who performed the VT-2 leak test examinations and reviewed their certifications for conformance with Procedure NA-QC-07004, Revision 1, "Certification of Nondestructive Examination Personnel" and Section IX of the ASME Code, 1995 Edition, through 1996 Addenda. All four were found to be properly qualified to perform the examination. The inspectors also reviewed the qualification requirements for the Boric Acid Corrosion Control personnel assigned to the walkdowns as described in Job Familiarization Guideline Qualification Card TSM-115 and verified qualification for a sample of inspectors. The training and qualification for these inspectors were considered appropriate.

Some operational challenges were encountered by the licensee during the heat up and Mode 3 operation and are discussed in inspection report 05000346/2003018. The test pressure of 2155 ± 50 psig was reached on September 22, 2003 and was held for a minimum of 4 hours prior to beginning the leak test examinations. While the Code required system leakage test does not require a hold time prior to examination, it does require a 4 hour hold for insulated components for any post maintenance testing. Walkdown teams consisting of both VT-2 qualified personnel and boric acid qualified inspectors were assigned various plant areas and components to inspect. The licensee planned to hold the plant at nominal operating pressure and for a period of at least 7 days in an effort to demonstrate that the reactor pressure vessel (RPV) lower head penetrations were not leaking. Both the upper and lower RPV heads and control rod

drive mechanism (CRDM) flanges were subsequently examined after depressurization and cool down and are discussed in this report.

On September 22 and 23, 2003, the inspectors accompanied licensee personnel during preliminary walkdowns of make-up system piping and components within the auxiliary building and of components and piping within the containment, both within and outside of the steam generator enclosures (the "D - rings"). These inspections were preliminary inspections prior to the official ASME leak check. The inspectors observed the licensee's pre-job briefs, personnel use of procedures, and field techniques for conducting the inspections. The inspectors also verified that licensee personnel identified leaking components and properly classified them in accordance with existing procedures. When examination of components exceeded a distance of 6 feet, the examiners were observed to verify adequate lighting and resolution by reading the VT-2 letters on the Code Visual Acuity Card per the test procedure. During walkdown of the west D - ring, the NRC inspectors identified a packing leak (condensate) on a steam line drain which appeared to have been missed by the licensee's inspectors. Condition Report (CR) 03-08026 was generated to repair the leak.

Overall, the walkdowns were observed to be thorough, with the exception noted above and the violation described below. The walkdowns were performed in accordance with procedure and Code requirements and were effective in locating RCS leakage. The walkdowns resulted in generating in excess of 150 CRs.

c. Findings

Introduction

A Green NCV was identified for failure to promptly identify a condition adverse to quality as required by 10 CFR 50, Appendix B, Criterion XVI. The licensee failed to identify and document a steam leak in an RCS valve seal weld on the pressurizer during the leak test walkdowns.

Description

On September 24, the inspectors accompanied licensee personnel during the ASME leak test walkdowns of the east D - ring area and CRDM flange area above the head insulation. During examination of the pressurizer, the NRC inspectors identified a steam leak on pressurizer level transmitter source valve RC 14B. The steam was leaking from the valve body to bonnet weld and appeared to have been missed by the licensee's inspectors. Condition Report 03-08065 was generated to investigate and repair the leak.

The licensee conducted the investigation promptly, as a leaking weld had the potential to cause termination of the pressure test. Further investigation identified that the valve body to bonnet joint was threaded and the leaking weld was a seal weld, which is not considered to be a pressure boundary by the ASME Code. As the leak was from a mechanical joint, it did not meet the Technical Specifications definition of pressure boundary leakage; however, it was considered as "identified leakage" which was limited by the Technical Specifications to 10 gpm. The leak was subsequently stopped by closing the valve and was weld repaired after pressure test completion. It was noted

that this valve had been replaced during the current outage; therefore, the leak was caused by a manufacturing defect.

As a result of this leak and the condensate leak discussed above, the licensee generated CR 03-08399 to evaluate the inspection team's performance. Plant Engineering decided to reinspect the D - ring areas with the east and west teams rotated to opposite sides. On September 29, the inspection teams identified a total of 11 findings within the D - ring inspection boundaries (approximately 350 components). The findings were all minor in nature with the majority being small packing leaks. Seven of the findings in the west D - ring were attributed to reactor coolant pump seal injection components. The licensee concluded that the additional findings were most likely the result of the 5 additional days of service time and a pressure / temperature cycle which was experienced during the pressure test.

Analysis

The inspectors reviewed this finding against the guidance contained in Appendix B, "Issue Dispositioning Screening," of IMC 0612, "Power Reactor Inspection Reports." In particular, the inspectors compared this finding to the findings identified in Appendix E, "Examples of Minor Issues," of IMC 0612 to determine whether the finding was minor. Following that review, the inspectors concluded that none of the examples listed in Appendix E accurately represented this example. As a result, the inspectors compared this performance deficiency to the minor questions contained in Section C, "Minor Questions," to Appendix B of IMC 0612. The inspectors determined that this finding had the potential to impact the Barrier Integrity Cornerstone. The inspectors concluded this finding was greater than minor because if left uncorrected, it would have become a more significant safety concern. Specifically, steam leaking from the seal weld, past the valve body to bonnet threads, could degrade the Code pressure boundary (i.e., the threaded connection) during plant operation. Had the inspectors not identified this issue, it could have resulted in RCS pressure boundary degradation.

The inspectors evaluated this finding using Manual Chapter 0609, "Significance Determination Process," Appendix A, "Significance Determination of Reactor Inspection Findings for At-Power Situations," Phase 1 screening associated with the Barrier Integrity Cornerstone. The inspectors concluded that this finding did not result in an actual degradation of the reactor coolant system barrier as the steam leak lasted only a few days during the leak test. Therefore, the inspectors determined that this issue was a finding of very low safety significance (Green).

Enforcement

Criterion XVI of 10 CFR 50, Appendix B, "Corrective Action", requires, in part, that measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected. Contrary to these requirements, on September 24, 2003, licensee staff failed to identify an active steam leak on pressurizer level transmitter source valve RC 14B as described above. The licensee's failure to identify this leak is an example of a violation of 10 CFR 50, Appendix B, Criterion XVI.

However, because of the very low safety significance of this finding and because the issue was entered into the licensee's corrective action program (CR 03-08065, 03-08264, and 03-08399), it is being treated as a NCV, consistent with Section VI.A.1 of the Enforcement Policy (NCV 05000346/2003023-01).

.2 Bottom Head Incore Instrumentation Nozzle Inspection

Background

Inspection reports 05000346/2002009 and 05000346/2002012 discussed the licensee's initial visual examination of the RPV bare bottom head. This inspection identified stains consisting of boric acid residue and rust/corrosion running down the sides and bottom of the RPV. The inspection showed a number of RPV bottom-head incore monitoring instrumentation (IMI) nozzle penetrations with deposits around the nozzles that the licensee attributed to washdown of borated water from higher elevations to the IMI nozzles. The licensee identified several potential sources for the flowpaths and deposits: (1) leakage from the refueling canal past the cavity seal plate; (2) leakage from the refueling canal through the RPV nozzle access covers; (3) leakage from cracks found in the RPV flange O-ring monitor lines; and/or (4) effluent from RPV upper-head decontamination and cleaning activities during the past refueling outages. The observed deposits were flat and tightly adhering to the RPV surface. No indications of "popcorn-type" deposits (i.e., this deposit morphology has been observed at other plants where nozzle leakage is occurring) were observed around any of the IMI penetrations.

During the inspection, the licensee obtained samples of the deposits for chemical analysis. The deposits from the side of the RPV, bottom of the RPV, and from around the nozzles were removed by scraping and were analyzed using inductively coupled plasma spectroscopy. The results of the analyses indicated that the concentrations of boron and lithium in the deposits were not uniformly distributed and did not provide conclusive evidence regarding the connection between the flowpaths and the nozzle deposits. In the material from nozzle deposits at other plants, a slightly higher concentration of boron and lithium was observed. The licensee compared their results to the chemistry results obtained from bottom-head deposits at the South Texas Project Nuclear Plant (STP), Unit 1, which were generated by primary coolant system leaks. The chemistry results from the Davis-Besse deposits showed that the concentrations of boron and lithium were a factor of 4 lower.

Public meetings on the inspection findings were held on November 26, 2002, and April 4, 2003. At the public meetings, the licensee presented the results of its inspection findings to the NRC staff. In addition, the licensee discussed a proposed test to pressurize the RCS to normal operating pressure (NOP) and maintain the pressure for approximately 7 days. Following the test, the IMI nozzle penetrations would be visually inspected with a remote video camera to confirm that there is no visible leakage from the IMI nozzles.

By letter dated July 30, 2003, the licensee docketed its inspection results and final conclusions as to the source of the residue on the lower head, with particular emphasis on the material found near the IMI penetrations. The licensee's conclusions were that the rust/corrosion stains and boric acid residue found around several IMI nozzle

penetrations did not result from leakage from the IMI nozzles. These conclusions were based on the following facts:

- During the visual inspection of the IMI nozzles, no "popcorn-type" deposits similar to those found recently at STP, Unit 1, were identified around any of the penetrations.

- The boron and lithium concentrations in the samples taken from the IMI nozzles were below the concentrations found in the STP, Unit 1, deposits, which were confirmed as resulting from RCS pressure boundary leakage. The chemistry results from the Davis-Besse deposits showed that the concentrations of boron and lithium were a factor of 4 lower than the deposits found at STP, Unit 1.

Based on review of the licensee's evaluation and experience with lower-head deposits observed by other licensees, the NRR staff concluded that: (1) the results of the chemical analysis did not provide conclusive evidence of RCS leakage from the IMI nozzles, and (2) the deposits observed at Davis-Besse were characteristic of deposits left by washdown from higher elevation sources.

a. Inspection Scope

In preparation for the bottom head examination following the 7 day hold at NOP, the inspectors reviewed digital photographs and video of the baseline examination conducted May 8, 2003. Procedure EN-DP-01500 "Reactor Vessel Inspection Procedure", Revision 4, and certifications for the inspection personnel were also reviewed prior to the bottom head inspection. General condition of the bottom head was directly observed through an opening in the insulation after the NOP test. The inspectors observed approximately 75% of the inspection real time. Comparisons of this inspection to the baseline were performed for several nozzles.

b. Observations

Digital photographs and video of the baseline inspection conducted May 8, 2003 showed that some white or rust colored residue remained in the area surrounding the penetrations even though the bottom head was pressure washed. The residue appeared thin and tightly adhered. Some residue was noted in the annular space between the nozzle and vessel bore and evidence of tape remained on the head in spots. Camera resolution was judge to be excellent. Procedure EN-DP-01500 "Reactor Vessel Inspection Procedure", Revision 4 was reviewed and found to contain adequate guidance for performing the inspection.

The inspectors observed approximately 75% of the post NOP examination which was conducted on October 6-7, 2003. A VT-2 qualified contract inspector and a boric acid control qualified inspector from the Davis-Besse staff performed the inspection. Proper location was verified by both inspectors and the remote camera operator. Visual acuity and lighting was verified at the beginning and end of each shift. Specifically, the procedure required the camera system to be able to resolve Code VT-2 sized alpha numeric characters; however, the VT-1 sized letters were also readily visible. The inspection was recorded on video tape. Overall, the resolution was judged to be excellent.

As discussed above, some residue was noted on the bottom head and in the annular space around the nozzles. Because of this residue, it was necessary to compare the examination results with the baseline examination for several penetrations. This was done to verify that there was no change in appearance after the 7 day NOP test. Four separate quadrant views of each penetration were recorded with significant overlap. All bottom head penetrations were inspected. The inspection did not identify any pressure boundary leakage or lower head corrosion beyond a light coat of surface rust as described in Bulletin 2003-02.

.3 Temporary Instruction 2515/152

a. Inspection Scope

On August 21, 2003, the NRC issued Bulletin 2003-02, "Leakage from Reactor Pressure Vessel Lower Head Penetrations and Reactor Coolant Pressure Boundary Integrity." The purpose of this Bulletin was to: (1) Advise PWR licensees that current methods of inspecting the RPV lower heads may need to be supplemented with additional measures (e.g., bare-metal visual inspections) to detect reactor coolant pressure boundary leakage; (2) request PWR addressees to provide the NRC with information related to inspections that have been or will be performed to verify the integrity of the RPV lower head penetrations, and; (3) require PWR addresses to provide a written response to the NRC in accordance with the provisions of Section 50.54(f) of Title 10 of the Code of Federal Regulations (10 CFR 50.54(f)).

The objective of Temporary Instruction 2515/152, Revision 1, "Reactor Pressure Vessel Lower Head Penetration Nozzles," was to support the NRC review of licensees' RPV lower head penetration inspection activities that were implemented in response to Bulletin 2003-02. The licensee had committed to perform a bare metal inspection of the lower vessel head in response to the NRC Bulletin 2003-02. The inspectors performed a review in accordance with the Temporary Instruction, of the licensee's procedures, equipment, and personnel used for RPV lower head penetration examinations to confirm that the licensee met commitments associated with Bulletin 2003-02. The results of the inspectors' review included documenting observations and conclusions in response to the questions identified in TI 2515/152. Specifically, the following activities were performed:

- performed a direct visual examination of the nozzle-to-head interface for portions of the bottom head penetrations from an opening in the insulation;
- reviewed approximately 75% of the digital photographs and video of the baseline IMI nozzle examination conducted May 8, 2003;
- interviewed contract and licensee nondestructive examination personnel;
- reviewed the lower head visual inspection procedure EN-DP-01500 "Reactor Vessel Inspection Procedure", Revision 4;
- reviewed the certification records for the nondestructive examination personnel;

- observed the licensee inspection personnel conducting the remote visual examination for approximately 75% of the IMI nozzles post NOP test;

b. Observations

Summary

Based upon a bare metal remote visual examination of the lower head after the 7 day NOP test, the licensee did not identify any evidence of RCS leakage. The general condition of the RPV bottom was acceptable, though not ideal for purposes of this examination. While the bottom head had been cleaned with a power wash prior to the baseline examination in May, some stains consisting of boric acid residue, rust/corrosion, and tape mastic as discussed above remained. Video and digital photos of the baseline examination provided an excellent reference for comparison to the post NOP examination.

Evaluation of Inspection Requirements

In accordance with requirements of TI 2515/152, the inspectors evaluated and answered the following questions:

(1) For each of the examination methods used during the outage, was the examination:

- Performed by qualified and knowledgeable personnel?

  Yes. The licensee conducted a remote visual examination of the RPV lower head penetration interface and RPV lower head surface for leakage of boric acid deposits with knowledgeable staff members certified to Level II as VT-2 examiners.

- Performed in accordance with demonstrated procedures?

  No. The licensee performed a bare metal inspection of the lower head in accordance with EN-DP-01500, “Reactor Vessel Inspection Procedure”, Revision 4. The procedure had not been demonstrated although it did contain requirements to verify resolution and lighting. Specifically, the procedure required the camera system to be able to resolve Code VT-2 sized alpha numeric characters (verified each shift). Overall, the resolution was judged to be excellent.

- Able to identify, disposition, and resolve deficiencies?

  Yes. VT-1 characters were also readily resolved. On several occasions, reference to the baseline examination performed prior to the NOP test was used to disposition questionable areas. The licensee also had obtained baseline chemistry swipes prior to the NOP test on several questionable penetrations which would have been used for comparison post-NOP if necessary.

- Capable of identifying pressure boundary leakage as described in the bulletin and/or RPV lower head corrosion?

  Yes. The inspectors performed a direct visual inspection of portions of the lower head. Based on this examination, the inspectors noted that the remote picture quality appeared to provide superior inspection to that available by direct visual examination. Therefore, the inspectors concluded that the remote visual examination was capable of detecting deposits indicative of pressure boundary leakage as described in the bulletin.

(2) Could small boric acid deposits, as described in Bulletin 2003-02, be identified and characterized?

Yes. As discussed above, resolution was excellent. This, coupled with the magnification provided by the camera, offered ample capability to detect boric acid deposits, as described in Bulletin 2003-02.

(3) How was the visual inspection conducted?

The inspection was conducted with a color camera mounted on a crawler device which moved along the top of the insulation.

(4) How complete was the coverage?

Four separate quadrant views of each penetration were recorded with significant overlap. All bottom head penetrations were inspected.

(5) What was the physical condition of the RPV lower head (e.g., debris, insulation, dirt, boric acid deposits from other sources, physical layout, viewing obstructions)?

The insulation package formed a flat deck under the vessel on which the camera, mounted on a remotely operated crawler moved. The crawler mechanism was inserted through a window provided by removing a section of insulation. Landmarks such as loose part monitoring mechanisms and the IMI nozzle pattern were used to verify location. Deposits on the lower head and in the annular space between the penetration and the vessel bore are discussed above. Vessel coating had come off in some areas.

(6) What material deficiencies (i.e., crack, corrosion, etc.) were identified that required repair?

None.

(7) What, if any, impediments to effective examinations, for each of the applied nondestructive examination method, were identified (e.g., insulation, instrumentation, nozzle distortion)?

Impediments to visual examination are discussed in paragraph .2.b above. No nondestructive examinations were performed.

(8) Did the licensee perform appropriate follow-on examinations for indications of boric acid leaks from pressure-retaining components above the RPV lower head?

Yes. See discussion in paragraph .2 above.

(9) Did the licensee take any chemical samples of the deposits?

Yes. Chemical samples were taken as discussed in paragraph .2 above.

(10) Is the licensee planning to do any cleaning of the head?

The licensee power washed the bottom head prior to performing the baseline examination in May 2003. No further cleaning is planned at this time.

(11) What are the licensee's conclusions regarding the origin of any deposits present and what is the rationale for those conclusions.

By letter dated July 30, 2003, the licensee docketed its inspection results and final conclusions as to the source of the residue on the lower head as discussed above. The conclusions and rationale were reviewed by NRR.

.4 Reactor Vessel Closure Head CRDM Penetration Inspection

a. Inspection Scope

In preparation for the RPV head examination following the 7 day hold at NOP, the inspectors reviewed video of the baseline examination conducted September 5-8, 2002. The inspectors also reviewed the Framatome "Summary Report for Davis-Besse RVH CRDM Penetrations," dated September 2002. Procedure EN-DP-01500 "Reactor Vessel Inspection Procedure", Revision 4, and certifications for the inspection personnel were also reviewed prior to the head inspection. The inspectors observed approximately 75% of the head inspection real time.

b. Observations

Installation of the unused RPV head from the canceled Midland plant is discussed in NRC inspection report 05000346/2002007. Video of the baseline inspection conducted in September 2002 showed that some minor debris remained in the area surrounding some of the penetrations. The residue appeared as dust and small particles. Camera resolution was judge to be excellent. During review of the video, the inspectors noted that staff performing the examination made a wrong call with respect to location on one of the penetrations. In response, the licensee had the entire set of tapes audited to verify proper location and corrected the wrong call. Procedure EN-DP-01500 "Reactor Vessel Inspection Procedure", Revision 4 was reviewed and found to contain adequate guidance for performing the inspection.

The inspectors observed approximately 75% of the post NOP examination which was conducted on October 14-15, 2003. The inspection was performed using a remotely operated color camera mounted on a crawler. A VT-2 qualified contract inspector and a boric acid control qualified inspector from the Davis-Besse staff performed the inspection. Proper location was verified by both inspectors and the remote camera operator. Visual acuity and lighting was verified at the beginning and end of each shift. Specifically, the procedure required the camera system to be able to resolve Code VT-2 sized alpha numeric characters; however, the VT-1 sized letters were also readily visible. Four separate quadrant views of each penetration were recorded with significant overlap. The inspection was recorded on video tape. Overall, the resolution and coverage was judged to be excellent.

During the examination, it was noted that the dust and small particles identified on the baseline examination conducted in September 2002, had increased to the point of interfering with the examination. The licensee found it necessary to use air pressure to blow the loose debris out of the viewing area around most of the penetrations, and reinspect. The use of air is discussed in the Electric Power Research Institute (EPRI) report No. 1006296, Revision 1 "Visual Examination for Leakage of PWR Reactor Head Penetrations on Top of RPV Head". The inspection found no evidence of RCS coolant leakage. However, penetrations #19 and adjacent #24 were found to have water stains going up into the insulation, and there was surface corrosion (rust) build up on the head between nearby penetrations #1 and #8. The rust build up on the head was subsequently cleaned off and the source was identified as a CRDM cooling water leak and is discussed in the following section.

.5 Inspection of CRDM Flanges

a. Inspection Scope

The CRDM assemblies at Davis-Besse are mounted to the head penetrations with a flanged, double gasketed connection located above the insulation. This connection has historically been the source of numerous RCS leaks. Examination of the flanges conducted after the 7 day NOP test was performed by remote camera operated from above the service structure. Procedure EN-DP-01500 "Reactor Vessel Inspection Procedure", Revision 4, and certifications for the inspection personnel were also reviewed prior to the head inspection. The inspectors observed approximately 25% of the head inspection and reviewed the Framatome evaluation dated October 31, 2003.

b. Observations

The remote cameras were mounted on a pole and positioned manually from above the CRDMs to obtain views of all four quadrants of each location. Cameras and lighting were positioned such that both the flange and the nut ring below the flange could be viewed. Procedure EN-DP-01500 "Reactor Vessel Inspection Procedure", Revision 4 was reviewed and found to contain adequate guidance for performing the inspection.

The inspectors observed approximately 25% of the post NOP examination which was conducted on October 8-10, 2003. A VT-2 qualified contract inspector and a boric acid control qualified inspector from the Davis-Besse staff performed the inspection. Proper location was verified by both inspectors and the remote camera operator. Visual acuity

and lighting was verified at the beginning and end of each shift. Specifically, the procedure required the camera system to be able to resolve Code VT-2 sized alpha numeric characters; however, the VT-1 sized letters were also readily visible. The inspection was recorded on video tape. Overall, the resolution was judged to be excellent.

The CRDM flanges and nut rings were new components supplied with the replacement RPV head. The CRDMs were previously used and were removed from the old Davis-Besse head. The initial inspection of the flanges found 30 of the 69 to be acceptable. The inspection identified several questionable indications:

- Apparent rusty leak trails from the flange joint
- Thin white water spots on some of the flanges
- Rust on several nut rings
- White deposits around several CRDM flange nameplates and test port covers

While none of the questionable indications had the appearance of a classical RCS flange leak, the remaining 39 flange locations were rejected based on a conservative acceptance criteria. The licensee obtained 16 chemistry samples from the deposits described above, performed a gamma spectroscopy analysis on each sample and sent the samples to Framatome for further analysis. The licensee's gamma spectroscopy analysis indicated that the deposits did not result from the current RCS inventory. This conclusion was based on the ratio of Cs 137 to Cs 134. This ratio of the RCS inventory during the NOP test was 1.93 while the deposits were higher (5.08 to over 30), indicating that the deposits were older material. Furthermore, a component cooling water (CCW) leak was found at the CRDM cooling water connection located at the top of the service structure. Hydrazine in the cooling water system leaves a white residue following evaporation.

Framatome condition report No. 6029378, dated October 31,2003, documented their evaluation of the visual inspections and the chemistry data. Evidence of splash like water marks were found on many of the flanges, CRDM nozzles, and nut rings. These splash marks were most likely a result of a cleaning operation prior to the NOP test or from the CCW leak mentioned above. The marks did not appear to be RCS leakage as the marks did not have the appearance of white boric acid residue. There was evidence of rust on several nut rings. The nut rings are made of carbon steel and are subject to rust in a damp environment. The effected nut rings were lumped together in an area roughly centered around nozzle 35 and 19. During the visual inspection, water was noted running down the CRDM tube above the flange on nozzle 35. This was the basis for concluding that the residue on the flange was from a leak above the flange. Also, during the inspection a drop of water was seen falling on nearby nozzle 5 flange. Little to no rust was observed on the flanges as distance increased from the area where the CCW leak was located.

Stainless steel nameplates are welded to the side of the CRDM flanges. There is evidence of trapped boric acid residue under the edge on many of the nameplates. The residue is most likely from the service period when the CRDMs were on the old Davis-Besse head. Chemical analysis of one of the nameplate deposits indicated that

the deposit was old and not from the current RCS inventory. Likewise for some deposits found on some of the four bolt vent port covers located above the CRDM flange.

In summary, there was a confirmed CCW leak at the top of the service structure and evidence of water dripping down on nozzle 35 and 5. During the NOP test, considerable air flow from the ventilation system would tend to disperse the leaking water. Of the 16 chemistry samples analyzed, seven had no detectable lithium, indicating that the deposits were not from RCS leakage. The remaining samples showed the ratio of Cs 137 to Cs 134 to be considerably higher than that of the current RCS inventory, indicating that the deposits were from previous leakage. This data combined with the location and general appearance of the deposits, provides reasonable assurance that the CRDM flanged connections and vent port covers are not leaking.

.6 (Closed) LER 05000346/2002-007-01: Potential Leakage of Incore Monitoring Instrumentation Nozzles at Bottom of Reactor Vessel

This issue is discussed in paragraphs .2 and .3 above. By letter dated July 30, 2003, the licensee docketed its inspection results and final conclusions as to the source of the residue on the lower head, with particular emphasis on the material found near the IMI penetrations. The licensee's conclusions were that the rust/corrosion stains and boric acid residue found around several IMI nozzle penetrations did not result from leakage from the IMI nozzles. Based on review of the licensee's evaluation and experience with lower-head deposits observed by other licensees, the NRR staff concluded that (1) the results of the chemical analysis did not provide conclusive evidence of RCS leakage from the IMI nozzles, and (2) the deposits observed at Davis-Besse were characteristic of deposits left by washdown from higher elevation sources. The NOP test demonstrated that there were no apparent bottom head nozzle leaks. This LER is closed.

4OA5 Other Activities

.1 Restart Checklist Item 3.c (Quality Audits and Self Assessment of Programs)

As part of the corrective actions resulting from the reactor vessel head degradation, the licensee established a Return to Service Plan to identify, monitor, and control all actions necessary for the safe and reliable return to service of Davis-Besse. The Plan consists of seven Building Blocks designed to support safe and reliable restart of the plant and to ensure sustained performance improvements. One of the Building Blocks, Program Compliance Plan, was tasked with performing reviews of selected plant programs to ensure that the programs were fulfilling required obligations, including effective interfaces and handoffs. NRC review of the Quality Audits program is documented in reports 05000346/2002011 and 05000346/2003009. The NRC was also interested in the licensee's plans for maintaining and improving plant programs going forward. Restart Checklist Item 3.c was held open pending review of the licensee's plans for self assessments of safety significant programs.

FirstEnergy Operating Business Practice NOBP-LP-2004, Revision 0 "FENOC Ongoing Self-Assessment Guideline," provided the expectation and general guidance for performing self assessment on an ongoing basis at the Section level. This was a high level document and was not prescriptive as to the techniques to be used. The Business Practice provides the expectation that Section managers develop a process that supports integrated analysis and trending of results, to enable continuous improvement. The Section manager is expected to provide periodic summary reports to management. The ongoing self assessments were expected to consist of techniques such as benchmarking, review of industry experience, performance trending and review of CRs, management / peer coaching, system walkdowns, etc.

Administrative Procedure NG-EN-00386, Revision 0, "Program Assessment, Ownership, and Development" provided guidance for developing, maintaining and assessing plant programs. The Senior Management Team was responsible for proposing a yearly schedule of programs to be reviewed based on input from plant performance, Quality Audits, Industry Experience, etc. The procedure calls for normally three programs per year to be assessed. A Senior Management Team member will sponsor the program review and the program owner was responsible for developing the assessment plan in accordance with the FENOC Focused Self-Assessment Guideline.

In addition to the yearly self-assessment plan, the procedure requires that the program owner ensure that self-assessments are performed on the program following major program changes and on a periodic basis (nominally 3 years).

FirstEnergy Operating Business Practice NOBP-LP-2001, Revision 1, "FENOC Focused Self-Assessment Guideline" provided detailed guidance for an in-depth assessment of programs, processes, or activities. In addition to the periodic focused self-assessments prescribed above, assessments could be triggered by such things as plant events, changes in regulatory requirements, emergent industry issues, etc. The scope and depth of the self-assessment is similar to the Program Compliance Reviews discussed in NRC inspection reports 05000346/2002011 and 05000346/2003009.

The inspectors reviewed the results of the licensee's pilot focused self-assessment of the Meteorological Monitoring Program (Focused Self-Assessment 2003-0004, Revision 1, dated April 2003). The effort was found to be a thorough and in-depth assessment of all aspects of the program. The assessment included attributes / techniques such as:

Regulatory Requirements
Industry Guidance
Benchmarking
Quality Audits
Interfaces and Handoffs
Performance Indicators
Roles and Responsibilities
Management Involvement
Training
Corrective Actions

Overall, the program and procedures in place appear to provide an adequate basis for maintaining and improving the programs at Davis-Besse. On October 9, 2003, the Davis-Besse Oversight Panel met to discuss this issue and concluded that Restart Checklist Item 3.c is closed.

.2 (Closed) URI 05000346/2002012-01: "Potential Leakage of Reactor Vessel Bottom Head Incore Penetration Nozzles". This issue is discussed in Section 4OA3.1 and 4OA3.2 above. The NOP test demonstrated that there are no apparent bottom head nozzle leaks. This URI is considered closed.

40A6 Meetings

.1 Exit Meeting

The NRC inspectors presented the inspection results to Mr. Lew Myers and other members of licensee management at the conclusion of the inspection on November 6, 2003. The NRC inspectors asked the licensee whether any materials discussed as potential report material should be considered proprietary. No proprietary information was identified.

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

L. Myers, Chief Operating Officer, FENOC
M. Bezilla, Site Vice President
C. Hengge, System Engineer
R. Perry, BACC Program Owner
J. Black, Staff Nuclear Engineer
P. Seniuk, Staff Nuclear Engineer
M, Parker, Supervisor, Predictive Maintenance
W. Marini, Regulatory Affairs

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened & Closed

05000346/2003023-01	NCV	Failure to identify active RCS steam leak

Closed

05000346/2002012-01	URI	Potential Leakage of Reactor Vessel Bottom Head Incore Penetration Nozzles
05000346/2002-007-01	LER	Potential Leakage of Incore Monitoring Instrumentation Nozzles at Bottom of Reactor Vessel

Discussed

None.

LIST OF DOCUMENTS REVIEWED

4OA3 Event Follow-up

CR 03-09065; Reactor Vessel Bare Head Inspection Findings; dated October 17, 2003

CR 03-08641; CRD Flange Inspection Unidentified Substance; dated October 9, 2003

CR 03-08203; Items Found by NRC Inspector During RCS Leakage Test; dated September 26, 2003

CR 03-08205; Evaluation of 7 Day NOP/NOT Hold Requirements; dated September 26, 2003

CR 03-00173; RC14B Pipe Between PZR ans Valve Require Evaluation; dated January 10, 2003

CR 03-08257; Through Pipe Wall Steam Leak Between MS202 and MS203; dated September 28, 2003

CR 03-05655; Refueling Canal Leakage Engineering Assessment Report - Recommendations; dated July 17, 2003

CR 03-09025; NRC Identified Concern on Boric Acid on Incore Tunnel for an Extended Period; dated October 20, 2003

CR 03-08659; Component Cooling Water Leak at Top of Service Structure; dated October 9, 2003

PCAQR 98-0538; Boric Acid on Walls and Ceiling of Incore Tunnel; dated April 8, 1998