April 28, 2000

EA 00-053

Mr. L. W. Myers
Senior Vice President
FirstEnergy Nuclear Operating Company
Beaver Valley Power Station
Post Office Box 4
Shippingport, Pennsylvania 15077

SUBJECT: NRC INTEGRATED INSPECTION REPORT NOS. 05000334/2000-002; 05000412/2000-002

Dear Mr. Myers:

This refers to the inspection conducted from February 20 to April 1, 2000, at the Beaver Valley Power Station facility. The enclosed report represents the results of this inspection.

During the 6-week inspection period, your conduct of activities at the Beaver Valley Power Station facility was generally characterized by safe plant operation during both refueling and online activities. Corrective maintenance and design change implementation, such as the emergency diesel generator governor upgrade, improved reactor safety.

Based on the results of this inspection, two apparent violations were identified. The first issue involved inadequate design control of the Unit 1 river water (RW) pumps safety related seal water supply. Your staff identified that the seal water strainer design was not adequate to provide the necessary pump seal water flow under adverse river silting conditions. The second issue involved an inadequate test program for the RW pumps. The test program failed to demonstrate that the RW system would perform satisfactorily while in service under adverse river silting conditions. The system design deficiency existed since 1976.

On April 13, 2000, these apparent violations, as well as the apparent violations described in NRC Integrated Inspection Reports 050000334; 412/1999-010 and 2000-001, were discussed in an open predecisional enforcement conference. Please be advised that the number and characterization of the apparent violations may change as a result of further NRC review. You will be advised by separate correspondence of the results of our deliberations on this matter. No response regarding these apparent violations is required at this time.

The NRC has also determined that one violation of NRC requirements occurred. The Severity Level IV violation is being treated as a Non-Cited Violation (NCV), consistent with Section VII.B.1.a of the Enforcement Policy (November 9, 1999; (64 FR 61142)). The NCV involved failure to implement appropriate procedures and controls during incore flux thimble tube replacement activities. The NCV is described in the subject inspection report. If you contest the violation or severity level of the NCV, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory

Commission, ATTN: Document Control Desk, Washington, D.C. 20555-0001, with copies to the Regional Administrator, Region I, and the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, D.C. 20555-0001.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be placed in the NRC Public Document Room.

Sincerely,

/RA/

Richard V. Crlenjak, Deputy Director
Division of Reactor Projects

Docket Nos.: 05000334; 5000412
License Nos: DPR-66, NPF-73

Enclosures:
1. Inspection Report Nos. 05000334/2000-002, 05000412/2000-002
2. Handout from the April 13, 2000 Predecisional Enforcement Conference (Expansion Joint and Preventative Maintenance)
3. Handout from April 13, 2000 Predecisional Enforcement Conference (RW Pump Binding and Strainer Fouling)

cc w/encls:
K. Ostrowski, Plant General Manager
R. Fast, Director, Plant Maintenance
F. von Ahn, Director, Plant Engineering
R. Donnellon, Director, Projects and Scheduling
M. Pearson, Director, Plant Services
W. Pearce, Manager, Operations
T. Cosgrove, Manager, Licensing
J. A. Hultz, Manager, Projects and Support Services, FirstEnergy
M. Clancy, Mayor, Shippingport, PA
Commonwealth of Pennsylvania
State of Ohio
State of West Virginia

Distribution w/encls (**VIA E-MAIL**):
Region I Docket Room (with concurrences)
NRC Resident Inspector
H. Miller, RA/J. Wiggins, DRA
J. Rogge, DRP
N. Perry, DRP
B. Platchek, DRP
J. Shea, OEDO
E. Adensam, PD1, NRR (RIDSNRRDIPMLPDI)
F. Peterson, NRR
D. Collins, NRR
V. Nerses, NRR
W. Scott, NRR
Inspection Program Branch, NRR (IPAS)

DOCUMENT NAME: G:\BRANCH7\Beaver Valley\:BV2000-002.wpd
To receive a copy of this document, indicate in the box: "C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICE	RI/DRP		RI/DRP		RI/DRP	
NAME	Kern/al/NSP fpr		Rogge/JR		Crlenjak/RC	
DATE	04/25/00		04/26/00		04/28/00	

OFFICIAL RECORD COPY

U. S. NUCLEAR REGULATORY COMMISSION

REGION I

License Nos.	DPR-66, NPF-73
Report Nos.	05000334/2000-002, 05000412/2000-002
Docket Nos.	05000334, 05000412
Licensee:	FirstEnergy Nuclear Operating Company Post Office Box 4 Shippingport, PA 15077
Facility:	Beaver Valley Power Station, Units 1 and 2
Inspection Period:	February 20, 2000 through April 1, 2000
Inspectors:	D. Kern, Senior Resident Inspector G. Dentel, Resident Inspector G. Wertz, Resident Inspector J. Furia, Health Physicist G. Smith, Senior Physical Security Inspector T. Burns, Reactor Inspector S. Pindale, Reactor Inspector
Approved by:	J. Rogge, Chief Projects Branch 7

EXECUTIVE SUMMARY

Beaver Valley Power Station, Units 1 & 2
NRC Inspection Report 05000334/2000-002 and 05000412/2000-002

This integrated inspection included aspects of licensee operations, engineering, maintenance, and plant support. The report covers a 6-week period of resident inspection; in addition, it includes the results of announced inspections by regional health physics, security and reactor inspectors.

Operations

- Fouling of the Unit 1 river water pump self-supplied seal water strainers occurred when the safety-related self supply was placed into continual service. Subsequent investigation by the Event Review Team identified that the seal water strainers were not sufficient to provide adequate flow to the river water pump seals and motors during all expected river water conditions. This design inadequacy was masked by use of non-safety related filtered water as the normal pump supply since initial plant operation. This design inadequacy was an apparent violation. (Section O2.1)

- The testing program for the river water pumps was performed using the non-safety related filtered supply. Testing in this configuration was not in accordance with the applicable design of the safety related seal water supply and prevented prompt identification of the strainer design inadequacy. This test program inadequacy was an apparent violation. (Section O2.1)

- The Event Review Team performed a detailed review and adequately characterized the root cause of the river water pump self-supply seal water strainer fouling events. Corrective actions were appropriate and comprehensive. (Section O2.1)

- Human performance during the Unit 1 refueling outage was generally good. Station personnel maintained a low threshold for placing issues in the corrective action system. Strong management oversight was evident. (Section O4.1)

- Noteworthy progress was made in reducing the backlog of outstanding control room deficiencies, temporary modifications, and bases for continued operation during the refueling outage. (Section O4.2)

- The Independent Safety Evaluation Group conducted a detailed pre-outage safety review in advance of the Unit 1 13th refueling outage. Independent Safety Evaluation Group engineers performed comprehensive safe shutdown equipment status reviews and plant walkdowns of critical outage systems. Discrepancies in the plant postings of safe shutdown equipment were captured in the corrective action program. (Section O7.1)

Maintenance

- Four refueling activities were performed safely with good communication and coordination, and appropriate supervisory oversight. The Operations Department manager performed a detailed infrequently performed activity briefing in support of reactor coolant loop isolation. (Section M1.2)

- Several performance errors contributed to a highly radioactive incore flux thimble tube breaking the water surface in the fuel transfer canal and creating the potential for unnecessary radiation exposures. The highly radioactive thimble tube free end momentarily caused radiation dose rates to increase significantly. No over-exposures resulted and FENOC responded appropriately to this incident. A crew of personnel, led by contractors, displayed poor decision making to proceed with underwater thimble tube operations without the resources (personnel and tools) necessary to successfully perform the evolution. Also, FENOC did not provide appropriate direct supervision of the underwater cutting operations. Failure to follow the controlling procedure for the incore flux thimble tube maintenance to maintain at least 10 feet of water for shielding, was a violation of Technical Specification 6.8.1. This severity level IV violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1.a of the NRC enforcement policy (Condition Report 00-1104). (Section M1.3)

- Maintenance on the “A” charging pump and implementation of a design change package on the emergency diesel generators was safely performed. Vibration levels remained high after replacement of the charging pump shaft, which required increasing the testing frequency. Post-maintenance testing on the emergency diesel generators demonstrated that the design change was properly implemented. Implementation of these design changes improved reactor safety. (Section M2.1)

Engineering

- On March 23, the Unit 1 “A” recirculation spray pump failed its periodic flow test due to foreign material blocking the pump suction. Immediate corrective actions to restore pump operability and extent of condition reviews by the event review team were comprehensive. The cause of the flow blockage was failure to remove temporary wood cribbing material used during a 1982 design change. Current material controls to preclude recurrence were appropriate. (Section E2.1)

- The inservice inspection was performed adequately and included appropriate ASME program coverage, qualified personnel, approved procedures, proper implementation, appropriate examination documentation and oversight. The steam generator tube sleeving and welding process was performed in a well planned and orderly manner by knowledgeable contractor personnel, and was closely monitored by licensee technical experts and project management. (Section E2.2)

Plant Support

- Appropriate radiological controls were implemented and maintained in support of the Unit 1 refueling outage. All observed radiologically significant areas (high and locked high radiation areas) were appropriately controlled in accordance with plant technical specifications. Outage exposure goals were appropriately developed, tracked on a daily basis, and discussed during daily outage status meetings. Through the first two weeks of the outage, exposures were tracking well with pre-outage projections. (Section R1)

- The condition report program was appropriately used to identify radiological issues, identify potential corrective actions, and verify closure of the identified actions. (Section R7)

TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY ii

TABLE OF CONTENTS v

I. Operations 2
- O1 Conduct of Operations 2
  - O1.1 General Comments 2
- O2 Operational Status of Facilities and Equipment 2
  - O2.1 Unit One River Water Pumps Seal Water Supply Design and Testing Deficiencies 2
- O4 Operator Knowledge and Performance 4
  - O4.1 Unit 1 Refueling Outage Human Performance 4
  - O4.2 Assessment of Unit 1 Post-Outage Control Room Deficiencies, Operator Workarounds, Temporary Modifications and Bases for Continued Operation 5
- O7 Quality Assurance in Operations 6
  - O7.1 Independent Safety Evaluation Group Outage Oversight 6
- O8 Miscellaneous Operations Issues 7
  - O8.1 Review of Industry Experience Assessment 7

II. Maintenance 7
- M1 Conduct of Maintenance 7
  - M1.1 Routine Maintenance Observations 7
  - M1.2 Routine Surveillance Observations 7
  - M1.3 High Dose Rates During Flux Thimble Tube Replacement Project Due to Poor Work Controls and Oversight 8
- M2 Maintenance and Material Condition of Facilities and Equipment 11
  - M2.1 Unit 1 Refueling Maintenance and Outage Design Changes 11

III. Engineering 12
- E2 Engineering Support of Facilities and Equipment 12
  - E2.1 Unit 1 Recirculation Spray Pump Flow Test Failure 12
  - E2.2 Unit 1 Inservice Inspection 13

IV. Plant Support 14
- R1 Radiological Protection and Chemistry (RP&C) Controls 14
- R7 Quality Assurance in Radiological Protection and Chemistry Activities 16
- S3 Security and Safeguards Procedures and Documentation 16

V. Management Meetings 17
- X1 Exit Meeting Summary 17

INSPECTION PROCEDURES USED 18

ITEMS OPENED, CLOSED AND DISCUSSED 18

LIST OF ACRONYMS USED 19

Report Details

Summary of Plant Status

Unit 1 began this inspection period in cold shutdown in the 13th refueling outage (1R13). The unit remained shutdown throughout the period.

Unit 2 began this inspection period at 100 percent power and remained at or near full power throughout the period.

I. Operations

O1 Conduct of Operations

O1.1 General Comments (71707)

Using Inspection Procedure 71707, the inspectors conducted frequent reviews of ongoing plant operations. In general, the conduct of operations was professional and safety-conscious; specific events and noteworthy observations are detailed in the sections below.

O2 Operational Status of Facilities and Equipment

O2.1 Unit One River Water Pumps Seal Water Supply Design and Testing Deficiencies

a. Inspection Scope (71707, 37551)

On February 19 and March 3, fouling of the Unit 1 river water (RW) pumps self-supplied seal water strainers occurred. As a result of a recent RW pump binding event (see NRC Integrated Inspection Report Nos. 05000334(412)/2000-001), the seal water supply had been realigned from the filtered water system to the safety-related pump discharge through a strainer. Operator action to flush the strainer prevented possible pump damage. However, since the pump discharge was the safety related supply of seal water, the fouling represented a challenge to the RW pump's capability to perform its design function under emergency conditions. The inspectors reviewed the issue and observed the event response team (ERT) assessment and corrective actions.

b. Observations and Findings

On February 19, during a period of increased river water level (approximately 10 feet above normal), the operating "B" RW pump low pressure alarm actuated. A plant operator was dispatched to the pump and identified that the in-line pump seal supply "Y" strainer was completely coated with mud and fine debris from the river. The strainer had to be continuously flushed for several minutes. On the following shift, a non-safety related motorized strainer was placed into service to provide seal water. This was documented in Condition Report (CR) 00-0751.

On March 3, the idle "C" RW pump was started and the pump seal water pressure fell from its normal 30 pounds per square inch (psig) to 5 psig within 10-15 seconds. Engineers subsequently determined that 5 psig seal header pressure was insufficient to support continued RW pump operation. A plant operator flushed the strainer several times before the seal water pressure returned to normal. Engineers determined that silt had accumulated under the pump while it was not operating. Upon starting the pump,

silt was drawn in and promptly fouled the strainer. Condition Report 00-1002 was initiated.

The ERT determined that the design of the self-supplied seal water strainers was inadequate to support river water pump operation under expected river water silt conditions. The modification which installed the filtered water as the primary seal water supply in 1976 had masked this inadequacy. The strainers were undersized and subsequently fouled during high silt periods. Operator action was required to restore adequate seal water flow.

10CFR50, Appendix B, Criterion III, "Design Control," requires that "measures shall be established for the selection and review for suitability of application of . . . equipment . . . essential to the safety-related functions of the . . . systems . . . " Fouling of the RW pump seal water strainers due to silt accumulation indicated an inadequacy in the selection and review for suitability of the safety-related strainers and resulted in the safety related river water pumps not being capable of performing their design function. Failure to ensure that the safety-related strainers support operation of the RW pumps appeared to be a violation of 10CFR50, Appendix B, Criterion III. **(EEI 05000334/00-02-01)**

Additionally, the inspectors questioned the adequacy of the RW test program. An adequate test program would have revealed the RW pump seal water design deficiency sooner. The inspectors noted that the non-safety related filtered water system was used as the pump seal supply during the quarterly RW pump surveillance test. In response to the inspectors' concern, the ERT determined that the RW pumps were not being tested in their safety-related alignment and that this testing methodology contributed to the licensee's failure to identify the design deficiency earlier. Review of past seal water problems (See NRC Integrated Inspection report 05000334(412)/2000-001) indicated that the filtered water had been used as the primary source of seal water supply since initial plant operation in 1976.

10CFR50, Appendix B, Criterion III, "Design Control," requires that, measures shall provide for verifying the adequacy of design by performance of design reviews, calculational methods, or a suitable test program . . . under the most adverse design conditions. In addition, 10CFR50, Appendix B, Criterion XI, "Test Control," requires that "all testing required to demonstrate that . . . systems . . . will perform satisfactorily is identified and performed in accordance with written test procedures which incorporate the requirements . . . contained in applicable design documents." The test program for the RW pumps did not verify the adequacy of the seal water strainer design, under the most adverse design conditions either through original construction testing or during periodic surveillance testing. Failure to perform an adequate test program to verify RW pump seal water design appeared to be a violation of 10 CFR 50, Appendix B, Criterion III and XI. **(EEI 05000334/00-02-02)**

The ERT recommended several appropriate and comprehensive corrective actions. The self-supply seal water strainers were replaced under design change package (DCP) 2400. The inspectors reviewed the DCP and observed the installation and performance testing. Other corrective actions included a review of a sample of surveillance test procedures on other safety related systems to determine if support systems are tested in their proper configuration. The ERT also recommended a review of periodic maintenance tasks and pump improvement options.

The ERT evaluated the risk of the strainer design deficiency and concluded that the overall increase in risk was low to moderate. The risk evaluation was comprehensive. Multiple cases were evaluated to determine the overall risk of the self-supplied seal water strainer fouling. The assumptions were reviewed by the inspectors and determined to be appropriate. The inspectors concluded that the ERT performed a detailed review and adequately characterized the root cause of the RW pump self-supply seal water strainer fouling events.

c. Conclusions

Fouling of the Unit 1 river water pump self-supplied seal water strainers occurred when the safety-related self supply was placed into continual service. Subsequent investigation by the Event Review Team identified that the seal water strainers were not sufficient to provide adequate flow to the river water pump seals and motors during all expected river water conditions. This design inadequacy was masked by use of non-safety related filtered water as the normal pump supply since initial plant operation. This design inadequacy was an apparent violation.

The testing program for the river water pumps was performed using the non-safety related filtered supply. Testing in this configuration was not in accordance with the applicable design of the safety related seal water supply and prevented prompt identification of the strainer design inadequacy. This test program inadequacy was an apparent violation.

The Event Review Team performed a detailed review and adequately characterized the root cause of the river water pump self-supply seal water strainer fouling events. Corrective actions were appropriate and comprehensive.

O4 Operator Knowledge and Performance

O4.1 Unit 1 Refueling Outage Human Performance

a. Inspection Scope (71707, 71750)

Significant work activities and infrequently performed tests were conducted during the Unit 1 refueling outage. The inspectors observed a sample of the activities, reviewed operator logs, and examined the condition reports (CRs) which focused on human performance and control of work activities.

b. Observations and Findings

Human performance during the outage was generally good. Station personnel maintained a low threshold for reporting human performance issues through the corrective action system. Good tracking and focus on current issues was performed by the human performance coordinator. Strong oversight, including focused human performance reviews at the daily managers' meetings, allowed for a prompt response if performance degraded.

The inspectors noted continued good controls over infrequently performed tests conducted by operations personnel. The use of senior reactor operators as lead test coordinators provided additional focus and control over the tests. Workers interviewed

were well aware of their assignments and possible contingencies associated with the tests.

In contrast to the overall good performance, there were examples of poor radiation practices and weak foreign material exclusion controls by contractors in containment. Several CRs were generated for various human errors associated with radiological work practices. Although for the most part these practices did not lead to increased dose due to strong health physics technician response, these events were potential precursors to more significant radiological control problems. An additional human error led to an unplanned emergency diesel generator (EDG) output breaker trip and EDG start signal during a surveillance test.

c. Conclusions

Human performance during the Unit 1 refueling outage was generally good. Station personnel maintained a low threshold for placing issues in the corrective action system. Strong management oversight was evident.

O4.2 Assessment of Unit 1 Post-Outage Control Room Deficiencies, Operator Workarounds, Temporary Modifications and Bases for Continued Operation

a. Inspection Scope (71707)

The inspectors reviewed the Unit 1 control room deficiencies, operator workarounds, temporary modifications, and bases for continued operation to assess the status following outage maintenance and the cumulative effect on plant operations.

b. Observations and Findings

The inspectors noted the following status of control room deficiencies, operator workarounds, temporary modifications, and bases for continued operation near the completion of the Unit 1 refueling outage:

- 11 control room deficiencies were eliminated, 4 remained.
- 1 operator workaround was eliminated, 9 remained.
- 16 temporary modifications were eliminated, 4 remained.
- 8 bases for continued operation were eliminated, 9 remained.

The major items completed included replacement of the residual heat removal heat exchanger flow control valve MOV-RH-758, replacement of numerous incore thermocouples, and permanent repair of previous operating cycle temporary leak repairs. The inspectors reviewed the remaining open items and determined that the overall cumulative impact of the remaining control room deficiencies, operator workarounds, temporary modifications, and bases for continued operation had minimal effect on plant operation. The inspectors determined that noteworthy progress had been made in reducing the outstanding items during the refueling outage. In addition, the inspectors determined that the remaining items were being effectively monitored.

c. Conclusions

Noteworthy progress was made in reducing the backlog of outstanding control room deficiencies, temporary modifications and bases for continued operation during the refueling outage.

O7 Quality Assurance in Operations

O7.1 Independent Safety Evaluation Group Outage Oversight

a. Inspection Scope (71707)

The inspectors reviewed Independent Safety Evaluation Group (ISEG) outage safety oversight. Specific items reviewed or observed included: the 1R13 Pre-Outage Safety Review report; and the oversight of plant configuration changes and resulting impact on safe shutdown conditions.

b. Observations and Findings

The ISEG conducted a detailed pre-outage safety review in accordance with Nuclear Power Division Administrative Procedure 8.26, “Shutdown Safety/Outage Management,” Rev. 8. The report was well written and accurately identified conditions during the outage where defense in depth systems were reduced.

Independent Safety Evaluation Group engineers performed comprehensive safe shutdown status reviews throughout the refueling outage. Control room observations were made to validate the safety function/equipment status sheets used to communicate safety equipment status to station personnel. The ISEG engineers performed plant walkdowns of critical outage systems and identified discrepancies in safe shutdown equipment postings. These were documented on CR 001033.

c. Conclusions

The Independent Safety Evaluation Group conducted a detailed pre-outage safety review in advance of the Unit 1 13th refueling outage. Independent Safety Evaluation Group engineers performed comprehensive safe shutdown equipment status reviews and plant walkdowns of critical outage systems. Discrepancies in the plant postings of safe shutdown equipment were captured in the corrective action program.

O8 Miscellaneous Operations Issues

O8.1 Review of Industry Experience Assessment (71707)

Institute of Nuclear Power Operations (INPO) personnel conducted a Beaver Valley Units 1 & 2 plant assessment during the period May 10-21, 1999. The final assessment report was issued in February 2000. The inspectors reviewed the INPO plant assessment report, determined that the observations and findings were consistent with documented NRC findings, and determined that no additional follow-up inspection associated with the plant assessment report was warranted.

II. Maintenance

M1 Conduct of Maintenance

M1.1 Routine Maintenance Observations

The inspectors observed selected maintenance activities on important systems and components. The work orders (WOs) observed and reviewed are listed below.

- WO 00-003561-002 Low Head Safety Injection Pump 1A Suction Isolation Valve Repair
- WO 00-003562-002 Low Head Safety Injection Pump 1B Suction Isolation Valve Repair

The activities observed and reviewed were performed safely and in accordance with proper procedures. Inspectors noted an appropriate level of supervisory attention based on the work activity's priority and difficulty.

M1.2 Routine Surveillance Observations

a. Inspection Scope (61726)

The inspectors observed selected surveillance tests and refueling activities. Operational surveillance tests (OSTs), operating manuals (OMs), and Beaver Valley Tests (BVT's) reviewed and observed by the inspectors are listed below.

- 1OM-6.4N "Draining the RCS for Refueling," Rev. 10
- 1OST-36.4 "Diesel Generator No. 2 Automatic Test," Rev. 13
- 1OST-11.14B "HHSI Full Flow Test," Rev. 6
- 1BVT-01.21.02 "Trevitest Method for Main Steam Safety Valve Setpoint Check," Rev. 7

b. Observations and Findings

The surveillance testing was performed safely and in accordance with proper procedures. Additional observations regarding surveillance testing are discussed in the following sections. The inspectors noted that an appropriate level of supervisory attention was given to the testing, based on its potential risk significance.

The reactor cooling system (RCS) draining activity was well controlled. The Unit 1 Operations Department manager performed a detailed infrequently performed test or experiment briefing for isolation of the third (and last) reactor coolant loop with the reactor vessel fueled. The briefing included a discussion of the safety significance of the activity and provided specific details of the defense in depth protection provided to the reactor core, as well as listing appropriate contingency recovery procedures. The inspectors determined that the briefing enhanced plant safety. The instrumentation accuracy was verified twice before starting the draindown. Holdpoints were established in advance of the draindown to stop and check the instrumentation. The RCS was successfully drained to one foot below the vessel flange.

The emergency diesel generator and main steam safety valve tests were performed satisfactorily. Good communication and coordination were noted by the inspectors.

c. Conclusions

Four refueling activities were performed safely with good communication and coordination, and appropriate supervisory oversight. The Operations Department manager performed a detailed infrequently performed activity briefing in support of reactor coolant loop isolation.

M1.3 High Dose Rates During Flux Thimble Tube Replacement Project Due to Poor Work Controls and Oversight

a. Inspection Scope (71707, 93702)

The inspectors reviewed FirstEnergy Nuclear Operating Company's (FENOC) response to a March 10, 2000, incident where the free end of an incore nuclear instrumentation flux thimble tube unexpectedly broke the water surface during underwater cutting and positioning operations in the Unit 1 fuel transfer canal. The highly radioactive (6000 R/hr) piece remained out of the water for several seconds. The inspectors reviewed the details associated with the incident, interviewed station personnel, reviewed the investigations conducted by the maintenance and radiation protection departments, and assessed the associated corrective actions.

b. Findings and Observations

When the thimble tube broke the water surface, the local radiation monitor alarmed at its high alarm setpoint (100 millirem (mR)/hr) and several workers' self-reading dosimeters alarmed at their high dose rate alarm setpoint (85 mR/hr). Workers involved with the thimble tube work activities immediately lowered the thimble tube underwater. The thimble tube was above the water surface for about five seconds. After determining that radiological conditions had stabilized, the health physics technician reviewed the underwater controls with the work crew with respect to the underwater operations and controls, and then permitted the crew to cut the remainder of that thimble tube. After cutting operations were completed for that particular thimble tube, all thimble tube operations were suspended, the work party exited containment, and a stand down of the work activity was conducted.

The actual radiological consequences of this occurrence were minimal because the workers promptly returned the thimble tube underwater. However, the consequences

could have been more severe had the workers not been able to return the thimble tube to below the water surface so quickly. The highest individual dose was 13 mR.

The thimble tube work was being performed and supervised by contractor personnel, with assistance from FENOC instrument technicians and other general support personnel. A FENOC instrument maintenance supervisor provided direct oversight during most of the operations. The work had been progressing (15 of the designated 18 thimble tubes were completed) for several days.

The thimble tube activity instructions were provided in vendor procedure MRS-SS-1053 DLW/DMW, "Flux Thimble Tube Replacement at Beaver Valley Unit 1," which was reviewed and approved by the Beaver Valley Onsite Safety Committee (OSC) on February 16, 2000 (OSC Meeting BV-OSC-07-00). The basic operation involved disconnecting the thimble tubes at the seal table, pushing them above the lower core plate, and then pulling the thimble tubes from above the reactor vessel to the transfer canal where the highly radioactive portion (about 20 feet) is cut underwater in sections of about 10 feet long and placed in an underwater debris canister. The remainder of the 120-foot long thimble tube is then removed from underwater and cut into sections on the refueling floor (thimble tube contact radiation levels are less than 5 mR/hr at that point).

At the start of the back-shift on March 10, the contractor preceded the instrument maintenance personnel (including the supervisor) into the containment because the instrument maintenance personnel were involved with other activities. At around 8:20 p.m., after the first 10-foot section of the highly radioactive portion of the thimble tube was cut in the transfer canal, it appeared that an excessive amount of thimble tube length was pulled from the reactor vessel which caused an increase spring force on the thimble tube from the reactor end of the tube. This configuration allowed the free end of the thimble tube to momentarily flip out of the water.

FENOC initiated Condition Report 00-1106 and commenced a detailed investigation. Their investigation identified the following causes:

- Oversight of contractor activities was inadequate to prevent an error;

- Lack of appropriate resources to perform the task. This included supervision, manpower, and tools. The crew failed to locate and use a tool that had been fabricated by maintenance personnel to enhance the underwater operations which provided a lateral and vertical restraint for the thimble tube. The tool was used successfully on prior shifts;

- Training was inadequate for personnel to obtain the proper skills and knowledge level to perform the task (general support personnel were used to perform tasks which were previously performed by qualified and trained personnel); and

- Minor performance deficiencies (precursors) occurred prior to this event but were not brought to management's attention.

The inspectors conducted an independent evaluation of this event and reviewed FENOC's event investigation. The inspectors interviewed station personnel, reviewed applicable procedures, and discussed the event details with the condition report

assigned evaluators. The inspectors found that FENOC's investigation was comprehensive and accurate.

In response to this event, FENOC instituted several corrective actions. In addition to those items described above, the short term actions included providing continuous management coverage inside the reactor containment to emphasize management's expectations and revising the contractor procedure to require direct FENOC supervision during underwater cutting activities. FENOC also plans to evaluate project management training for project coordinators.

In reviewing the controlling procedure and related information, the inspectors determined that the lead contractor was not a shift supervisor as specified in the procedure (step 11.2.3 and definition 3.9). Further, the condition report evaluation that was in progress at the end of this inspection indicated that the elevation of the underwater thimble tube was relatively high in the transfer canal prior to its breaking the water surface. This was also contrary to the controlling procedure (step 11.2.3), which stated that at least 10 feet of water be maintained for shielding purposes. Failure to follow procedure MRS-SS-1053 DLW/DMW contributed to the March 10 incident. The failure to follow this procedure was a violation of Technical Specification (TS) 6.8.1. This severity level IV violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy, November 9, 1999 (64FR61142) **(NCV 50-334/00-02-03).** This violation is in FENOC's corrective action program as CR 00-1104.

c. Conclusions

Several performance errors contributed to a highly radioactive incore flux thimble tube breaking the water surface in the fuel transfer canal and creating the potential for unnecessary radiation exposures. The highly radioactive thimble tube free end momentarily caused radiation dose rates to increase significantly. No over-exposures resulted and FENOC responded appropriately to this incident. A crew of personnel, led by contractors, displayed poor decision making to proceed with underwater thimble tube operations without the resources (personnel and tools) necessary to successfully perform the evolution. Also, FENOC did not provide appropriate direct supervision of the underwater cutting operations. Failure to follow the controlling procedure for the incore flux thimble tube maintenance to maintain at least 10 feet of water for shielding, was a violation of Technical Specification 6.8.1. This severity level IV violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1.a of the NRC enforcement policy (Condition Report 00-1104).

M2 Maintenance and Material Condition of Facilities and Equipment

M2.1 Unit 1 Refueling Maintenance and Outage Design Changes

a. Inspection Scope (71707, 37551, 62707)

The inspectors reviewed two outage maintenance activities along with their associated post-maintenance testing. Portions of the following activities were reviewed:

- Emergency Diesel Generator Governor Control Circuit Modification
- "A" Charging Pump Shaft Replacement

b. Observations and Findings

The replacement of the "A" charging pump shaft was performed due to the high number of operating hours and a previous gas binding event. The inspectors concluded that replacement of the shaft was important due to the above reasons and due to increased vibration readings noted during routine surveillance testing. The high head safety injection full flow test was modified appropriately to perform an acceptable post-maintenance test. The lead test coordinators properly controlled the testing. High vibration was detected on the pump outboard bearing during initial post-maintenance operation. Additional maintenance was performed but was unsuccessful in resolving the high vibration levels. The high vibration condition required the pump to be placed on an increased testing frequency. The inspectors reviewed the recorded vibration data and determined that the pump was operable. Condition Report 00-1337 documented the condition and additional engineering resolution was being pursued to reduce the vibration levels. Delays in the replacement schedule for the "A" pump resulted in the decision to delay the replacement of the "C" pump to the next refueling outage. The engineering justification for the delay was reasonable.

Routine outage maintenance and a modification to the Emergency Diesel Generator (EDG) governor controls were performed appropriately during 1R13. The modification performed was DCP 2337 which configured the EDG governor to operate in isochronous (constant frequency) mode during emergency operation. This DCP corrected an administrative condition in which the EDG frequency range, which was limited by TS to between 58.8 and 61.2 hertz, had to be more restrictively controlled between 60.0 and 60.4 hertz in order to properly support safety related loads. Post-maintenance testing identified that the DCP was properly implemented. The frequency remained within the acceptance band during the EDG automatic test.

The inspectors identified that although the DCP had been implemented and the EDG was about to be declared operable, the operating crew had not been trained on the new EDG operating characteristics due to the new governor. The inspectors discussed this with the Operations Department manager, who agreed and subsequently had just-in-time training performed. The inspectors determined that the modification turnover process had a potential flaw in that it did not require training prior to restoration of equipment operability. The training department recognized this when the Operations Department manager requested the just-in-time training and initiated CR 00-0985 to document this concern.

c. Conclusions

Maintenance on the "A" charging pump and implementation of a design change package on the emergency diesel generators were safely performed. Vibration levels remained high after replacement of the charging pump shaft, which required increasing the testing frequency. Post-maintenance testing on the emergency diesel generators demonstrated that the design change was properly implemented. Implementation of these design changes improved reactor safety.

III. Engineering

E2 Engineering Support of Facilities and Equipment

E2.1 Unit 1 Recirculation Spray Pump Flow Test Failure

a. Inspection Scope (37551, 62707, 61726)

On March 23, 2000, inside recirculation pump 1RS-P-1A failed periodic flow verification test 1BVT 1.13.5, "Inside Recirculation Spray (RS) Pump Test," Rev. 12. Subsequent visual inspections identified three pieces of wood partially blocking the pump impeller suction from the containment sump. Station personnel quarantined the pump area and formed an ERT to investigate the cause of the problem and evaluate historical pump operability and associated risk implications. The inspectors interviewed station personnel, conducted in-plant visual inspections, and monitored ERT activities to evaluate response to this issue.

b. Observations and Findings

Six safety-related pumps, used for long-term core cooling and containment pressure control, take suction from the containment sump. Individual protective screens around each of these pumps' suction prevent foreign material from fouling pump suctions. The ERT determined that the wood debris (2 x 4 inch blocks which were between 5 and 8 inches long) found in the pump impeller area was most likely left over cribbing material used during implementation of a plant design change in 1982. Periodic pump flow surveillance tests between 1982 and 2000 satisfactorily demonstrated pump operability. This indicated that the wood cribbing had recently become dislodged from its previous support position. Pump disassembly revealed no significant damage. Visual inspections of the containment sump area and suction lines for each of the six safety-related pumps identified no additional foreign debris. 1RS-P-1A was reassembled and successfully retested on March 30. Appropriate foreign material controls as well as post-maintenance testing criteria were implemented.

Unit 1 was in Mode 5 (cold shutdown) during the March 23 test and RS was not required to be operable. The inspectors reviewed the Unit 1 operating probabilistic risk assessment and determined that the RS function had minimal effect on overall risk of core damage. The ERT determined that the wood material could degrade the RS system's ability to control containment building pressure following a design loss of coolant accident. The wood blocks reduced 1RS-P-1A pump flow by about 15 percent during the March 23 test. Additionally, the wood could break down into smaller pieces which could plug a portion of the RS nozzles upon reaching the spray ring. Engineers determined that several RS system design parameters included safety margins which may compensate for the degraded RS flow. Two examples were that, since 1982, both the number of RS heat exchanger tubes plugged and river water temperature had

remained lower than the values assumed in the station's accident analysis. Determination of past RS system operability, reportability, and corresponding risk significance remained in progress (CR 00-1316) at the end of the inspection period. Preliminary evaluations indicated that the risk associated with this event was minimal.

c. Conclusions

On March 23, the Unit 1 "A" recirculation spray pump failed its periodic flow test due to foreign material blocking the pump suction. Immediate corrective actions to restore pump operability and extent of condition reviews by the event review team were comprehensive. The cause of the flow blockage was failure to remove temporary wood cribbing material used during a 1982 design change. Current material controls to preclude recurrence were appropriate.

E2.2 Unit 1 Inservice Inspection

a. Inspection Scope (73753)

The inspectors reviewed plans and schedules for the current Unit 1 Inservice Inspection interval (ISI) (first period, third interval) to verify compliance with the requirements of American Society of Mechanical Engineers (ASME) Section XI, 1989 edition (no addenda) and 10 CFR 50.55a. Areas inspected included ASME Section XI ISI program coverage, qualifications and certifications of nondestructive examination (NDE) personnel, NDE procedures, results of NDE and disposition of nonconforming conditions identified during conduct of examinations. In addition, the inspector observed selected NDE activities, including ultrasonic (UT) and magnetic particle (MT) examination of some welds on steam generator feedwater piping. The inspectors also reviewed the Unit 1 steam generator examination guidelines, and inspected the installation and welding of sleeves in steam generators "A" and "B".

b. Observations and Findings

The inspectors determined the ISI program complied with the requirements of ASME Section XI, 1989 edition and with properly approved relief requests. No deficiencies were noted in the ISI program.

FirstEnergy Nuclear Operating Company supplemented their staff with contractors for the performance of ISI activities and provided site specific training, procedures, and supervision. The qualifications of contract personnel were reviewed by a FENOC level III individual. The contract personnel performed their examination function within the quality assurance program requirements established by FENOC and reported directly to FENOC supervisors. The inspectors verified that the NDE procedures used for UT, MT, and liquid penetrant were developed and qualified by FENOC, and complied with the requirements of the ASME Code.

Steam generator tube eddy current (ET) examination, tube sleeving, and welding were performed by contract personnel using FENOC procedures. Supplementary vendor input was reviewed and approved by FENOC prior to implementation. Oversight and compliance with the steam generator guidelines were provided by the FENOC steam generator coordinator. The inspectors verified that personnel evaluating ET test data were appropriately qualified to a minimum level of IIA for interpretation of this data.

Personnel performing degradation analysis were qualified as Qualified Data Analyst and certified in accordance with SNT-TC-1A. Oversight of the steam generator ET examination data interpretation was provided by a contracted Level III examiner. The inspectors verified that this examiner was qualified for this function, and those qualifications had been reviewed and approved by FENOC.

The inspectors reviewed a sample of the examination data and documentation for the NDE tests, and determined that the results were properly recorded. In those cases where rejectable indications were noted, the indications were dispositioned in accordance with the requirements established by site procedures. Nondestructive examination personnel promptly dispositioned indications noted during examinations by comparison of the results with previously identified and characterized indications.

The inspectors reviewed the ET results of steam generator tube examination and conducted interviews of several data acquisition personnel, resolution analysts, and the FENOC level III analyst and found them to be knowledgeable of their designated responsibilities. The inspectors observed the remote installation and welding of a sample of tube sleeves. The work performed was thorough and sufficiently detailed and controlled to properly locate and weld the sleeves within the tubes. The inspectors observed the remote automated ultrasonic testing of the completed weld to determine if specified width and penetration was achieved. No deficiencies were identified during these observations.

c. Conclusions

The inservice inspection was performed adequately and included appropriate ASME program coverage, qualified personnel, approved procedures, proper implementation, appropriate examination documentation and oversight. The steam generator tube sleeving and welding process was performed in a well planned and orderly manner by knowledgeable contractor personnel, and was closely monitored by licensee technical experts and project management.

IV. Plant Support

R1 Radiological Protection and Chemistry (RP&C) Controls

a. Inspection Scope (83750)

A health physics inspection during routine operations and a refueling outage was conducted. Areas of inspection focus were based on the following regulatory requirements from 10 CFR Part 20:

20.1101	Radiation protection program
20.1601	Control of access to high radiation areas
20.1602	Control of access to very high radiation areas
20.1902	Posting requirements
20.1904	Labeling containers
20.2103	Records of surveys

Special focus during this inspection was on the 1R13 and its associated activities. During this inspection period, activities ongoing included reactor disassembly and fuel

movement, valve and snubber inspection and repair, and ET testing and tube sleeving in the steam generators.

b. Observations and Findings

For 1R13, an exposure goal of not more than 270 person-rem was established. Major outage activities included: boric acid walkdowns in the containment; snubber examination and testing; inservice inspection; reactor disassembly and reassembly; repair and testing of various motor operated valves; steam generator testing and repair; and miscellaneous inspections, repairs, maintenance activities, and design changes. During daily outage status meetings, exposure performance was discussed. Through the first two weeks of the outage, exposures were tracking well with projections.

Tours of various portions of the radiologically controlled areas including the Unit 1 containment, primary auxiliary building, and safeguards building indicated that an appropriate program for the control of access to radiologically significant areas had been established and was being maintained. All high radiation areas were appropriately posted and barricaded, and current survey maps were typically posted near the entrance to each. Locked high radiation areas were also determined to have appropriate locking controls to prevent unauthorized entry. These controls appropriately met the criteria contained in the plant technical specifications.

Steam generator platforms were controlled as high radiation areas and hot particle zones. Workers on the platforms were under constant electronic surveillance and control through the use of closed circuit TV camera and dedicated communications headsets. These workers' exposures were also monitored remotely via the use of electronic teledosimeters, in addition to the thermoluminescent dosimeters worn to measure dose-of-record.

c. Conclusions

Outage exposure goals were appropriately developed, tracked on a daily basis, and discussed during daily outage status meetings. Through the first two weeks of the outage, exposures were tracking well with pre-outage projections.

Appropriate radiological controls were implemented and maintained in support of the Unit 1 refueling outage. All observed radiologically significant areas (high and locked high radiation areas) were appropriately controlled in accordance with plant technical specifications.

R7 Quality Assurance in Radiological Protection and Chemistry Activities

a. Inspection Scope (83750)

The program for ensuring quality in radiation protection activities included the identification of conditions adverse to quality using a site-wide system of condition reports. Identified items are then reviewed, corrective actions proposed, and the successful completion of corrective actions verified. During the 1R13 refueling outage, a number of items were identified in the condition reporting system that are related to radiation protection activities. The inspector reviewed one item, considered potentially the most radiologically significant item during the first 2 weeks of the outage.

b. Observations and Findings

Condition Report 00-0849 was written to document an occurrence on February 23, 2000, in which a worker reached through the open manway cover into the primary side of the steam generator to retrieve a bucket containing old tube plugs that were being removed robotically. A worker was sent to the “B” steam generator work platform to retrieve the full bucket and allow radiation protection technicians the opportunity to conduct dose rate determinations on the bucket and its contents. In performing this task, the worker exceeded the authorized work activities allowed to be performed under his radiation work permit (RWP). Specifically, the worker placed a portion of his whole body (right upper arm above the elbow) into the steam generator manway, an activity specifically prohibited under the workers RWP (100-4042). The worker’s teledosimeter went into alarm mode when the dose rate exceeded the set point of 1000 millirad per hour. The worker, who was being observed via closed circuit TV from the steam generator work center, was immediately directed to leave the steam generator work platform. Total exposure to the worker was well below regulatory limits, and based on teledosimetric measurements determined to be approximately 43 millirad.

This event was documented by the licensee as a CR, and a review of the workers actions, together with a review of radiation protection controls was conducted. Proposed corrective actions included a review of the procedure developed for this task. Since this was the first attempt to remove this material from any of the three steam generators, a job critique was also conducted, and as a result a new methodology for completing this task was developed using the available steam generator mock-up for procedure development and training.

c. Conclusions

The condition report program was appropriately used to identify radiological issues, identify potential corrective actions, and verify closure of the identified actions.

S3 Security and Safeguards Procedures and Documentation (81700)

An in-office review was conducted of changes to the Beaver Valley Physical Security Plans identified as Issue 4, Revisions 37 and 38, submitted to the NRC in September 1999 and January 2000, in accordance with the provisions of 10 CFR 50.54(p). Based on the licensee’s determination that the changes did not decrease the overall effectiveness of the security plans and after limited review, no NRC approval was

determined to be required. Implementation of these changes will be subject to future inspection.

V. Management Meetings

X1 Exit Meeting Summary

The inspectors presented the inspection results to members of licensee management at the conclusion of the inspection on April 10, 2000. The licensee acknowledged the findings presented.

The licensee did not indicate that any of the information presented at the exit meeting was proprietary.

INSPECTION PROCEDURES USED

IP 37551:	Onsite Engineering
IP 61726:	Surveillance Observation
IP 62707:	Maintenance Observation
IP 71707:	Plant Operations
IP 71750	Plant Support
IP 73753	Inservice Inspection
IP 81700	Physical Security Program for Power Reactors
IP 83750	Occupational Control
IP 93702	Prompt Onsite Response to Events at Operating Power Reactors

ITEMS OPENED, CLOSED AND DISCUSSED

Opened

05000334/00-02-01	EEI	River Water Pump Seal Water Supply Design Deficiencies (Section O2.1)
05000334/00-02-02	EEI	River Water Pump Surveillance Testing Deficiencies (Section O2.1)

Opened/Closed

0500334/00-02-03	NCV	Failure to Follow Procedures During Incore Flux Thimble Tube Replacement (Section M1.3)

LIST OF ACRONYMS USED

1R13	Unit 1 13th Refueling Outage
ASME	American Society of Mechanical Engineers
BVT	Beaver Valley Test
CFR	Code of Federal Regulations
CR	Condition Report
DCP	Design Change Package
EEI	Escalated Enforcement Issue
EDG	Emergency Diesel Generator
ERT	Event Response Team
ET	Eddy Current
FENOC	FirstEnergy Nuclear Operating Company
INPO	Institute of Nuclear Power Operations
ISEG	Independent Safety Evaluation Group
ISI	Inservice Inspection
mR	Millirem
MT	Magnetic Particle
NCV	Noncited Violation
NDE	Nondestructive Examination
NRC	Nuclear Regulatory Commission
OM	Operating Manual
OSC	Onsite Safety Committee
OST	Operational Surveillance Test
psig	Pounds per Square Inch
RCS	Reactor Coolant System
RP&C	Radiological Protection and Chemistry
RS	Recirculation Spray
RW	River Water
RWP	Radiation Work Permit
TS	Technical Specification
UT	Ultrasonic
WO	Work Order