FENOC

FirstEnergy Nuclear Operating Company

Beaver Valley Power Station
Route 168
P.O. Box 4
Shippingport, PA 15077-0004

Lew W. Myers
Senior Vice President

724-682-5234
Fax: 724-643-8069

April 1, 2002
L-02-032

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Subject: Beaver Valley Power Station, Unit No. 1 and No. 2
BV-1 Docket No. 50-334, License No. DPR-66
BV-2 Docket No. 50-412, License No. NPF-73
15-Day Response to Bulletin 2002-01, Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity

This letter provides the FirstEnergy Nuclear Operating Company (FENOC) 15-day response for Beaver Valley Power Station (BVPS) Units 1 and 2 to NRC Bulletin 2002-01 dated March 18, 2002. The Bulletin was issued to obtain plant-specific information related to the integrity of the reactor coolant pressure boundary, including the reactor pressure vessel head, and the extent to which inspections have been undertaken to satisfy applicable regulatory requirements.

As noted in our response, BVPS Unit 1 has completed its inspections of the reactor vessel head in accordance with Bulletin 2001-01 during refueling outage 1R14 in September 2001, and the results were submitted on October 31, 2001. The inspections were reviewed by the NRC in accordance with the requirements of the NRC Temporary Instruction (TI) 2515/145, "Circumferential Cracking of RPV Head Penetration Nozzles" and the results are documented in Attachment 1 of the NRC Inspection Report 50-334/01-08, 50-412/01-08 dated October 17, 2001.

BVPS Unit 2 completed its inspections of the reactor vessel head in accordance with the Bulletin 2001-01 during refueling outage 2R09 in February 2002, and the results were submitted on March 28, 2002.

A095

As requested by the Bulletin, the BVPS 15-day response for Units 1 and 2 to address reactor pressure vessel head degradation, is provided in Enclosure 1 to this letter. A subsequent 60-day response will be provided as required, to address the integrity of the remainder of the reactor coolant pressure boundary.

If there are any questions concerning this matter, please contact Mr. Larry R. Freeland, Manager, Regulatory Affairs/Corrective Action at 724-682-5284.

I declare under penalty of perjury that the following is true and correct. Executed on April 1, 2002.

Sincerely,

Lew W. Myers

Enclosure
c: Mr. D. S. Collins, Project Manager
Mr. D. M. Kern, Sr. Resident Inspector
Mr. H. J. Miller, NRC Region I Administrator
Mr. D. A. Allard, Director BRP/DEP
Mr. L. E. Ryan (BRP/DEP)
Ms. C. O'Clair, Ohio Emergency Management Agency

Enclosure 1

15-Day Response to NRC Bulletin 2002-01 "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity" for Beaver Valley Power Station (BVPS) Units 1 and 2

Note that these responses apply for both BVPS Units 1 and 2 because the inspections and maintenance programs are common for both units. Plant specific information for each unit is provided where necessary.

The Bulletin required that PWR licensees provide the following information within 15 days of the date of the Bulletin:

1A. A summary of the reactor pressure vessel head inspection and maintenance programs that have been implemented at your plant:

Response:

The following is a summary of the BVPS inspection and maintenance programs for the Reactor Pressure Vessel (RPV) head, and the structural integrity of the reactor coolant system pressure boundary as it relates to the RPV head.

1. Inspection Programs include the following:

- **Boric Acid Corrosion Control Program**

  The Boric Acid Corrosion Control Program was implemented to identify, trend and follow-up with appropriate corrective actions for system leakage as evidenced by boric acid accumulations. The program verifies through systematic visual inspections that leakage as evidenced by boric acid accumulations is identified, evaluated and effectively corrected to prevent subsequent leakage.

- **ASME Section XI System Leakage Program**

  The System Leakage Program implements the system leakage examination requirements set forth by the American Society of Mechanical Engineers (ASME) Section XI Code, "Rules for Inservice Inspection of Nuclear Power Plant Components". The program verifies that Class 1, 2 & 3 systems maintain pressure boundary integrity through periodic systematic visual inspections.

- **ASME Section XI Bolted Connection Program**

  The Bolted Connection Program implements the bolted connection visual examination requirements set forth by the ASME Section XI Code, "Rules for Inservice Inspection of Nuclear Power Plant Components". The goal of the program is to verify through systematic visual inspections that closures (bolted connections) are assembled and maintained to have a low risk of leakage.

Subsequent inspections at appropriate intervals are conducted as part of the program.

2. Maintenance Programs include the following:

- **PM Program for Containment Ventilation Systems**

During refueling outages, maintenance personnel perform various Preventive Maintenance (PM) tasks on the containment ventilation system components. The tasks include inspection and cleaning of the Control Rod Drive Mechanism (CRDM) Shroud Fan cooling coils and abnormalities are identified and addressed through the Corrective Action Program.

- **Plant Monitoring and Trending**

From data obtained from periodic system walkdowns and operation surveillance logs, the plant system engineer for the Reactor Coolant System (RCS) performs system monitoring and trending. System monitoring and trending is a vital component for determining the health of a system and provides a tool to assist in pro-actively identifying degrading performance. The engineer responsible for the RCS also performs monitoring of the parameters associated with the Reactor Building Containment. Trending data is reviewed for RCS leakage, containment sump pumpout rate, and containment humidity for potential abnormalities or precursors to identifying problems within the RCS pressure boundary.

In addition, monitoring of the reactor vessel flange for leakage is performed. The reactor vessel flange consists of a double o-ring design. In the event that the inner reactor vessel flange o-ring would fail, leakage would be directed to the primary drains tank via the Reactor Vessel Leakage Detection System. A temperature sensor/indicator located on the piping from the reactor vessel flange to the primary drains tank would sense this leakage and alert the control room personnel of the failure. The outer reactor vessel flange o-ring would then become the pressure boundary to prevent leakage from the vessel.

- **Refueling Activities (reactor disassembly and reassembly)**

Refueling activities provide an excellent opportunity for inspection and observation of the exposed portions of the reactor vessel head for indications of boric acid leakage. These inspections are typically conducted every 18 months based on the scheduled refueling outage intervals for each unit.

Enclosure 1

- **Reactor Building Containment (RBC) Radiation Monitor Leakage Detection System**

  The RBC Radiation Monitor Leakage Detection System is comprised of two separate instrument monitoring channels (a particulate and gaseous channel) that continuously monitor for changes in airborne radiation concentration inside Containment. These monitors are equipped with beta scintillation detectors and draw a sample from the containment atmosphere recirculation system and then discharge back to the RBC. Each unit is equipped with a gas channel and a moving filter particulate monitor.

- **Management Oversight and Corrective Action Programs**

  Management Oversight Process includes Daily Managers' Communications and Teamwork Meetings to provide a broad-base forum for management to review station performance and to discuss operating issues and potential adverse trends. Included in the individual plant operating status report are the current calculated RCS leakage rate and the average containment pumpout rate for the previous 24 hours.

  The Corrective Action Program at Beaver Valley is a process for identifying and documenting conditions at the plant and to assure that conditions adverse to quality are promptly identified and corrected. For significant conditions adverse to quality, measures taken include root cause determination and corrective actions to preclude repetition of adverse conditions. Identified boric acid accumulation issues are entered and tracked via the Corrective Action Program.

1B. An evaluation of the ability of your inspection and maintenance programs to identify degradation of the reactor pressure vessel head including, thinning, pitting, or other forms of degradation such as the degradation of the reactor pressure vessel head observed at Davis-Besse:

Response:

The BVPS inspection and maintenance programs listed in the response to item 1A provide reasonable assurance that leakage that would result in serious degradation of the reactor pressure vessel head would be detected prior to the occurrence of such damage.

1. Inspection Programs:

- **Boric Acid Corrosion Control Program**

  Following each operating cycle, a formal, scheduled boric acid walkdown is performed by Visual Testing (VT) qualified personnel prior to general containment access to identify boric acid accumulations for indications of leakage from borated systems. Identified accumulations are tracked through the site corrective action program and resolved through the site maintenance and design change processes.

- **ASME Section XI Leakage Program**

  The effectiveness of the bare head, under the insulation, visual examination performed in September 2001 at Unit 1 and in February 2002 at Unit 2 resulted in a complete examination of the vessel head penetrations using qualified remote examination equipment and personnel. The bare head visual examinations were performed in response to NRC Bulletin 2001-01.

  Following each refueling outage, a walkdown is performed by VT qualified personnel at nominal operating temperature and pressure to detect leakage or evidence of leakage from the reactor coolant system prior to plant startup. In addition to other portions of the reactor coolant system, this examination specifically encompasses the reactor vessel conoseal joints, control rod drive housings (above the installed insulation) as well as the instrumentation penetrations at the bottom of the reactor vessel. Leakage accumulations identified during the walkdown are tracked through the site corrective action program and resolved through the site maintenance and design change processes.

- **ASME Section XI Bolted Connection Program**

  ASME Class 1 bolted connections are visually examined for evidence of leakage every refueling outage as required by the Code. This includes the reactor vessel head-to-flange bolted connection (the studs, nuts and washers). ASME Class 2 bolted connections in borated systems for the purpose of controlling reactivity are visually examined for evidence of leakage every 40-month period as required by the Code.

2. **Maintenance Programs:**

- **PM Program for Containment Ventilation Systems**

  As part of the routine preventive maintenance performed on the Containment Ventilation system during refueling outages, inspections and cleaning of cooling coils associated with the Control Rod Drive Mechanism (CRDM) Shroud Fans are performed. The CRDM Fan coils are inspected for debris and dirt accumulation that would reduce the efficiency of the coils. A review of CRDM Shroud Fan cooling coil inspection/cleaning PM (Preventive Maintenance) work orders for the past two refueling outages for Unit 1 (1R13 and 1R14) and Unit 2 (2R08 and 2R09) found no instances where accumulation of boric acid on the cooling coils was recorded.

  Follow-up interviews were conducted with several individuals that have been involved in CRDM Shroud Fan cooling coil inspection/cleaning during past refueling outages. The individuals stated that they had not observed evidence of boric acid being present on the CRDM Shroud Fan cooling coils. Evidence of boric acid on the CRDM Shroud Fan cooling coils would be an indication of a leak at the Reactor Vessel Head area since air is drawn from the CRDM Shroud.

- **Plant Monitoring and Trending**

  The plant system engineers perform periodic walkdowns of their assigned systems to document system performance, material condition, key system parameter trends, and potential problems that might affect system performance. The following key system parameters are routinely monitored by the Reactor Coolant System (RCS) System Engineer to determine the health of the RCS pressure boundary (which includes the reactor head): reactor containment building sump pumpout rate, RCS leakage rate, and reactor containment building dewpoint temperature. A review of these key system parameters over the past two years has shown no adverse trends. The BVPS RCS leakage rate and the reactor containment building sump pumpout rate were compared to recent data obtained from Davis-Besse over the same time period. The comparisons show no similar trends or precursors to indicate potential problems with chronic leakage inside the RBC's at Beaver Valley.

As explained in Section A2, the reactor vessel flange consists of a double o-ring design. In the event that the inner reactor vessel flange o-ring would fail, high temperature fluid would be directed to the primary drains tank located in the basement of the reactor containment building. A temperature element located on the piping from the reactor vessel flange to the primary drains tank would sense this high temperature fluid and initiate the reactor vessel flange leakage detection system temperature annunciator. The reactor vessel flange leakage detection system would alert the control room personnel of the failure and the appropriate alarm response procedure would be followed. A review of the reactor vessel flange temperature data over the past two fuel cycles has shown no indication of leakage from the reactor vessel flange.

- **Refueling Activities (reactor disassembly and reassembly)**

  During each refueling outage, removal of the reactor vessel head includes the disassembly of ventilation ductwork associated with the CRDM Shroud Coolers. This ductwork has several joints that must be disassembled during each reactor disassembly. These joints and the direct opening to the shroud area provide excellent opportunities for observing evidence of boric acid as it would travel towards the Shroud Coolers. Evidence of foreign material/boric acid in the ductwork would be identified at that time and appropriate corrective actions would be taken to determine the origin of the foreign material. Boric acid accumulation has not been noted in this ductwork at Beaver Valley.

  Following completion of reactor reassembly, a visual inspection of the four thermocouple column bolted connections is performed at a RCS pressure of approximately 300 psig to check for leakage prior to plant startup after each refueling outage.

- **Reactor Containment Building (RBC) Radiation Monitor Leakage Detection System**

  The monitors associated with the RBC Radiation Monitor Leakage Detection System satisfy applicable requirements for Technical Specifications 3.3.3.1 and 3.4.6.1 and are capable of detecting reactor coolant pressure boundary degradation (0.5 to 1.0 gpm). These monitors, in conjunction with other plant instrumentation that monitor parameters such as containment sump pump-out rate, temperature and humidity, provide early warning indication(s) of potential reactor coolant system leakage.

  For BVPS Unit 1, the analog ratemeter indication and sample flows for each channel are monitored and recorded on a per shift basis for trending purposes. Monitor data is collected, recorded, and reviewed, and anomalies noted are reported to the Control Room staff and Health Physics Supervision. One of the radiation monitors is equipped with a moving filter paper that can be analyzed in the event of an increase in monitor readings or if filter paper loading is indicated.

For BVPS Unit 2, the radiation monitor is part of the Digital Radiation Monitoring System. The monitor is capable of storing 10-minute, hourly, and daily trends. Monitor data is collected, recorded, and reviewed, and anomalies noted are reported to the Control Room staff and Health Physics Supervision. As noted above for BVPS Unit 1, one of the radiation monitors at BVPS Unit 2 is also equipped with a moving filter paper that can be analyzed in the event of an increase in monitor readings or if filter paper loading is indicated.

Due to the sealed nature of the containment buildings at BVPS (no external ventilation), the containment radiation monitoring system is extremely sensitive to leakage from the RCS pressure boundary.

Historically at Beaver Valley, the installed leakage detection radiation monitors have demonstrated the ability to identify Reactor Coolant Pressure Boundary (RCPB) leakage. This ability has been successfully used in the past for the identification, confirmation, and trending of RCS leakage.

- **Management Oversight and Corrective Action Programs**

  As part of the Daily Managers' Communications and Teamwork Meeting, the operating status of the Units are discussed. Included in the individual plant operating status report is the current calculated RCS leakage rate and the average containment pumpout rate for the previous 24 hours. Station management routinely reviews this data and would identify a change to the data so it can be further investigated, as appropriate. The site's Corrective Action Program is used to document the need for further evaluation of an operating plant problem, including an adverse change or trend in RCS leakrate.

  The site Corrective Action Program is utilized to identify and document degradation of the reactor coolant pressure boundary conditions at the plant. Management expectations at Beaver Valley are that conditions shall be identified when the expectations regarding materials, parts, components, activities, processes, procedures and documents associated with the design, maintenance or operation of the plant are not met. This low threshold enables conditions to be identified, and that the appropriate resources can be applied for their resolution. The program has elevated the site awareness of the need to identify, evaluate and correct occurrences of boric acid accumulations expeditiously.

1C. A description of any conditions identified (chemical deposits, head degradation) through the inspection and maintenance programs described in 1.A that could have led to degradation and the corrective actions taken to address such conditions.

Response:

BVPS Unit 1 Discussion:

The reactor vessel head at Beaver Valley Power Station Unit 1 was most recently examined during refueling outage 1R14 on September 9-12, 2001 in accordance with the guidance provided in NRC Bulletin 2001-01.

The examination method employed in 1R14 was a bare head, under the insulation, visual examination using a robotic crawler supplemented with a video probe in areas with limited access. The examination was accomplished through the three shroud ventilation openings. Insulation panels were raised at each of the three openings to allow access for the remote visual equipment. Following the examination, the inspection video was reviewed independently by the site Materials Engineer, and an NRC representative was present during the review as part of a routine Inservice Inspection. The inspections performed in response to NRC Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles," were reviewed by the NRC in accordance with the requirements of the NRC Temporary Instruction (TI) 2515/145, "Circumferential Cracking of RPV Head Penetration Nozzles." The description of the inspection scope and results are documented in Attachment 1 of the NRC Inspection Report 50-334/01-08, 50-412/01-08 dated October 17, 2001.

The Unit 1 examination summary and evaluation report was previously docketed via letter L-01-136, dated October 31, 2001. The results of the inspection are summarized below:

- The bare head examination of the Reactor Head penetrations (sixty-five vessel head penetrations and one reactor head vent line penetration) under the insulation found no indication of boric acid leakage extruding from any penetration onto the reactor vessel head.

- The inspection did identify loose boric acid pebbles and some debris scattered across the surface of the reactor vessel head. Additionally the inspection identified boric acid residue in a spray pattern in the vicinity of vessel head penetrations 59 and 65, summarized as follows:

  - Vessel Head Penetration #59 is associated with thermocouple temperature measurement penetration (Conoseal #1.) The Unit 1 site records indicate that leakage of a conoseal mechanical joint was identified during refueling outage 1R04 (October 1984). The records noted that the boric acid residue

was removed from the head. In the information submitted for Unit 1, it was noted that "very little accumulation of boric acid residue can be seen at the base of the penetrations. The accumulation around the base of the penetration is light dry boric acid no more than 1/16 inch in thickness in the form of a film or coating rather than distinct accumulations of boric acid puff balls". The absence of boric acid accumulation around the base of Penetration #59 provides sufficient evidence that the boric acid residue is a result of past Conoseal leakage and not from a through-wall leak of the vessel head penetration.

- Vessel Head Penetration #65 is associated with a thermocouple temperature penetration (Conoseal #2.) A small amount of boric acid residue was noted to be accumulated on the up-hill side of this penetration as well as a small amount of wastage in the area of Penetration #65 (estimated depth 1/16 to 1/8 inch and approximately ½ inch in width). Staining on the sides of the CRDM indicated that leakage from above had occurred in the past. A similar investigation of the Conoseal leakage history of the #2 Conoseal was performed and leakage during 1R07 (September, 1989) was noted in site records. The absence of corrosion product around the base of penetration #65 and no evidence of recurrent leakage provide assurances that a through-wall leak from the CRDM tube is not present.

BVPS Unit 2 Discussion:

The reactor vessel head at Beaver Valley Power Station Unit 2 was most recently examined during refueling outage 2R09 on February 9 through 11, 2002 in accordance with the guidance provided in NRC Bulletin 2001-01.

The examination method employed in 2R09 was a bare head visual examination under the insulation, using a robotic crawler supplemented with a video probe. The examination was accomplished through the three shroud ventilation openings. Insulation panels were raised at each of the three openings to allow access for the remote visual equipment. Following the examination, the inspection video was reviewed independently by the site Materials Engineer, and an NRC representative was present during the review as part of a routine Inservice Inspection.

The Unit 2 examination summary and evaluation report was recently docketed via letter L-02-021, dated March 28, 2002. The results of the inspection are summarized below:

- The bare metal inspection of the Reactor Head penetrations (sixty-five vessel head penetrations and one reactor head vent line penetration) under the insulation found no indication of boric acid leakage extruding from any penetration onto the reactor vessel head. None of the penetrations displayed boric acid accumulations of a nature that are indicative of through-wall leakage.

Enclosure 1

The general condition of the RV Head was good with very little debris found during the inspections. All penetrations were inspected and free of obstruction. (Reference FENOC letter L-02-021, dated March 28, 2002)

1D. Your schedule plans, and basis for future inspections of the reactor pressure vessel head and penetration nozzles. This should include the inspection method(s), scope, frequency, qualification requirements, and acceptance criteria.

Response:

The planned inspection method for the next scheduled examination is a qualified visual examination of the reactor vessel head and penetrations. Examination scope for the planned inspection includes the reactor vessel head penetrations and the ligaments between the penetrations.

The next scheduled qualified visual examination of the Beaver Valley Unit 1 reactor vessel will be performed during the 1R15 refueling outage currently scheduled to begin in March, 2003.

Based on the inspection results to date at Beaver Valley Unit 2 and insights gained from the next scheduled examinations at Unit 1 during the 1R15 refueling outage, FENOC will evaluate the need for follow-up visual examinations of the Unit 2 reactor vessel head. Changes to the currently planned inspection approach and acceptance criteria will be evaluated routinely based upon the information available from the ASME Section XI Code and the EPRI MRP (Materials Reliability Project) Alloy 600 ITG (Issues Task Group) recommendations.

The acceptance criteria for the visual inspections of the reactor vessel head and penetration nozzles are as follows:

- Coverage requirements - 100% visual inspection around each vessel head penetration along with the general area of the bare vessel head.

- Limitations – No conditions or limitations that hinder the ability to detect evidence of leakage from any of the head penetrations or evidence of head degradation, specifically, no accumulations of Boric acid that mask the area of interest.

- Examination results will be evaluated by qualified FENOC VT Level II or Level III personnel to verify results and assess the quality of the examination documentation.

- Accumulations of Boric Acid (if present) will be evaluated by comparison with images of known pressure boundary leakage from other facilities to determine subsequent actions.

Personnel, equipment and documentation of the completed examinations will continue to meet the VT-1/VT-2 requirements per ASME Section XI, with respect to the resolution capabilities, lighting and angle of vision.

1E. Your conclusion regarding whether there is reasonable assurance that regulatory requirements are currently being met (see the Applicable Regulatory Requirements, above). This discussion should also explain your basis for concluding that the inspections discussed in response to Item 1.D will provide reasonable assurance that these regulatory requirements will continue to be met. Include the following specific information in this discussion:

1. ***If your evaluation does not support the conclusion that there is reasonable assurance that regulatory requirements are being met, discuss your plans for plant shutdown and inspection.***

Response:

Based on the previous discussions, Beaver Valley concludes that there is reasonable assurance that regulatory requirements are being met, and therefore this item is not applicable. See response to part 1E.2 below.

2. ***If your evaluation supports the conclusion that there is reasonable assurance that regulatory requirements are being met, provide your basis for concluding that all regulatory requirements discussed in the applicable Regulatory Requirements section will continue to be met until the inspections are performed.***

Response:

As noted in our response to item 1C, bare head examinations were performed for both BVPS Units 1 and 2 during our most recent refueling outages in accordance with the guidance provided in NRC Bulletin 2001-01.

We have reviewed the Programs and procedures in place at BVPS regarding Boric Acid Corrosion Control, ASME Section XI Leakage, and ASME Section XI Bolted Connections. The Programs and procedures developed for BVPS are based on the applicable regulatory requirements that are identified in the Applicable Regulatory Requirements section of this Bulletin. Our criteria are as follows:

- Coverage requirements - 100% visual inspection around each vessel head penetration along with the general area of the bare vessel head.

- Limitations – No conditions or limitations that hinder the ability to detect evidence of leakage from any of the head penetrations or evidence of head degradation, specifically, no accumulations of Boric acid that mask the area of interest.

- Examination results will be evaluated by qualified FENOC VT Level II or Level III personnel to verify results and assess the quality of the examination documentation.

- Accumulations of Boric Acid (if present) will be evaluated by comparison with images of known pressure boundary leakage from other facilities to determine subsequent actions.

Since the work activities at BVPS regarding boric acid corrosion control are being performed in accordance with these Programs and procedures, there is reasonable assurance that these regulatory requirements are currently being met.

Future inspections at BVPS Unit 1 and Unit 2 will continue to be performed in accordance with the BVPS Programs and procedures. Therefore, there is reasonable assurance that the regulatory requirements discussed in the Applicable Regulatory Requirements section of the Bulletin will continue to be met.