



FirstEnergy Nuclear Operating Company

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L-08-377

10 CFR 54

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

SUBJECT:

Beaver Valley Power Station, Unit Nos. 1 and 2
BV-1 Docket No. 50-334, License No. DPR-66
BV-2 Docket No. 50-412, License No. NPF-73
Supplemental Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594) and License Renewal Application Amendment No. 34

The Reference provided the FirstEnergy Nuclear Operating Company (FENOC) License Renewal Application (LRA) for the Beaver Valley Power Station (BVPS). Due to recent site operating experience with Boral neutron absorber blistering, FENOC is crediting the existing plant-specific Boral Surveillance Program for aging management in the LRA. This letter provides the associated changes to the LRA.

The Attachment provides the reason for crediting the Boral Surveillance Program. The Enclosure provides Amendment No. 34 to the BVPS LRA.

There are no regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Clifford I. Custer, Fleet License Renewal Project Manager, at 724-682-7139.

I declare under penalty of perjury that the foregoing is true and correct. Executed on January 19, 2009.

Sincerely,

Kevin L. Ostrowski

A108
NRR

Beaver Valley Power Station, Unit Nos. 1 and 2
L-08-377
Page 2

Reference:

FENOC Letter L-07-113, "License Renewal Application," August 27, 2007.

Attachment:

Supplemental Information Regarding Beaver Valley Power Station, Units 1 and 2,
License Renewal Application

Enclosure:

Amendment No. 34 to the BVPS License Renewal Application

cc: Mr. K. L. Howard, NRC DLR Project Manager
Mr. S. J. Collins, NRC Region I Administrator

cc: w/o Attachment or Enclosure
Mr. B. E. Holian, NRC DLR Director
Mr. D. L. Werkheiser, NRC Senior Resident Inspector
Ms. N. S. Morgan, NRC DORL Project Manager
Mr. D. J. Allard, PA BRP/DEP Director
Mr. L. E. Ryan, PA BRP/DEP

ATTACHMENT
L-08-377

Supplemental Information Regarding
Beaver Valley Power Station, Units 1 and 2,
License Renewal Application
Page 1 of 1

Recent Beaver Valley Power Station operating experience indicates that the Boral neutron absorber material used in the Unit 1 Spent Fuel Pool may be susceptible to an aging effect requiring management that was not previously considered applicable.

Following submittal of the License Renewal Application, inspection of Boral coupons under the existing site Boral Surveillance Program identified that the coupons exhibited numerous blisters. In region 1 fuel storage racks, blisters can displace water from the flux traps between storage cells and challenge dimensional assumptions used in the criticality analysis.

Due to the results of this inspection, FENOC will credit the existing Boral Surveillance Program for management of aging of Boral in the Unit 1 Spent Fuel Pool. Specifically, the Boral Surveillance Program will confirm the effectiveness of the Water Chemistry Program in managing loss of material of the Boral's aluminum cladding, and will manage the aging effect of blistering.

See the Enclosure to this letter for the revision to the BVPS LRA.

ENCLOSURE

Beaver Valley Power Station (BVPS), Unit Nos. 1 and 2

Letter L-08-377

Amendment No. 34 to the BVPS License Renewal Application

Page 1 of 15

License Renewal Application Sections Affected

3.3.2.2.6

Table 3.3.1-13

3.5.2.1.14

Table 3.5.2-14

3.5, Note 515

A.1.43

Table B.1-1

Table B.1-2

Table B.1-3

B.2.43

The Enclosure identifies the correction by Affected License Renewal Application (LRA) Section, LRA Page No., and Affected Paragraph and Sentence. The count for the affected paragraph, sentence, bullet, etc. starts at the beginning of the affected Section or at the top of the affected page, as appropriate. Below each section the reason for the change is identified, and the sentence affected is printed in *italics* with deleted text ~~lined-out~~ and added text underlined.

<u>Affected LRA Section</u>	<u>LRA Page No.</u>	<u>Affected Paragraph and Sentence</u>
Section 3.3.2.2.6	3.3-50	New paragraph
		Recent Beaver Valley Power Station operating experience indicates that the Boral neutron absorber material used in the Unit 1 Spent Fuel Pool may be susceptible to an aging effect requiring management that was not previously considered applicable. FirstEnergy Nuclear Operating Company (FENOC) will credit the existing plant-specific BVPS Boral Surveillance Program for management of aging of Boral in the Unit 1 Spent Fuel Pool. A sixth paragraph is added to section 3.3.2.2.6:

Additionally, blistering of Boral coupons has recently been identified at BVPS Unit 1. While the neutron absorption properties of Boral are not affected by blistering, severe blistering could have the potential to challenge dimensional assumptions of water flux traps in the region 1 fuel storage criticality analysis. Therefore, blistering is considered an aging effect requiring management. The Boral Surveillance Program (Section B.2.43) will confirm the effectiveness of the Water Chemistry Program related to managing the aging effect of loss of material of the Boral's aluminum cladding in the Unit 1 Spent Fuel Pool, and will manage blistering of the Boral sheets in the Unit 1 Spent Fuel Pool.

<u>Affected LRA Section</u>	<u>LRA Page No.</u>	<u>Affected Paragraph and Sentence</u>
Table 3.3-1	3.3-66	Item 3.3.1-13, Discussion column

Recent Beaver Valley Power Station operating experience indicates that the Boral neutron absorber material used in the Unit 1 Spent Fuel Pool may be susceptible to an aging effect requiring management that was not previously considered applicable. FENOC will credit the existing plant-specific BVPS Boral Surveillance Program for management of aging of Boral in the Unit 1 Spent Fuel Pool. The discussion column of item 3.3.1-13 in Table 3.3-1 is revised to read:

Consistent with NUREG-1801, with exception.

Unit 1 has Boral neutron-absorbing sheets in Spent Fuel Pool storage racks; Unit 2 does not.

Reduction of neutron-absorbing capacity for Boral does not need aging management. However, the aging effect of loss of material will be managed by the Water Chemistry (B.2.42) Program. The Boral Surveillance Program (B.2.43) will confirm the effectiveness of the Water Chemistry Program in managing loss of material of the Boral's aluminum cladding and will manage blistering.

Further evaluation is documented in Section 3.3.2.2.6.

<u>Affected LRA Section</u>	<u>LRA Page No.</u>	<u>Affected Paragraph and Sentence</u>
Section 3.5.2.1.14	3.5-17	“Aging Effects Requiring Management,” new bullet

Recent Beaver Valley Power Station operating experience indicates that the Boral neutron absorber material used in the Unit 1 Spent Fuel Pool may be susceptible to an aging effect requiring management that was not previously considered applicable. FENOC will credit the existing plant-specific BVPS Boral Surveillance Program for management of aging of Boral in the Unit 1 Spent Fuel Pool. Section 3.5.2.1.14 is revised to read:

Aging Effects Requiring Management

The following aging effects associated with Fuel Building components require management.

- *Blistering*
- Cracking
- Loss of material

Affected LRA Section **LRA Page No.** **Affected Paragraph and Sentence**

Table 3.5.2-14 **3.5-124** **New Rows**

Recent Beaver Valley Power Station operating experience indicates that the Boral neutron absorber material used in the Unit 1 Spent Fuel Pool may be susceptible to an aging effect requiring management that was not previously considered applicable. FENOC will credit the existing plant-specific BVPS Boral Surveillance Program for management of aging of Boral in the Unit 1 Spent Fuel Pool. Two new rows are added to Table 3.5.2-14 as follows:

Row No.	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Item	Table 1 Item	Notes
<i>New</i>	<i>Spent fuel rack neutron absorbers</i>	<i>SHD, SSR</i>	<i>Boral</i>	<i>Exposed to treated water</i>	<i>Loss of Material</i>	<i>Boral Surveillance (B.2.43)</i>	<i>VII.A2-5 (A-88)</i>	<i>3.3.1-13</i>	<i>E. 515</i>
<i>New</i>	<i>Spent fuel rack neutron absorbers</i>	<i>SHD, SSR</i>	<i>Boral</i>	<i>Exposed to treated water</i>	<i>Blistering</i>	<i>Boral Surveillance (B.2.43)</i>	<i>VII.A2-5 (A-88)</i>	<i>3.3.1-13</i>	<i>E. 515</i>

<u>Affected LRA Section</u>	<u>LRA Page No.</u>	<u>Affected Paragraph and Sentence</u>
Section 3.5 Notes	3.5-231	Note 515

Recent Beaver Valley Power Station operating experience indicates that the Boral neutron absorber material used in the Unit 1 Spent Fuel Pool may be susceptible to an aging effect requiring management that was not previously considered applicable. FENOC will credit the existing plant-specific BVPS Boral Surveillance Program for management of aging of Boral in the Unit 1 Spent Fuel Pool. Note 515 in Section 3.5 is modified to read:

The listed AMP is a plant-specific AMP for this item. The BVPS plant-specific AMR concluded Boral does not require aging management for the period of extended operation for its neutron absorbing function; however, aging management for blistering and for loss of material of its aluminum constituent is required. Management of blistering is compared to row VII.A2-5 because it has the potential to challenge assumptions used in the criticality analysis for region 1 fuel storage.

<u>Affected LRA Section</u>	<u>LRA Page No.</u>	<u>Affected Paragraph and Sentence</u>
Section A.1.43	A.1-19	Section Number & New Section
		Recent Beaver Valley Power Station operating experience indicates that the Boral neutron absorber material used in the Unit 1 Spent Fuel Pool may be susceptible to an aging effect requiring management that was not previously considered applicable. FENOC will credit the existing plant-specific BVPS Boral Surveillance Program for management of aging of Boral in the Unit 1 Spent Fuel Pool. The Section number of A.1.43, "Appendix A.1 References," is modified, and a new Section A.1.43 is inserted as follows:

A.1.43 BORAL SURVEILLANCE PROGRAM (UNIT 1 ONLY)

The Boral Surveillance Program is an existing plant-specific condition monitoring program for which there is no comparable NUREG-1801 aging management program. The program manages the neutron absorbing function of the BVPS Unit 1 High Density Spent Fuel Storage Racks by the removal and testing of sample Boral neutron absorber coupons. Coupon analysis is performed by a vendor, and recommendations based on the analysis are provided to FENOC.

The purpose of the program is to characterize certain properties of the Boral in the storage racks to assure its capability to fulfill its intended function, and to assure that assumptions made in the Fuel Pool criticality analysis remain valid. Because the test coupons are located and configured to ensure exposure to higher-than-average levels of gamma radiation, data gathered by the program represent accelerated use, and there is reasonable assurance that degradation will be detected and corrective actions taken prior to a loss of intended function.

A.1.43 A.1.44 APPENDIX A.1 REFERENCES

<u>Affected LRA Section</u>	<u>LRA Page No.</u>	<u>Affected Paragraph and Sentence</u>
Table B.1-1	B.1-7	New row

Recent Beaver Valley Power Station operating experience indicates that the Boral neutron absorber material used in the Unit 1 Spent Fuel Pool may be susceptible to an aging effect requiring management that was not previously considered applicable. FENOC will credit the existing plant-specific BVPS Boral Surveillance Program for management of aging of Boral in the Unit 1 Spent Fuel Pool. A new row is added to Table B.1-1:

Aging Management Program Title	LRA Section	Status
<i><u>Boral Surveillance (Unit 1 only)</u></i>	<i><u>B.2.43</u></i>	<i><u>Existing</u></i>

<u>Affected LRA Section</u>	<u>LRA Page No.</u>	<u>Affected Paragraph and Sentence</u>
Table B.1-2	B.1-12	New row

Recent Beaver Valley Power Station operating experience indicates that the Boral neutron absorber material used in the Unit 1 Spent Fuel Pool may be susceptible to an aging effect requiring management that was not previously considered applicable. FENOC will credit the existing plant-specific BVPS Boral Surveillance Program for management of aging of Boral in the Unit 1 Spent Fuel Pool. A new row is added to Table B.1-2:

NUREG-1801 Number	NUREG-1801 Program	BVPS Program	LRA Section
<u>NA</u>	<u>Plant-specific Program</u>	<u>Boral Surveillance (Unit 1 Only)</u>	<u>B.2.43</u>

Affected LRA Section **LRA Page No.** **Affected Paragraph and Sentence**

Table B.1-3 **B.1-13** **New row**

Recent Beaver Valley Power Station operating experience indicates that the Boral neutron absorber material used in the Unit 1 Spent Fuel Pool may be susceptible to an aging effect requiring management that was not previously considered applicable. FENOC will credit the existing plant-specific BVPS Boral Surveillance Program for management of aging of Boral in the Unit 1 Spent Fuel Pool. A new row is added to Table B.1-3:

Program Name	Plant Specific	NUREG-1801 Comparison		
		Programs Consistent with NUREG-1801	Programs with Enhancement(s)	Programs with Exception(s) to NUREG-1801
<u>Boral Surveillance (Unit 1 Only)</u>	<u>Yes</u>	==	==	==

<u>Affected LRA Section</u>	<u>LRA Page No.</u>	<u>Affected Paragraph and Sentence</u>
Section B.2.43	B.2-120	New section

Recent Beaver Valley Power Station operating experience indicates that the Boral neutron absorber material used in the Unit 1 Spent Fuel Pool may be susceptible to an aging effect requiring management that was not previously considered applicable. FENOC will credit the existing plant-specific BVPS Boral Surveillance Program for management of aging of Boral in the Unit 1 Spent Fuel Pool. A new section is added to Appendix B:

B.2.43 BORAL SURVEILLANCE (UNIT 1 ONLY)

Program Description

The Boral Surveillance Program is an existing plant-specific condition monitoring program for which there is no comparable NUREG-1801 aging management program. The program manages the neutron absorbing function of the BVPS Unit 1 High Density Spent Fuel Storage Racks by the removal and testing of sample Boral neutron absorber coupons. Coupon analysis is performed by a vendor, and recommendations based on the analysis are provided to FENOC.

The purpose of the program is to characterize certain properties of the Boral in the storage racks to assure its capability to fulfill its intended function, and to assure that assumptions made in the Fuel Pool criticality analysis remain valid. Because the test coupons are located and configured to ensure exposure to higher than average levels of gamma radiation, data gathered by the program represent accelerated use, and there is reasonable assurance that degradation will be detected and corrective actions taken prior to a loss of intended function.

Aging Management Program Elements

The results of an evaluation of each of the 10 aging management program elements described in NUREG-1800 [Reference 1.3-4], Appendix A, are provided as follows:

- **Scope of Program**

The scope of the program consists of the Boral neutron absorbing material in the High Density Spent Fuel Storage Racks at BVPS Unit 1. The program applies only to BVPS Unit 1, because the BVPS Unit 2 Spent Fuel Storage Racks do not use Boral as a neutron absorber.

- **Preventive Actions**

The program is a condition monitoring program that does not contain preventive actions.

- **Parameters Monitored / Inspected**

The program monitors changes in physical properties of the Boral by performing measurements on representative Boral coupons. The coupons simulate as nearly as possible the actual in-service geometry, physical mounting, materials, and flow conditions of the Boral panels in the storage racks. The coupons are removed in accordance with a prescribed schedule. Upon removal, each coupon is inspected and tested to determine changes in physical properties of the Boral in the spent fuel pool. The measurements performed are:

- Visual Observation and Photography
- Neutron Attenuation
- Dimensional Measurements (length, width, and thickness)
- Weight and Specific Gravity

The program provides for additional, optional measurement parameters and actions, including radiography, destructive wet chemical analysis, re-insertion of tested coupons, and in-service inspection of the Boral panels themselves. These additional actions provide options for confirming or further investigating results of coupon analysis.

- **Detection of Aging Effects**

The program was approved by the NRC in the "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 178 to Facility Operating License No. DPR-66" (ADAMS Accession number ML003767816). Detection of aging effects occurs through monitoring changes in physical properties of the Boral coupons. When the program was initiated, a total of 20 test coupons were installed in the Unit 1 fuel pool, with 10 coupons installed in each of 2 coupon trees. Coupons are removed for analysis according to a prescribed schedule. The schedule is such that coupons will be removed through the period of extended operation.

After removal, three length measurements and three width measurements are taken and compared to corresponding pre-irradiation measurements. Five thickness measurements are taken and compared to corresponding pre-irradiation measurements. The coupons are examined visually for signs of

degradation, including edge and corner defects, discoloration, and surface pitting.

The coupons are then dried carefully in three stages to avoid expansion of the water which has been absorbed and subsequent bulging of the coupon.

Neutron attenuation measurements are made relative to a standard sample. Weight and specific gravity measurements are also taken.

- **Monitoring and Trending**

The evaluation of the coupons provides information on the radiological effects, thermal effects, and chemical effects of the spent fuel pool environment on the Boral panels. For the first several refueling cycles after installation, the coupon trees are surrounded by discharged fuel assemblies having a high specific power prior to shutdown. This fuel storage configuration is intended to accelerate aging of the test coupons. Over the duration of the coupon testing program, the coupons will have accumulated more radiation dose than the expected lifetime dose for normal storage cells.

Because the test coupon data gathered by the program represents accelerated use, there is reasonable assurance that degradation will be detected and corrective actions taken prior to a loss of intended function of the Boral panels themselves.

- **Acceptance Criteria**

The most significant measurements taken are thickness (to monitor for swelling) and neutron attenuation (to confirm the concentration of Boron-10 in the Boral). Acceptance criteria for these measurements are as follows:

- A decrease of no more than 5% in Boron-10 content as determined by neutron attenuation.
- An increase in thickness at any point should not exceed 10% of the initial thickness at that point.

Changes in excess of either of these two criteria require investigation and engineering evaluation to identify whether further testing or corrective actions may be necessary.

The remaining measurement parameters serve a supporting role and should be examined for early indications of the potential onset of Boral degradation that would suggest a need for further attention. These include:

- Visual or photographic evidence of unusual surface pitting, corrosion or edge deterioration
- Unaccountable weight loss in excess of the measurement accuracy
- The existence of areas of reduced boron density should an optional neutron radiograph be taken

- **Corrective Actions**
This element is discussed in Section B.1.3.
- **Confirmation Process**
This element is discussed in Section B.1.3.
- **Administrative Controls**
This element is discussed in Section B.1.3.
- **Operating Experience**
The program administers the removal and testing of sample Boral neutron absorber coupons. Coupon analysis is performed by a vendor, and recommendations based on the analysis are provided to FENOC. The results of Boral coupon analysis are recorded in inspection reports. Recommended items for evaluation from the reports have been documented in the BVPS Corrective Action Program.

To date, the most recent program inspection report was issued in 2007. Two Boral coupons were removed from the BVPS Unit 1 Spent Fuel Pool in June 2007 and shipped to Northeast Technology Corp (NETCO) for testing. The results of these tests are indicative of satisfactory material performance. However, both coupons had numerous blisters in the Boral cladding. The previous inspection report, issued in 2002, identified a few small blisters on the coupons. Prior to that, no blisters were noted on the coupons. Because the blisters displace water from the flux trap of the Region 1 racks, they could potentially challenge dimensional assumptions made in the fuel pool criticality analysis. FENOC performed an evaluation of the blisters through the Corrective Action Program. FENOC will monitor future surveillance coupons for extent and progression of corrosion and blister growth. This action is consistent with recommendations from NETCO and EPRI Report 1013721, "Handbook of

Neutron Absorber Materials for Spent Nuclear Fuel Transportation and Storage Applications.”

Although the results of the coupon analysis warranted further evaluation, the neutron attenuation and structural integrity of the coupons was determined to be unaffected. The operating experience for the program provides evidence that continued surveillance of the coupons will effectively manage aging effects such that there is no loss of intended function.

Enhancements

None

Conclusion

Continued implementation of the Boral Surveillance Program provides reasonable assurance that the aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions, consistent with the current licensing basis, for the period of extended operation.