UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 26, 2009

Mr. Peter P. Sena III
Site Vice President
FirstEnergy Nuclear Operating Company
Beaver Valley Power Station
Mail Stop A-BV-SEB1
P.O. Box 4, Route 168
Shippingport, PA 15077

SUBJECT: BEAVER VALLEY POWER STATION, UNIT NO. 2 - ISSUANCE OF AMENDMENT RE: THE USE OF CONTAINMENT ACCIDENT PRESSURE IN DETERMINING AVAILABLE NET POSITIVE SUCTION HEAD OF RECIRCULATION SPRAY PUMPS (TAC NO. ME0098)

Dear Mr. Sena:

The Commission has issued the enclosed Amendment No. 167 to Facility Operating License No. NPF-73 for the Beaver Valley Power Station, Unit No. 2 (BVPS-2). This amendment consists of changes to the Updated Final Safety Analysis Report (UFSAR) in response to your application dated November 7, 2008.

The amendment revises the licensing basis, as described in Section 6.2.2.3.2 of the BVPS-2 UFSAR, regarding the method of calculating the net positive suction head available of the recirculation spray pumps. This change to the BVPS-2 licensing basis relates to issues associated with Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors."

A copy of the related safety evaluation (SE) is also enclosed. The Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

Nadiyah S. Morgan, Project Manager
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-412

Enclosures:
1. Amendment No. 167 to NPF-73
2. SE

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UNITED STATES
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FIRSTENERGY NUCLEAR OPERATING COMPANY

FIRSTENERGY NUCLEAR GENERATION CORP.

OHIO EDISON COMPANY

THE TOLEDO EDISON COMPANY

DOCKET NO. 50-412

BEAVER VALLEY POWER STATION, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 167
License No. NPF-73

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by FirstEnergy Nuclear Operating Company, et al. (FENOC, licensee), dated November 7, 2008, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, this license amendment authorizes changes to Section 6.2.2.3.2 of the Updated Final Safety Analysis Report (UFSAR) as shown in Attachment 1 to the licensee's letter dated November 7, 2008. The licensee shall submit the changes authorized by this amendment with the next update of the UFSAR in accordance with 10 CFR 50.71(e).

3. This license amendment is effective as of the date of its issuance and shall be implemented within 30 days.

FOR THE NUCLEAR REGULATORY COMMISSION

Mark G. Kowal, Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Date of Issuance: March 26, 2009

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 167 TO FACILITY OPERATING LICENSE NO. NPF-73

FIRSTENERGY NUCLEAR OPERATING COMPANY

FIRSTENERGY NUCLEAR GENERATION CORP.

OHIO EDISON COMPANY

THE TOLEDO EDISON COMPANY

BEAVER VALLEY POWER STATION, UNIT NO. 2

DOCKET NO. 50-412

1.0 INTRODUCTION

By application dated November 7, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML083170522), FirstEnergy Nuclear Operating Company (FENOC, licensee), requested changes to the Beaver Valley Power Station, Unit No. 2 (BVPS-2) operating license.

The proposed changes would revise the method used to calculate the available net positive suction head (NPSH) for the BVPS-2 recirculation spray (RS) pumps as described in Section 6.2.2.3.2 of the BVPS-2 Updated Final Safety Analysis Report (UFSAR). Specifically, the proposed changes would revise the BVPS-2 UFSAR to take credit for containment overpressure by allowing for the difference between containment total pressure and the vapor pressure of the water in the containment sump in the available NPSH calculation.

The licensee stated that in order to address Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors," a change in methodology is required for calculating the available NPSH for the BVPS-2 RS pumps. By letter dated August 28, 2008 (ADAMS Accession No. ML082480045), the licensee committed to submitting an application for BVPS-2 for NRC approval of this methodology change.

The licensee proposed to use the same NPSH analysis method that is currently used for BVPS-1, and changes to the BVPS-2 Technical Specifications are not required, as the NRC Standard Review Plan, Section 6.2.2 permits the use of containment accident pressure in determining the available NPSH of the ECCS and containment heat removal pumps.

2.0 REGULATORY EVALUATION

2.1 Description of System

The BVPS-2 RS system is described in Section 6.2.2.2.2 of the BVPS-2 UFSAR. The system consists of four pumps and four heat exchangers. The two redundant RS pumps that are connected to the same spray ring header are supplied with emergency power from separate emergency diesel generators.

Section 4.6 of Enclosure 2 to the licensee's letter dated June 2, 2004 (ADAMS Accession No. ML041560461), summarized the different pump configurations of the BVPS-1 and 2 emergency pumps relevant to NPSH considerations:

> When evaluating the NPSH limits, the different pump configurations in BVPS-1 and 2 result in different evaluations for NPSH. In particular, BVPS-1 has a Low Head Safety Injection (LHSI) pump which takes suction directly from the containment sump and consequently, must have sufficient NPSH for sustained operation. For BVPS-2, the LHSI pump stops, and the Emergency Core Cooling System (High Head Safety Injection and 6 inch cold leg injection lines) receives flow from the discharge of two of the four recirculating spray pumps when the system switches over to containment recirculation. BVPS-2 LHSI pump does not take suction from the sump and the two recirculation spray pumps that switch to RCS injection have heat exchangers to cool the water before it enters the RCS. [***]

The four BVPS-2 RS pumps are vertical deep well centrifugal pumps. The UFSAR states that, "the pumps have shaft extensions to permit locating the pump suctions at a level below the containment sump, with the motors at an elevation slightly above grade."

2.2 Proposed Methodology Changes

For BVPS-1, the available NPSH is determined by the following equation (using BVPS-1 UFSAR notation):

$$NPSHA = P_c + Z - H_f - P_v$$

where,

NPSHA is the available NPSH,

P_c is the head equivalent to the containment atmosphere total pressure,

Z is the elevation head of water above the first stage impeller,

H_f is the head loss from pipe friction and fittings (valves, pipe bends, etc.) in the suction pipe, and

P_v is the head equivalent to the vapor pressure of the sump liquid.

Currently, the NPSHA for BVPS-2 is determined by equating the vapor pressure head to the total pressure head. This method is consistent with the guidance of Section 6.2.2 of the NRC Standard Review Plan, which means that the pressure due to the air in the containment atmosphere is neglected (Reference 4). Thus, NPSHA is determined as NPSHA = $Z - H_f$. This is conservative, but unrealistic.

The sump screen design modifications proposed by the licensee for BVPS-2 to satisfy the guidance of GL 2004-02 are described in the licensee's letter dated October 29, 2008 (ADAMS Accession No. ML083080094) to the NRC.

In order to satisfy the NPSH requirements for the new sump design, the licensee may have to include the contribution of the air in the containment atmosphere to the calculated containment pressure. (The licensee has not made a final decision. The licensee stated that the final NPSHA calculations are not yet completed.) Therefore, the licensee proposed to revise the BVPS-2 licensing basis to use the complete equation for NPSHA.

2.3 Regulatory Requirements and Guidance

General Design Criterion (GDC) 35, "Emergency core cooling," in Appendix A of Title 10 of the *Code of Federal Regulations* (10 CFR) requires that the emergency core cooling system (ECCS) provide abundant core cooling so that fuel and clad damage that could interfere with continued effective core cooling is prevented, and so that clad metal-water action is limited to negligible amounts. Adequate NPSH margin is necessary to ensure abundant core cooling.

GDC 38, "Containment heat removal," requires that a system to remove heat from the reactor containment be provided whose safety function is to reduce rapidly, consistent with the functioning of other associated systems, the containment pressure and temperature following a loss-of-coolant accident (LOCA). Adequate NPSH margin is necessary to ensure that the containment spray pumps can cool the post-LOCA containment atmosphere.

3.0 TECHNICAL EVALUATION

The current licensing basis for BVPS-1 with respect to NPSH was proposed by the licensee as part of the conversion of the BVPS-1 and 2 containments from subatmospheric to atmospheric (Reference 1). The NRC approved this conversion and the accompanying analysis methods (Reference 3). The NPSH calculations for BVPS-1 are also described in Attachment 1 to Reference 6. As described above, the licensee now proposes to apply the BVPS-1 NPSH analysis methods and assumptions to BVPS-2.

Use of the complete equation for NPSHA reflects the physical processes actually occurring in the containment during the postulated accident. The mass of air in the containment remains constant (with the exception of a small loss due to containment leakage) and is heated by the release of steam to the containment during the LOCA. Heating the air increases its partial pressure.

The licensee makes conservative assumptions in the NPSH calculations. These assumptions are discussed in the licensee's original application for conversion of the BVPS-1 and 2 containments from subatmospheric to atmospheric and in Reference 1. These assumptions result in a conservatively low containment pressure and a conservatively high sump water temperature.

The licensee also models the break flow conservatively. For NPSH calculations, the licensee determines the break flow enthalpy by assuming mixing of the mass and energy released from the two sides of the pipe break before the flow enters the containment. The distribution of mass and energy to the containment atmosphere and to the containment sump is then determined. The steam in the break flow released to the containment atmosphere is minimized by this mixing and the water in the break flow added to the containment sump is maximized. Therefore, this method was conservative and found acceptable for BVPS-1 during the NRC staff's review of the containment conversion.

In addition to these conservative assumptions, the Z term in the NPSH equation is determined in a conservative manner in the calculations. For example, the licensee biases the distribution of the containment spray flow so as to present a greater opportunity for water hold up.

3.1 Staff Findings

Based on the fact that the NPSH analysis method for BVPS-1 was found conservative and acceptable in an earlier NRC review, and since the containment designs are similar, the NRC staff concludes that application of the BVPS-1 NPSH analysis methods and assumptions to BVPS-2 are acceptable.

The NRC staff's evaluation and conclusion are applicable to the NPSHA calculation methods. The scope of this review did not include the results from using these methods.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Pennsylvania State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (73 FR 76411). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

7.0 REFERENCES

1. Letter from L. William Pearce, Site Vice President, Beaver Valley Power Station, Unit Nos. 1 and 2, to USNRC, Beaver Valley Power Station Unit No. 1 and No. 2, License Amendment Request Nos. 317 and 190, June 2, 2004 (ADAMS Accession No. ML041560461).

2. NRC Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized Water Reactors," USNRC, September 13, 2004.

3. Letter from USNRC to James H. Lash, Vice President, FirstEnergy Nuclear Operating Company, Beaver Valley Power Station, Beaver Valley Power Station, Unit Nos. 1 and 2 (BVPS-1 and BVPS-2)-Issuance of Amendments Re: Containment Conversion from Subatmospheric to Atmospheric Operating Conditions, February 6, 2006 (ADAMS Accession No. ML060100325).

4. U.S. Nuclear Regulatory Commission Standard Review Plan, Section 6.2.2, Containment Heat Removal Systems, Revision 5, March 2007 (ADAMS Accession No. ML07016610).

5. Letter from Peter P. Sena III, Site Vice President, Beaver Valley Power Station, Unit Nos. 1 and 2, to USNRC, Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During design Basis Accidents at Pressurized Water Reactors" – Request for Extension of Completion Date for Corrective Actions, August 28, 2008 (ADAMS Accession No. ML082480045).

6. Letter from Peter P. Sena III, Site Vice President, Beaver Valley Power Station, Unit Nos. 1 and 2, to USNRC, Supplemental Response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors" – Request for Extension of Completion Date for Corrective Actions, October 29, 2008, Items 3.f.14 and 3.g (ADAMS Accession No. ML083080094).

7. Letter from Peter P. Sena III, Site Vice President, Beaver Valley Power Station, Unit Nos. 1 and 2, to USNRC, Beaver Valley Power Station, Unit No. 2, License Amendment Request No. 08-029, Credit for Containment Overpressure, November 7, 2008, (ADAMS Accession No. ML083170522).

Principal Contributor: R. Lobel

Date: March 26, 2009

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Sincerely,

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Nadiyah S. Morgan, Project Manager
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Amendment No.: ML090270068 *Input received. No substantive changes made.

OFFICE	LPLI-1/PM	LPLI-1/LA	DSS/SCVB/BC	OGC	LPLI-1/BC
NAME	NMorgan	SLittle	RDennig	LSubin (NLO w/ comment)	MKowal
DATE	2/10/09	2/5/09	01/13/2009*	2/19/09	3/26/09

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