May 15, 2003

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

SUBJECT: BEAVER VALLEY POWER STATION, UNIT 2 - ISSUANCE OF AMENDMENT RE: NEW FUEL STORAGE RACK FUEL ENRICHMENT LIMITS (TAC NO. MB5301)

Dear Mr. Pearce:

The Commission has issued the enclosed Amendment No. 135 to Facility Operating License No. NPF-73 for the Beaver Valley Power Station, Unit 2 (BVPS-2). This amendment consists of changes to the Technical Specifications (TSs) in response to your application dated May 31, 2002, as supplemented September 11, 2002, January 30, and February 21, 2003. The amendment changes the enrichment limit for new fuel stored in the BVPS-2 new fuel storage racks from 4.85 weight percent (w/o) U-235 to a nominal 5.00 w/o U-235 with a maximum tolerance of + 0.05 w/o U-235.

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

Sincerely,

Timothy Colburn, Senior Project Manager, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-412

Enclosures: 1. Amendment No. 135 to NPF-73
2. Safety Evaluation

cc w/encls: See next page

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PENNSYLVANIA POWER COMPANY

OHIO EDISON COMPANY

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

THE TOLEDO EDISON COMPANY

FIRSTENERGY NUCLEAR OPERATING COMPANY

DOCKET NO. 50-412

BEAVER VALLEY POWER STATION, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 135
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. (the licensee), dated May 31, 2002, as supplemented September 11, 2002, January 30, and February 21, 2003, 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, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. NPF-73 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 135, and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated in the license. FENOC shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of the date of its issuance and shall be implemented within 60 days.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Richard J. Laufer, Chief, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: May 15, 2003

ATTACHMENT TO LICENSE AMENDMENT NO. 135

FACILITY OPERATING LICENSE NO. NPF-73

DOCKET NO. 50-412

Replace the following page of the Appendix A Technical Specifications with the attached revised page. The revised page is identified by amendment number and contains marginal lines indicating the areas of change.

Remove	Insert
5-2	5-2

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 135 TO FACILITY OPERATING LICENSE NO. NPF-73

PENNSYLVANIA POWER COMPANY

OHIO EDISON COMPANY

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

THE TOLEDO EDISON COMPANY

FIRSTENERGY NUCLEAR OPERATING COMPANY

BEAVER VALLEY POWER STATION, UNIT 2

DOCKET NO. 50-412

1.0 INTRODUCTION

By application dated May 31, 2002, as supplemented by letters dated September 11, 2002, January 30, and February 21, 2003, the FirstEnergy Nuclear Operating Company (FENOC, the licensee), requested changes to the Technical Specifications (TSs) for Beaver Valley Power Station, Unit 2 (BVPS-2). The supplements dated September 11, 2002, January 30, and February 21, 2003, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the original proposed no significant hazards consideration determination as published in the *Federal Register* on September 17, 2002 (67 FR 58645).

The proposed changes would revise TS 5.3.1.2.a to increase the fuel enrichment limit for fuel stored in the BVPS-2 new fuel storage racks. The limit would be increased from 4.85 weight percent (w/o) U-235 to a nominal 5.00 w/o U-235 with a maximum tolerance of + 0.05 w/o U-235. Future core designs may feature higher capacity factors and ultimately may require higher enriched fuel assemblies in order to meet core energy requirements. BVPS-2 License Amendment No. 128, dated February 11, 2002, approved increasing the maximum fuel enrichment of fuel assemblies located in the spent fuel pool from 4.85 w/o to 5.00 w/o U-235. The May 31, 2002, amendment request is needed to allow storage in the new fuel storage area of new fuel with enrichments up to 5.00 w/o U-235 prior to this new fuel being moved to the spent fuel pool.

2.0 REGULATORY EVALUATION

Section 182a of the Atomic Energy Act (the “Act”) requires applicants for nuclear power plant operating licenses to include TSs as part of the license. The TSs ensure the operational capability of structures, systems and components that are required to protect the health and safety of the public. The Commission’s regulatory requirements related to the content of the

TSs are contained in Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.36. That regulation requires that the TSs include items in the following specific categories: (1) safety limits, limiting safety systems settings, and limiting control settings (50.36(c)(1)); (2) Limiting Conditions for Operation (50.36(c)(2)); (3) Surveillance Requirements (50.36(c)(3)); (4) design features (50.34(c)(4)); and (5) administrative controls (50.36(c)(5)).

In general, there are two classes of changes to the TSs: (1) changes needed to reflect modifications to the design basis (TSs are derived from the design basis), and (2) voluntary changes to take advantage of the evolution in policy and guidance as to the required content and preferred format of TSs over time. This amendment deals with the first class of changes.

Raising the new fuel storage enrichment limit from 4.85 to 5.00 w/o nominal U-235 is less restrictive. The licensee had previously demonstrated that a similar change did not impact safety for Beaver Valley Power Station, Unit 1 (BVPS-1). The evaluation for this similar change to the BVPS-1 TSs is provided in an enclosure to BVPS-1 License Amendment No. 204, dated May 28. 1997.

For the BVPS-2 new fuel storage analysis the licensee used the effective multiplication factor (k_{eff}) limits of American National Standards Institute (ANSI), Standard N18.2 to demonstrate that adequate safety margins are maintained with the new fuel enrichment. The licensee followed the guidelines in Section III of Standard Review Plan (SRP) 9.1.1, Revision 3, "New Fuel Storage," to calculate the maximum k_{eff} resulting from increasing the new fuel storage enrichment limit from 4.85 to 5.00 w/o U-235.

SRP 9.1.1, Revision 3, entitled, "New Fuel Storage," dated April 1996, Section II, Acceptance Criterion 4, guides staff to verify the licensee's compliance with the requirements of 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 62 by assuring that the dry environment vault "spacing is adequate to prevent criticality during earthquakes or other natural phenomena, as well as to prevent flooding with potential moderators." The review procedures of Section III guide that spacing should maintain the k_{eff} less than 0.95 with pure water moderation, and k_{eff} less than or equal to 0.98 assuming optimum moderation.

Section 9.1.1, "New Fuel Storage," of the Beaver Valley Updated Final Safety Analysis Report, Revision 12, establishes the licensing basis to maintain a 5% subcriticality margin under all conditions of low density to high density unborated moderation. This requires that the k_{eff} of the fresh fuel in the fresh fuel racks be less than 0.95 including all biases and uncertainties at a 95/95 probability/confidence level assuming no soluble boron. BVPS-2 was previously granted an exemption from 10 CFR 70.24 on April 9, 1986. Therefore, they are exempted from the criticality alarm system provisions so far as this section applies to storage of fuel assemblies held under their license. Licensees holding a 70.24 exemption who have not elected compliance with 10 CFR 50.68 must maintain compliance with the terms of their exemption. In the February 21, 2003, supplemental submittal, FENOC confirmed that the basis for the BVPS-2 Exemption for 10 CFR 70.24 remains valid.

The licensee provided a Westinghouse criticality analysis in Attachment C of their May 31, 2002, submittal. GDC 62 requires prevention of criticality in fuel handling and storage by physical systems or processes, preferably by use of geometrically safe configurations. The aim

of the criticality analysis was to demonstrate that the fresh fuel will remain subcritical under moderated conditions by configuration control. The technical evaluation of the criticality analysis follows.

3.0 TECHNICAL EVALUATION

The Nuclear Regulatory Commission (NRC) staff reviewed the justification for the proposed license amendment as described in the licensee's May 31, 2002, application, as supplemented. The detailed evaluation below will support the conclusion 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.

3.1 Criticality Analysis Methods

The analysis methods used consist of NITAWL-II, XSDRNPM-S, and KENO-Va computer codes which are part of the SCALE package. KENO is a three-dimensional Monte Carlo neutron tracking code that calculates the system k_{eff}. In Section 2.1 of the criticality analysis report, Westinghouse included a method bias and uncertainty taken from Westinghouse Topical Report, WCAP-14416, "Westinghouse Spent Fuel Criticality Analysis Methodology," Revision 1, dated November 1996. The staff questioned whether the same code versions and cross sections were used for the benchmarking and, if not, the staff asked that the basis for using the bias and uncertainty from the topical be provided. Westinghouse stated that the code versions and cross section libraries were the same as used in the original benchmark.

The SCALE methodology has been extensively benchmarked by the nuclear industry. However, Westinghouse performed additional critical experiment benchmarks with their specific methodology to determine the calculational uncertainty and bias for their specific application. The staff questioned the use of critical experiments with enrichments ranging from 2.35 w/o to 4.31 w/o and asked how the experiments were extrapolated to represent 5.00 w/o enriched fuel. Westinghouse stated in response that no significant biases or trends were observed in the Westinghouse benchmark results as a function of enrichment. The staff subsequently questioned why low-enriched experiments (i.e. 2.35 w/o and 2.46 w/o) which supplemented the 4.31 w/o enriched experiments were applicable, based on the guidance available in NUREG/CR-6698. Table 2.3 of this NUREG contains physical parameters for areas of applicability, including enrichment. A range of appropriate evaluated benchmark experiments is listed given the enrichment to be modeled. There is no question that the benchmark experiments used for the validation are appropriate if they fall within the range listed in the table. However, if the experiments to be credited do not fall within the specified ranges, the licensee must justify why the experiments used are appropriate. The low-enriched experiments used by the licensee in the May 31, 2002, application are beyond the range of the guidance. Through supplemental analysis transmitted by letter dated February 21, 2003, Westinghouse demonstrated that the use of 12 benchmark experiments with enrichments of the appropriate range could be used to establish the validity of the calculated k_{eff}.

The staff discovered that the multiplier used to determine the 95/95 confidence level was being used inappropriately. The staff questioned the licensee and informed them that the application was not in agreement with staff practice. The staff and licensee agreed to the use of the

following equation, which is approved by the staff and is used to develop the maximum 95/95 k_{eff}:

$$k_{eff} = k_{worst} + B_{method} + M\sqrt{ks^2_{worst} + ks^2_{method}}$$

where:

k_{worst} = worst case KENO k_{eff}
B_{method} = method bias determined from benchmark critical comparisons
ks_{worst} = 95/95 uncertainty in the worst case KENO k_{eff}
ks_{method} = 95/95 uncertainty in the method bias
M = multiplier to determine 95/95 confidence level

3.2 New Fuel Storage Rack Analysis

The BVPS-2 fresh fuel rack consists of a 5 by 14 array of storage cells on a nominal center-to-center spacing of 20.9375 inches. The licensee prevents criticality of the fresh fuel assemblies by limiting the U-235 enrichment in the rods to less than 5.05 w/o (i.e. nominal 5.00 w/o enrichment with a maximum + 0.05 w/o tolerance) and by maintaining a minimum separation distance between assemblies. Since unirradiated fuel contains no radioactive fission products, it requires no cooling or shielding and is normally stored in a dry condition. Less than 10% Δ k occurs in the case of a fuel assembly drop assuming the presence of a moderator. The staff approves however the double contingency principle, and the fact that the dry case reactivity is less than 0.65. Therefore, the introduction of a moderator is the bounding accident.

Westinghouse has performed calculations for the racks at various moderator densities in order to obtain the optimum moderator density which results in maximum reactivity. Since the fresh fuel is stored in cavities that have internal dimensions larger than the outside dimensions of a fuel assembly, there is an uncertainty in the lateral placement of any one assembly in its cavity. However, eccentric placement of the assemblies reduces the multiplication factor. Therefore, the NRC staff accepts modeling the assemblies as centered in the cells.

The NRC staff requested additional information to clarify the enrichment used in the Westinghouse criticality analysis. Westinghouse performed the criticality analysis for storage of BVPS-2 fresh fuel assemblies at 5.05 w/o U-235 enrichment. The staff approved the use of this analysis given that 5.05 w/o is a nominal 5.00 w/o enrichment with a maximum 0.05 w/o tolerance. Since the analysis was performed with the maximum possible enrichment, the NRC staff considers the enrichment chosen for this analysis to be sufficiently conservative.

The licensee, by supplemental analysis, showed that a loaded rack will meet the acceptance criterion of k_{eff} less than 0.95 in both high and low density moderation cases. The full density k_{eff} is bounded by the optimum moderation case which results in a k_{eff} of 0.94631. Since k_{eff} is less than 0.95 for both cases, the NRC staff finds the requested configuration with nominally 5.00 w/o enriched fuel acceptable. The licensing basis maintaining a 5% subcriticality margin under all moderation conditions does not change with approval of this request.

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 (67 FR 58645). 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.

Principal Contributors: S. Colpo
P. Hearn

Date: May 15, 2003