October 8, 2002

Mr. Mark B. Bezilla
Vice President
FirstEnergy Nuclear Operating Company
Beaver Valley Power Station
Post Office Box 4
Shippingport, PA 15077

SUBJECT: BEAVER VALLEY POWER STATION, UNIT NOS. 1 AND 2 - ACCEPTANCE OF METHODOLOGY FOR REFERENCING PRESSURE TEMPERATURE LIMITS REPORT (TAC NOS. MB3319 AND MB3320)

Dear Mr. Bezilla:

The Nuclear Regulatory Commission (NRC) staff has completed its review of the pressure temperature (P/T) curves and low temperature overpressure protection (LTOP) system limits methodology submitted by FirstEnergy Nuclear Operating Company by letter dated October 31, 2001, as supplemented December 21, 2001, February 4, and May 31, 2002. The NRC staff finds your methodology to be acceptable for referencing in the administrative controls section of the Beaver Valley Power Station, Units 1 and 2 (BVPS-1 and 2), technical specifications to the extent specified and under the limitations delineated in your submittals and the associated NRC safety evaluation (SE), which is enclosed.

The methodology for review relating to the P/T limit curves and the LTOP system limits is provided in the references listed in Section 5.0 of the enclosed SE. WCAP-14040-NP-A, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and Reactor Coolant System Heatup and Cooldown Limit Curves," Revision 2, January 15, 1996, provided in part, the methodology used for determining the acceptance of the BVPS-1 and 2 methodology.

Should our criteria or regulations change so that our conclusions as to the acceptability of the methodology is invalidated, licensees referencing these documents will be expected to revise and resubmit their respective documentation, or submit justification for the continued effective applicability of the documents without revision of their respective documentation.

If you have any questions regarding this letter or the enclosed SE, please contact Dan Collins at (301) 415-1427.

Sincerely,

/RA/

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

Docket Nos. 50-334 and 50-412

Enclosure: Safety Evaluation

cc w/encl: See next page

If you have any questions regarding this letter or the enclosed SE, please contact Dan Collins at (301) 415-1427.

Sincerely,

/***RA***/

Richard J. Laufer, Chief, Section 1
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REVIEW OF METHODOLOGY FOR THE RELOCATION OF THE REACTOR COOLANT SYSTEM PRESSURE TEMPERATURE LIMIT CURVES AND LOW TEMPERATURE OVERPRESSURE PROTECTION SYSTEM LIMITS

LICENSE NOS. DPR-66 AND 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 NOS. 1 AND 2

DOCKET NOS. 50-334 AND 50-412

1.0 INTRODUCTION

By letter dated October 31, 2001, and supplemented by letters dated December 21, 2001, February 4, and May 31, 2002, FirstEnergy Nuclear Operating Company (FENOC) requested changes to the technical specifications (TSs) for Beaver Valley Nuclear Power Station, Units 1 and 2 (BVPS-1 and 2). The requested changes included relocating reactor coolant system (RCS) pressure temperature (P/T) limit curves and low temperature overpressure protection (LTOP) system limits from the TSs to a licensee-controlled Pressure Temperature Limits Report (PTLR). The P/T limit curves and LTOP system setpoints were developed, in part, using the Nuclear Regulatory Commission (NRC) staff-approved methodology documented in Westinghouse Topical Report, WCAP-14040-NP-A, Revision 2, dated January 15, 1996 (Reference 1). The licensee also applied the American Society of Mechanical Engineers (ASME) Code Case N-640 in the estimation of material properties as previously approved by the NRC.

These changes were requested in accordance with Generic Letter (GL) 96-03, “Relocation of the Pressure Temperature Limit Curves and Low Temperature Overpressure Protection System Limits,” dated January 31, 1996 (Reference 2). GL 96-03 provides licensees the option to relocate the P/T limit curves and the LTOP system setpoints to a licensee-controlled PTLR provided that the limiting curves and setpoints are developed using an NRC-approved

methodology. The limits can then be changed using the referenced methodologies in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 59 without prior NRC review and approval. Changes to the PTLR parameters will be reported to the NRC as directed by the TS administrative controls reporting requirements.

2.0 BACKGROUND

GL 96-03, lays out a three-step process for relocation of P/T limit curves and LTOP limits to licensee-controlled documents. The licensee must (1) have a methodology approved by the NRC to reference in its TSs; (2) develop a report such as a PTLR or a similar document to contain the figures, values, parameters, and any explanation necessary; and (3) modify the applicable sections of the TSs accordingly.

The implementation of the BVPS -1 and 2 PTLRs will be performed in accordance with this guidance. As part of the October 31, 2001, submittal, FENOC included its draft PTLRs and proposed revisions to the TSs. This safety evaluation (SE) addresses only the methodology used by FENOC in establishing its P/T limits and overpressure protection system setpoints. The acceptability of the PTLRs and proposed TS revisions will be addressed in a subsequent SE.

3.0 EVALUATION

3.1 Neutron Fluence

Material properties change with irradiation. Therefore, the P/T and LTOP limits change accordingly and need to be reevaluated as a function of vessel exposure. GL 96-03 requires that the P/T and LTOP limits be determined using NRC-approved methodologies; and that such methodologies be referenced in the PTLR.

In its October 31, 2001, application, FENOC stated that both the P/T limits and LTOP system setpoints were calculated using the methodology described in WCAP-14040-NP-A as modified by: (1) ASME Code Case N-640, “Alternate Reference Fracture Toughness for Development of PT Limits for Section XI, Division 1,” and (2) the 1996 version of ASME Code, Section XI, Appendix G, “Fracture Toughness Criteria for Protection Against Failure.” WCAP-14040, Section 2.2 provides an NRC staff-approved methodology for neutron fluence calculations and satisfies the first requirement of GL 96-03.

FENOC uses the calculational methodology of WCAP-14040-NP-A, in performing surveillance capsule evaluations. However, for BVPS-2, the application lists WCAP-14484, “Analysis of Capsule V from Duquesne Light Company Beaver Valley Unit 2 Reactor Vessel Radiation Surveillance Program,”[1] dated September 1985, as a reference. WCAP-14484 uses best estimate fluence values generated using the FERRET computer code, which has not been reviewed or approved by the NRC. By letter dated December 21, 2001, FENOC committed to use updated cross sections and calculated fluence values when performing surveillance

[1]Duquesne Light Company was a previous owner/operator of BVPS-1 and 2. Its ownership interests in these units were transferred to Pennsylvania Power Company and its operating authority was transferred to FENOC in December of 1999.

capsule evaluations, although the best estimate fluence values will be provided for information only. The licensee's December 21, 2001, letter further clarified that the commitment will remain in effect until such time that the NRC approves an alternate methodology for performing fluence evaluations. The NRC staff finds this commitment to be appropriate. The NRC staff finds it acceptable to reference WCAP-14040-NPA in connection with relocation of RCS P/T limit curves and LTOP system limits to PTLRs.

3.2 Pressure Temperature (P/T Limits)

3.2.1. Licensee's Proposed P/T Limit Definition Methodology

In their October 31, 2001, submittal, FENOC stated that the methodology they would utilize to develop reactor pressure vessel (RPV) P/T limits in the BVPS-1 and 2 PTLRs would consist of application of the methodology in WCAP-14040-NP-A, Revision 2, as modified by:

1. Application of the provisions of the 1995 Edition through the 1996 Addenda of the ASME Boiler and Pressure Vessel Code (ASME Code), Section XI, Appendix G, "Fracture Toughness Criteria for Protection Against Failure," and

2. Application of the provisions of ASME Code Case N-640, "Alternate Reference Fracture Toughness for Development of P/T Limits for Section XI, Division 1."

The proposed methodology description was addressed in both the proposed PTLRs for BVPS-1 and 2 and in the revised TSs which were submitted for each unit.

WCAP-14040-NP-A, Revision 2, documented a complete, general methodology employed by Westinghouse for calculating RPV material adjusted reference temperatures (ARTs), determining RPV P/T limits, evaluating RPV surveillance programs, etc. When this report was published in January 1996, it was based on the underlying considerations found in the 1989 Edition of ASME Code, Section XI, Appendix G, because that was the edition of reference within the regulations (i.e., Appendix G to 10 CFR Part 50 and 10 CFR 50.55a). Since then, the NRC staff has determined that the methodology defined in WCAP-14040-NP-A, Revision 2, is adequate to support the development of PTLRs by other licensees.

Since January 1996, the "state-of-the-art" in the determination of RPV P/T limit curves has progressed. One development was the NRC staff's incorporation of the 1995 Edition through the 1996 Addenda of ASME Code, Section XI, Appendix G, into the regulations as an acceptable evaluational basis for establishing RPV P/T limit curves. The changes in ASME Code, Section XI, Appendix G, between the 1989 Edition and the 1995 Edition through the 1996 Addenda were relatively minor. Currently, the 1995 Edition through the 1996 Addenda of ASME Code, Section XI, Appendix G, remains the edition of reference for P/T limit curve determination in the regulations.

Another development in the progression has been the introduction of several ASME Code Cases, the provisions of which are not incorporated into the 1995 Edition through the 1996 Addenda of ASME Code Section XI, Appendix G. With regard to the BVPS-1 and 2 PTLR submittal, ASME Code Case N-640 is of interest. This Code Case permits the use of the less restrictive ASME Code lower bound static initiation fracture toughness curve (K_{Ic}) in lieu of the ASME Code lower bound dynamic/crack arrest fracture toughness curve (K_{Ia}) as the basis

curve for establishing RPV P/T limits. As an alternative for meeting the underlying intent of Appendix G to 10 CFR Part 50, the NRC staff has, consistent with 10 CFR 50.60 and 10 CFR 50.12, granted exemptions to licensees to enable the use of Code Case N-640. Exemptions were granted to FENOC regarding the use of Code Case N-640 for BVPS-1 on February 19, 2002, and for BVPS-2 on September 6, 2000.

One additional item addressed in the BVPS PTLR methodology concerns the development of P/T limits for an isolated reactor coolant loop. BVPS-1 and 2 are unusual among pressurized water reactors (PWRs) in that their RCS design includes loop isolation valves which can be used to separate the RPV from the other components in, or associated with, a given loop (the steam generator, reactor coolant pumps, etc.). Therefore, conditions (pressure and temperature) could exist within an isolated reactor coolant loop which are significantly different from the conditions in the RPV. As a result, the licensee previously developed and incorporated isolated loop P/T limit curves into the BVPS-1 and 2 TS bases. These curves were developed using the methodology in ASME Code, Section III, Appendix G (which is equivalent to the methodology in the 1995 Edition through the 1996 Addenda of ASME Code, Section XI, Appendix G), as modified by the provision from ASME Code Case N-640 to utilize the K_{Ic} curve in lieu of the K_{Ia} curve.

In its PTLR submittal, the licensee proposed to move the existing isolated loop P/T limit curves from the BVPS-1 and 2 TS bases into the PTLRs and accept the methodology noted above as the basis for their generation. Note that unlike RPV P/T limit curves, which are expected to change with time as RPV materials are exposed to higher levels of neutron irradiation, the isolated loop P/T limit curves are static with time because the material properties of the "limiting material" in an isolated loop, the steam generator channel heads, are not expected to change significantly.

Finally, consistent with NRC GL 96-03 guidance on requests to implement PTLRs, the licensee submitted proposed PTLRs for BVPS-1 and 2 in their October 31, 2001, submittal. These proposed PTLRs identified the figures, values, and parameters to be included in each unit's PTLR. Based on NRC staff comments, the licensee modified the BVPS Unit 1 PTLR to include additional information regarding RPV surveillance data from St. Lucie Unit 1 and Ft. Calhoun that the licensee used to evaluate the BVPS-1 RPV material properties. Changes to the BVPS-1 PTLR were submitted by the licensee by letter dated May 31, 2002.

3.2.2 NRC Staff Evaluation of BVPS-1 and 2 PTLR P/T Limit Methodology

The NRC staff has reviewed the methodology proposed by FENOC to support the development of BVPS-1 and 2 PTLRs. As noted previously, this methodology would consist of application of the methodology in WCAP-14040-NP-A, Revision 2, as modified by:

(1) Application of the provisions of the 1995 Edition through the 1996 Addenda of the ASME Code, Section XI, Appendix G, "Fracture Toughness Criteria for Protection Against Failure," and

(2) Application of the provisions of ASME Code Case N-640.

Each of these individual "pieces" of the proposed methodology has been found to be acceptable by the NRC staff. The use of the general methodology in WCAP-14040-NP-A,

Revision 2, was approved by the NRC staff on October 16, 1995. The use of the provisions of the 1995 Edition through the 1996 Addenda of the ASME Code, Section XI, Appendix G, was approved by the NRC staff when the rulemaking to update 10 CFR 50.55a (referenced by 10 CFR Part 50, Appendix G), was completed on September 22, 1999. Finally, FENOC's use of the provisions of ASME Code Case N-640 was approved via exemptions granted to the licensee for both BVPS-1 and 2 as previously discussed.

In addition, the results of the licensee's application of the complete methodology (i.e., when the three identified "pieces" are combined) has been previously reviewed by the NRC staff inasmuch as this methodology was used to develop the existing RPV P/T limit curves which were incorporated in the BVPS-1 and 2 TSs. The staff approved the incorporation of the existing P/T limit curves into the BVPS-1 TSs by amendment number 249, dated February 20, 2002. Similarly, the same methodology was used to establish the current BVPS-2 P/T limits that were incorporated into the TSs by Amendment Number 113, dated September 6, 2000.

The staff also evaluated the use of the proposed methodology for the development of isolated reactor coolant loop P/T limit curves. The staff concluded that the proposed methodology is acceptable for the evaluation of the steam generator channel head materials and, therefore, is acceptable for the generation of P/T limit curves for an isolated reactor coolant loop. Further, based on the information provided by the licensee, the staff evaluated the specific isolated reactor coolant loop P/T limit curves which were proposed for inclusion in the BVPS-1 and 2 PTLRs and concluded that those curves were acceptable.

Therefore, the NRC staff concludes that the methodology for P/T limit curve generation referenced in the proposed BVPS-1 and 2 TSs is acceptable for use as the basis for developing PTLRs for BVPS-1 and 2.

3.3 LTOP Setpoints

The LTOP system uses the pressurizer power-operated relief valves (PORVs) during startup or shutdown operation. By choosing proper PORV setpoints, the LTOP system is designed with the capability to automatically prevent the RCS from exceeding the P/T limits, and prevent the reactor vessel from being exposed to conditions of fast propagating brittle fracture. Once the system is enabled, no operator action is involved for the LTOP system to perform its intended pressure mitigation function. Modifications of the LTOP enable temperature and the PORV setpoints as a result of the changes in the P/T limits to extend reactor operation period are routinely made on nuclear plants.

The LTOP setpoint and enable temperature are determined to ensure that 10 CFR Part 50, Appendix G, pressure limit is not exceeded. The Appendix G pressure limit is calculated based on the limiting projected ART at the 1/4T location for the limiting reactor vessel materials, subject to the fluence values at the projected EFPY.

The maximum allowable pressure limits are calculated corresponding to the reactor vessel permissible membrane stress intensity, and corrected for the pressure instrument uncertainty and location bias in relation to the reactor vessel beltline. The LTOP pressure setpoint is selected to ensure that the maximum allowable pressure limits are not exceeded by the maximum attainable pressure during design-basis transients. The setpoint is determined in

accordance with WCAP 14040-NP-A, Revision 2, with consideration of two types of design-basis transients: mass addition and heat addition transients. For both BVPS-1 and 2, the LTOP setpoints are evaluated to show that with the addition of pressure overshoots during the design-basis mass and heat addition transients, and the consideration of the instrumentation uncertainties and measurement location bias, the maximum attainable RCS pressure during the transients would not exceed the maximum allowable pressure limits based on the most limiting reactor vessel materials.

The NRC staff previously reviewed FENOC's design-basis mass addition and heat addition transients as part of the reviews associated with license Amendment Nos. 249 and 113 for BVPS-1 and 2, respectively. The NRC staff concluded that the proposed methodology is acceptable for establishing LTOP setpoints. Therefore, the NRC staff concludes that the methodology for establishing LTOP setpoints referenced in the proposed BVPS-1 and 2 TSs is acceptable for use as the basis for developing PTLRs for BVPS-1 and 2.

4.0 CONCLUSION

Based upon the staff evaluations, the calculations satisfy the requirements of Appendix G as supplemented by Code Case N-640. The methodology described in WCAP-14040-P-A, Revision 2, has been approved by the NRC staff, and satisfies the requirements of GL 96-03. Therefore, as discussed in Section 3.0 above, the NRC staff concludes that the methodology used by FENOC in establishing its P/T limits and overpressure protection system setpoints is acceptable for referencing in the BVPS-1 and 2 TSs in connection with relocation of RCS P/T limit curves and LTOP system limits to PTLRs.

5.0 REFERENCES

1. WCAP-14040-NP-A, Revision 2, Westinghouse Electric Corporation, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves," January 15, 1996.

2. NRC Generic Letter 96-03, "Relocation of the Pressure Temperature Limit Curves and Low Temperature Overpressure Protection System Limits," January 31, 1996.

3. Letter from L. W. Myers, First Energy Nuclear Operating Company, to NRC, "Beaver Valley Power Station, Units 1 and 2, BV-1 Docket No. 50-334, License No. DPR-66, BV-2 Docket No. 50-412, License No. NPF-73, License Amendment Request Nos. 295 and 167, " dated October 31, 2001.

4. WCAP-15570, Revision 2, "Beaver Valley Unit 1 Heatup and Cooldown Limit Curves for Normal Operation," by T. J. Laubham, Westinghouse Electric Company, LLC, April 2001.

5. WCAP-15139, "Beaver Valley Unit 2 Heatup and Cooldown Limit Curves During Normal Operation at 15 EFPY Using Code Case N-626," by T. J. Laubham, Westinghouse Electric Company, LLC, January 1999.

6. NPD-OPES(99)-055, “Low Temperature Over pressure Protection System Setpoint Review for Beaver Valley Unit 2 15 EFPY Heatup and Cooldown Curves,” Westinghouse Electric Company, LLC, March 1999.

7. Letter from L. W. Myers, First Energy Nuclear Operating Company, to NRC, “Beaver Valley Power Station, Units 1 and 2, BV-1 Docket No. 50-334, License No. DPR-66, BV-2 Docket No. 50-412, License No. NPF-73, Supplement to License Amendment Request Nos. 295 and 167,'' dated December 21, 2001.

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Date: October 8, 2002