February 3, 2005

Mr. Lew W. Myers
Chief Operating Officer
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Perry Nuclear Power Plant
P.O. Box 97, A290
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Perry, OH 44081

SUBJECT: PERRY NUCLEAR POWER PLANT, UNIT 1 - ISSUANCE OF AMENDMENT RE: REVISION OF THE MINIMUM CRITICAL POWER RATIO SAFETY LIMIT (TAC NO. MC2599)

Dear Mr. Myers:

The Commission has issued the enclosed Amendment No. 132 to Facility Operating License No. NPF-58 for the Perry Nuclear Power Plant, Unit 1. This amendment revises the Technical Specifications in response to your application dated April 5, 2004, as supplemented by letters dated June 22 and December 6, 2004.

This amendment modifies the existing minimum critical power ratio (MCPR) safety limit contained in Technical Specification 2.1.1.2. Specifically, the change modifies the MCPR safety limit values by decreasing the limit for two recirculation loop operation from 1.10 to 1.08, and decreasing the limit for single recirculation loop operation from 1.11 to 1.10.

A copy of the Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,

/RA/

William A. Macon, Jr., Project Manager, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-440

Enclosures: 1. Amendment No. 132 to NPF-58
2. Safety Evaluation

cc w/encls: See next page

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FIRSTENERGY NUCLEAR OPERATING COMPANY

DOCKET NO. 50-440

PERRY NUCLEAR POWER PLANT, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 132
License No. NPF-58

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

   A. The application for amendment by the FirstEnergy Nuclear Operating Company (the licensee) dated April 5, 2004, as supplemented by letters dated June 22 and December 6, 2004, 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-58 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No. 132, are hereby incorporated into this license. The FirstEnergy Nuclear Operating Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of its date of its issuance and shall be implemented within 90 days of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Gene Y. Suh, Chief, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: February 3, 2005

ATTACHMENT TO LICENSE AMENDMENT NO. 132

FACILITY OPERATING LICENSE NO. NPF-58

DOCKET NO. 50-440

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
2.0-1	2.0-1

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 132 TO FACILITY OPERATING LICENSE NO. NPF-58

FIRSTENERGY NUCLEAR OPERATING COMPANY

PERRY NUCLEAR POWER PLANT, UNIT 1

DOCKET NO. 50-440

1.0 INTRODUCTION

By application to the U.S. Nuclear Regulatory Commission (NRC, Commission) dated April 5, 2004 (Reference 1), as supplemented by letters dated June 22 (Reference 2) and December 6, 2004 (Reference 3), FirstEnergy Nuclear Operating Company (the licensee) requested changes to the Technical Specifications (TSs) for the Perry Nuclear Power Plant, Unit 1 (PNPP). The supplements dated June 22 and December 6, 2004, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on May 11, 2004 (69 FR 26189).

The proposed changes would modify the existing minimum critical power ratio (MCPR) safety limit contained in TS 2.1.1.2. Specifically, the changes would modify the MCPR safety limit values, as calculated by Global Nuclear Fuel (GNF), by decreasing the limit for two recirculation loop operation from 1.10 to 1.08, and decreasing the limit for single recirculation loop operation from 1.11 to 1.10. In addition, the term "Minimum Critical Power Ratio" will be inserted into the TS prior to the first use of the acronym, "MCPR."

The safety limit for MCPR (SLMCPR) is one of the limits used to protect the nuclear fuel. Since the parameters that result in fuel damage are not directly observable during reactor operation, the thermal and hydraulic conditions that result in the onset of transition boiling (i.e., MCPR = 1.00) have been used to mark the beginning of the region in which fuel damage could occur. Although it is recognized that the onset of transition boiling would not result in damage to boiling water reactor (BWR) fuel rods, the critical power at which boiling transition is calculated to occur has been adopted as a convenient limit. The safety limit is defined as the critical power ratio in the limiting fuel assembly for which more than 99.9 percent of the fuel rods in the core are expected to avoid boiling transition, considering the power distribution within the core and various uncertainties. The SLMCPR provides a 95 percent probability at the 95 percent confidence level that following any abnormal operating occurrence, greater than 99.9 percent of the fuel rods avoid the boiling transition.

2.0 REGULATORY EVALUATION

Title 10 of the *Code of Federal Regulations,* Part 50 (10 CFR 50), Appendix A, General Design Criterion (GDC) 10, "Reactor design," states, in part, that the reactor core and associated coolant, control, and protective system be designed to assure that the specified acceptable fuel

design limits are not exceeded during any condition of steady-state operation, normal operational transients, and anticipated operational occurrences.

Fuel design limits can likely be exceeded if the core exceeds critical power. Critical power is a term used for the power at which the fuel departs from nucleate boiling and enters a transition to film boiling. For BWRs, the critical power is predicted using a correlation known as the GE critical quality boiling length correlation, or better known as the GEXL correlation. Due to core wide and operational variations, the margin to boiling transition is most easily described in terms of a critical power ratio (CPR), which is defined as the rod critical power as calculated by GEXL divided by the actual rod power. The more a CPR value exceeds 1.0, the greater the margin to boiling transition is. The SLMCPR is calculated using a statistical process that takes into account all operating parameters and the uncertainties. The operating limit MCPR (OLMCPR) is equal to the SLMCPR plus a CPR margin for transients. At the OLMCPR, at least 99.9% of the rods avoid boiling transition during steady state operation and transients caused by single operator error or equipment malfunction.

Safety limits are required to be included in the TSs by 10 CFR 50.36, “Technical Specifications.” The SLMCPR is calculated on a cycle-specific basis because it is necessary to account for the core configuration-specific neutronic and thermal-hydraulic response.

In accordance with 10 CFR 50.90, “Application for amendment of license or construction permit,” and TS 2.1.1, the licensee was required to submit their evaluation for NRC staff review in support of the SLMCPR changes. TS 2.1.1, "Reactor Core Safety Limits," will be changed by revising Section 2.1.1.2 to read:

> With the reactor steam dome pressure $\geq$ 785 psig and core flow $\geq$ 10% rated core flow:
>
> The Minimum Critical Power Ratio (MCPR) shall be $\geq$ 1.08 for two recirculation loop operation or $\geq$ 1.10 for single recirculation loop operation.

3.0 TECHNICAL EVALUATION

The proposed PNPP cycle-specific SLMCPR values (1.08 for two recirculation loop operation, and 1.10 for single recirculation loop operation for Fuel Cycle 10) were determined using the NRC-approved methods detailed in Reference 4. The PNPP-specific evaluation for the Fuel Cycle 10 core reload resulted in different calculated SLMCPR values from the previous cycle because different inputs were used, and due to the differences in the core design and bundle design used between Fuel Cycles 9 and 10. Compliance with a SLMCPR greater than or equal to the calculated value will ensure that less than 0.1 percent of the fuel rods will experience boiling transition. This in turn ensures fuel damage does not occur following transients due to excessive thermal stresses on the fuel cladding. The MCPR operating limits are set higher (i.e., more conservative) than the safety limit such that potentially limiting plant transients prevent the MCPR from decreasing below the SLMCPR during the transient. As a result, there is no impact on any of the limiting Appendix 15B transients described in the PNPP Updated Safety Analysis Report (USAR).

As indicated earlier, the licensee stated in the submittal that their evaluations yielded different calculated SLMCPR values because different inputs were used for Fuel Cycles 9 and 10. In comparing the PNPP Fuel Cycle 9 and 10 SLMCPR values, it is important to note the impact of the differences in the core and bundle designs, as presented in the submittal. In general, the calculated safety limit is dominated by two key parameters: (1) flatness of the core bundle-by-bundle MCPR distributions, and (2) flatness of the bundle pin-by-pin power/R-factor distributions. It was further stated that greater flatness in either parameter yields more rods susceptible to boiling transition, and therefore, the necessity of a higher (more conservative) calculated SLMCPR. On the basis of the calculated values, as presented in the submittal, it can be concluded that the Fuel Cycle 10 core MCPR distribution is slightly flatter than the distribution evaluated for Fuel Cycle 9. Furthermore, the uncontrolled bundle pin-by-pin power distributions were compared between the PNPP Fuel Cycle 9 bundles and the Fuel Cycle 10 bundles. Pin-by-pin power distributions are characterized in terms of R-factors using the NRC-approved methodology (Reference 5). For the PNPP Fuel Cycle 10 limiting case analyzed at end of cycle, the calculated values suggest that the PNPP Fuel Cycle 10 bundles are more peaked than the bundles used for the Fuel Cycle 9 SLMCPR analysis.

The licensee’s calculations use the GEXL14 correlation for GE14 fuel. The potential impact of a bias on the calculated SLMCPR due to a GE14 top-peaked (or outlet-peaked) or a GE14 double-humped axial power shape was considered. The licensee states that for PNPP Fuel Cycle 10, no top-peaked or double-humped axial power shapes will be present.

After the initial review, the NRC staff requested the licensee to provide additional information. By letter dated December 6, 2004, the licensee submitted responses to the NRC staff’s request for additional information (RAI), as discussed below.

The calculated values presented in the licensee's submittal for Fuel Cycle 10 indicate that the core bundle-by-bundle MCPR distribution is slightly flatter than the distribution evaluated for Fuel Cycle 9; whereas, Fuel Cycle 10 has a more peaked in-bundle pin-by-pin power distribution than what was used for Fuel Cycle 9. Contrary to the licensee’s assertion that greater flatness in either core bundle-by-bundle MCPR distribution or bundle pin-by-pin power/R-factor distribution results in a higher calculated SLMCPR, the NRC staff noted that although the bundle-by-bundle MCPR distribution is flatter for Fuel Cycle 10, the proposed SLMCPR for Fuel Cycle 10 is lower (less conservative) than Fuel Cycle 9. In RAI question no. 1, the NRC staff requested the licensee to explain this apparent contradiction.

In their response, the licensee stated that the submittal statement, "Greater flatness in either parameter yields more rods susceptible to boiling transition," means that if all other parameters are held constant then if the core bundle-by-bundle MCPR distributions showed greater flatness this would yield more rods susceptible to boiling transition. On the other hand, if all other parameters were held constant and if the bundle pin-by-pin power/R-factor distributions showed greater flatness then this would yield more rods susceptible to boiling transition. However, when both parameters change, as was the case for the PNPP, the trend is determined by a combination of the two parameters based on a statistical analysis discussed in the RAI response. The NRC staff finds the response to be acceptable.

In RAI question no. 2, the NRC staff stated that the proposed cycle-specific determination of the SLMCPR values for PNPP Fuel Cycle 10 are only acceptable provided that all the restrictions stated in the NRC staff's safety evaluation (SE) dated March 11, 1999

(Reference 4), approving the General Electric (GE) licensing topical reports NEDC-32601P, NEDC-32694P, and Amendment 25 to NEDE-24011P-A, are met. The NRC staff, therefore, requested the licensee to affirm that all the restrictions discussed in the SE have been satisfied. In order for the licensee to generate the proposed SLMCPR values, if it was necessary to deviate from any of the assumptions and the conditions outlined in the NRC staff SE for a cycle-specific determination of the SLMCPR, then the licensee should discuss those deviations and provide the technical justifications for their acceptability.

In their response, the licensee stated that the PNPP SLMCPR calculations comply with all the restrictions stated in the NRC staff's evaluation of the SLMCPR methodology. The restrictions cited on page 3 of the March 11, 1999, SE, were identified as restrictions (1) through (4). Restrictions (1) and (2) are satisfied since the GE12 and GE14 fuel in the PNPP core were specifically covered in NEDC-32601P, and the change to R-factor methodology is covered in Reference 5. Restriction (3) discusses the bundle-by-bundle MCPR distribution criteria parameter value that needs to be attained during the evaluation to assure that the limiting core conditions used in the SLMCPR evaluation will result in conservative SLMCPR values (higher values) compared to values that would be obtained for expected operation of the plant. This criterion is still considered to be applicable to current fuel and core designs. Restriction (4) refers specifically to the use of the reduced power uncertainties as defined in NEDC-32694P. The Fuel Cycle 10 SLMCPR evaluation was performed using the NRC staff-approved methodology covered in GETAB NEDO-10958-A (Reference 6), power uncertainties. Therefore, Restriction (4) does not apply to the PNPP Fuel Cycle 10 SLMCPR evaluation. The NRC staff finds the response acceptable.

Finally, RAI question no. 3, the NRC staff requested the licensee to confirm whether the proposed SLMCPR values for PNPP Fuel Cycle 10 are applicable only for the currently approved (for Fuel Cycle 9) operating conditions, and that operation beyond the currently approved conditions and power level is not anticipated for Fuel Cycle 10.

In their response, the licensee stated that PNPP is licensed for a maximum of 3758 megawatts thermal, and is operated in accordance with the conditions described within the PNPP USAR [e.g., maximum extended operating domain]. The licensee does not currently have a license amendment request to change the power level or operating conditions either in progress or before the NRC for review.

On August 24, 2004, GNF and General Electric Nuclear Energy (GENE) notified the NRC by issuing a 10 CFR Part 21, "Reporting of Defects and Noncompliance," report (Reference 7) that the process for determining the MCPR safety limit could result in non-conservative MCPR safety limits. GNF and GENE determined that using limiting control rod blade patterns developed for less than rated flow at rated power conditions could sometimes yield more limiting bundle-by-bundle MCPR distributions and/or more limiting bundle axial power shapes than the limiting control rod patterns developed for a rated flow/rated power SLMCPR calculation. GNF and GENE took corrective actions that require the SLMCPR to be calculated at the rated power/rated flow and at the minimum core flow/rated power conditions, using appropriate limiting control rod patterns. By letter dated September 29, 2004 (Reference 8), GNF and GENE notified the NRC that a number of BWRs are unaffected by this issue, and that PNPP was one of the facilities listed as being unaffected by this issue.
Therefore, the changes in the MCPR safety limit values proposed by this license amendment request need not be revised.

On the basis of the information submitted by the licensee by letter dated April 5, 2004, and the information provided in response to the NRC staff's RAI, the NRC staff concludes that the calculated SLMCPR values of 1.08 for two-loop operation, and 1.10 for single-loop operation for PNPP are acceptable. The licensee affirmed that the Fuel Cycle 10 specific SLMCPR values were calculated based on the NRC-approved methodologies, as referenced in the submittal, and that all the assumptions and the restrictions outlined in the relevant NRC staff SEs have been met. The NRC staff, therefore, approves this license amendment as requested.

4.0 STATE CONSULTATION

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

5.0 ENVIRONMENTAL CONSIDERATION

This 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 or changes a surveillance requirement. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluent 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 this amendment involves no significant hazards consideration and there has been no public comment on such finding (69 FR 26189). Accordingly, this 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 this amendment.

6.0 CONCLUSION

The NRC staff 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 this amendment will not be inimical to the common defense and security or to the health and safety of the public.

7.0 REFERENCES

1. Kanda, W.R., Perry Nuclear Power Plant, letter to U.S. NRC, "License Amendment Request Pursuant to 10 CFR 50.90: Revision of the Minimum Critical Power Ratio Safety Limit," April 5, 2004 (ML043220206).

2. Kanda, W.R., Perry Nuclear Power Plant, letter to U.S. NRC, "License Amendment Request Pursuant to 10 CFR 50.90: Revision of the Minimum Critical Power Ratio Safety Limits," June 22, 2004 (ML041890396).

3. Anderson, R.L., Perry Nuclear Power Plant, letter to U.S. NRC, "Response to Request for Additional Information (RAI) Associated with a License Amendment Request for Revision of the Minimum Critical Power Ratio Safety Limit," December 6, 2004 (ML043500601).

4. Akstulewicz, F., NRC letter to Glen A. Watford, GE, "Acceptance for Referencing of Licensing Topical Reports NEDC-32601P, *Methodology and Uncertainties for Safety Limit MCPR Evaluations;* NEDC-32694P, *Power Distribution Uncertainties for Safety Limit MCPR Evaluation;* and Amendment 25 to NEDE-24011-P-A on Cycle Specific Safety Limit MCPR," March 11, 1999 (ML993140559).

5. Essig, T.H., NRC letter to Glen A. Watford, GE, "Acceptance for Referencing of Licensing Topical Report NEDC-32505P, Revision 1, *R-Factor Calculation Method for GE11, GE12 and GE13 Fuel,"* January 11, 1999.

6. NEDO-10958-A, “General Electric BWR Thermal Analysis Basis (GETAB): Data, Correlation and Design Application,” January 1977.

7. Post, J.S., GE Nuclear Energy, letter to U.S. NRC, “Part 21 Reportable Condition and 60-Day Interim Report Notification: Non-conservative SLMCPR,” August 24, 2004 (ML042720293).

8. Post, J.S., GE Nuclear Energy, letter to U.S. NRC, “Part 21 Final Report: Non-conservative SLMCPR,” September 29, 2004 (ML042800267).

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Date: February 3, 2005

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