May 18, 1989

Docket No. 50-440

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Mr. Alvin Kaplan, Vice President
Nuclear Group
The Cleveland Electric Illuminating Company
10 Center Road
Perry, Ohio 44081

Dear Mr. Kaplan:

SUBJECT: CORRECTION TO AMENDMENT NO. 20 TO FACILITY OPERATING LICENSE NO. NPF-58

On April 26, 1989, the Commission issued Amendment No. 20 to Facility Operating License No. NPF-58 for the Perry Nuclear Power Plant, Unit No. 1, in response to your application dated November 28, 1988, as amended December 29, 1988. The amendment increased the minimum critical power ratio from 1.06 to 1.07, added two limiting lattice most-limiting average planar linear heat generation rate (MAPLHGR) curves to the TS to account for new fuel types being used in the cycle, and deleted the MAPLHGR curve for natural uranium bundles.

Two Technical Specification pages transmitted with the amendment contained minor typographical errors. Page 3/4 2-1, (footnote 2) contained an error in a reference to a page number; Page B 3/4 2-2 contained an error in the last paragraph in referring to TS Figures. The reference should have read 3.2.1-3 through 3.2.1-6, not "and" 3.2.1-6.

A minor error also existed in the Safety Evaluation to the proposed amendment. Section 2.6 of the Safety Evaluation reads "The licensee has included in its reload analyses several assumptions regarding equipment inoperability which will allow operating flexibility. Equipment not credited in the analyses include recirculation pump trip, rods withdrawal limiter and thermal power monitor." These sentences should read "The licensee has included in its reload analyses several assumptions regarding equipment operability/inoperability which will allow operating flexibility. Equipment credited in the analyses include recirculation pump trip, rod withdrawal limiter and thermal power monitor." The staff had incorrectly interpreted from your submittal whether you were taking credit for these items being in service. This change is considered minor and does not in any way change the staff's conclusions regarding acceptability of your submittal. A revised Safety Evaluation is enclosed for your convenience.

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Please accept our apologies for any inconvenience these errors may have caused you.

Sincerely,

/s/

Timothy G. Colburn, Sr. Project Manager
Project Directorate III-3
Division of Reactor Projects - III,
IV, V and Special Projects
Office of Nuclear Reactor Regulation

Enclosures:
1. TS pages 3/4 2-1 and
   B 3/4 2-2
2. Revised Safety Evaluation

cc w/enclosures:
See next page

Office:	LA/PDIII-3	PM/PDIII-3	SRXB	PD/PDIII-3
Surname:	PKreutzer	TColburn/tg	WHodges	JHannon
Date:	5/11/89	5/12/89	5/18/89	5/18/89

Mr. Alvin Kaplan
The Cleveland Electric
Illuminating Company

cc: Jay E. Silberg, Esq.
Shaw, Pittman, Potts & Trowbridge
2300 N Street, N.W.
Washington, D.C. 20037

David E. Burke
The Cleveland Electric
Illuminating Company
P.O. Box 5000
Cleveland, Ohio 44101

Resident Inspector's Office
U.S. Nuclear Regulatory Commission
Parmly at Center Road
Perry, Ohio 44081

Regional Administrator, Region III
U.S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Frank P. Weiss, Esq.
Assistant Prosecuting Attorney
105 Main Street
Lake County Administration Center
Painesville, Ohio 44077

Ms. Sue Hiatt
OCRE Interim Representative
8275 Munson
Mentor, Ohio 44060

Terry J. Lodge, Esq.
618 N. Michigan Street
Suite 105
Toledo, Ohio 43624

John G. Cardinal, Esq.
Prosecuting Attorney
Ashtabula County Courthouse
Jefferson, Ohio 44047

Robert A. Newkirk
Cleveland Electric
Illuminating Company
Perry Nuclear Power Plant
P. O. Box 97 E-210
Perry, Ohio 44081

Mr. James W. Harris, Director
Division of Power Generation
Ohio Department of Industrial
Relations
P. O. Box 825
Columbus, Ohio 43216

The Honorable Lawrence Logan
Mayor, Village of Perry
4203 Harper Street
Perry, Ohio 44081

The Honorable Robert V. Orosz
Mayor, Village of North Perry
North Perry Village Hall
4778 Lockwood Road
North Perry Village, Ohio 44081

Attorney General
Department of Attorney General
30 East Broad Street
Columbus, Ohio 43216

Radiological Health Program
Ohio Department of Health
1224 Kinnear Road
Columbus, Ohio 43212

Ohio Environmental Protection
Agency
361 East Broad Street
Columbus, Ohio 43266-0558

Mr. Phillip S. Haskell, Chairman
Perry Township Board of Trustees
Box 65
4171 Main Street
Perry, Ohio 44081

State of Ohio
Public Utilities Commission
180 East Broad Street
Columbus, Ohio 43266-0573

Michael D. Lyster
Cleveland Electric
Illuminating Company
Perry Nuclear Power Plant
P. O. Box 97 SB306
Perry, Ohio 44081

3/4.2 POWER DISTRIBUTION LIMITS

3/4.2.1 AVERAGE PLANAR LINEAR HEAT GENERATION RATE

LIMITING CONDITION FOR OPERATION

3.2.1 All AVERAGE PLANAR LINEAR HEAT GENERATION RATES (APLHGRs) shall not exceed the result obtained from multiplying the applicable MAPLHGR values* by the smaller of either the flow dependent MAPLHGR factor ($MAPFAC_f$) of Figure 3.2.1-1 or the power dependent MAPLHGR factor ($MAPFAC_p$) of Figure 3.2.1-2.

APPLICABILITY: OPERATIONAL CONDITION 1, when THERMAL POWER is greater than or equal to 25% of RATED THERMAL POWER.

ACTION:

If at any time during operation it is determined that an APLHGR is exceeding the result of the above multiplication, initiate corrective action within 15 minutes and restore APLHGR to within the required limits within 2 hours or reduce THERMAL POWER to less than 25% of RATED THERMAL POWER within the next 4 hours.

SURVEILLANCE REQUIREMENTS

4.2.1 All APLHGRs shall be verified to be equal to or less than the above limits:

a. At least once per 24 hours,

b. Within 12 hours after completion of a THERMAL POWER increase of at least 15% of RATED THERMAL POWER in one hour, and

c. Initially and at least once per 12 hours when the reactor is operating with a LIMITING CONTROL ROD PATTERN for APLHGR.

d. The provisions of Specification 4.0.4 are not applicable.

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* These applicable MAPLHGR values are:

1) Those that have been approved for the respective fuel and lattice type as a function of the average planar exposure (as determined by the NRC approved methodology described in GESTAR-II)

or

2) When hand calculations are required, the MAPLHGR as a function of the average planar exposure for the most limiting lattice (excluding natural uranium) shown in the Figures 3.2.1-3, 3.2.1-4, 3.2.1-5, and 3.2.1-6 for the applicable type of fuel.

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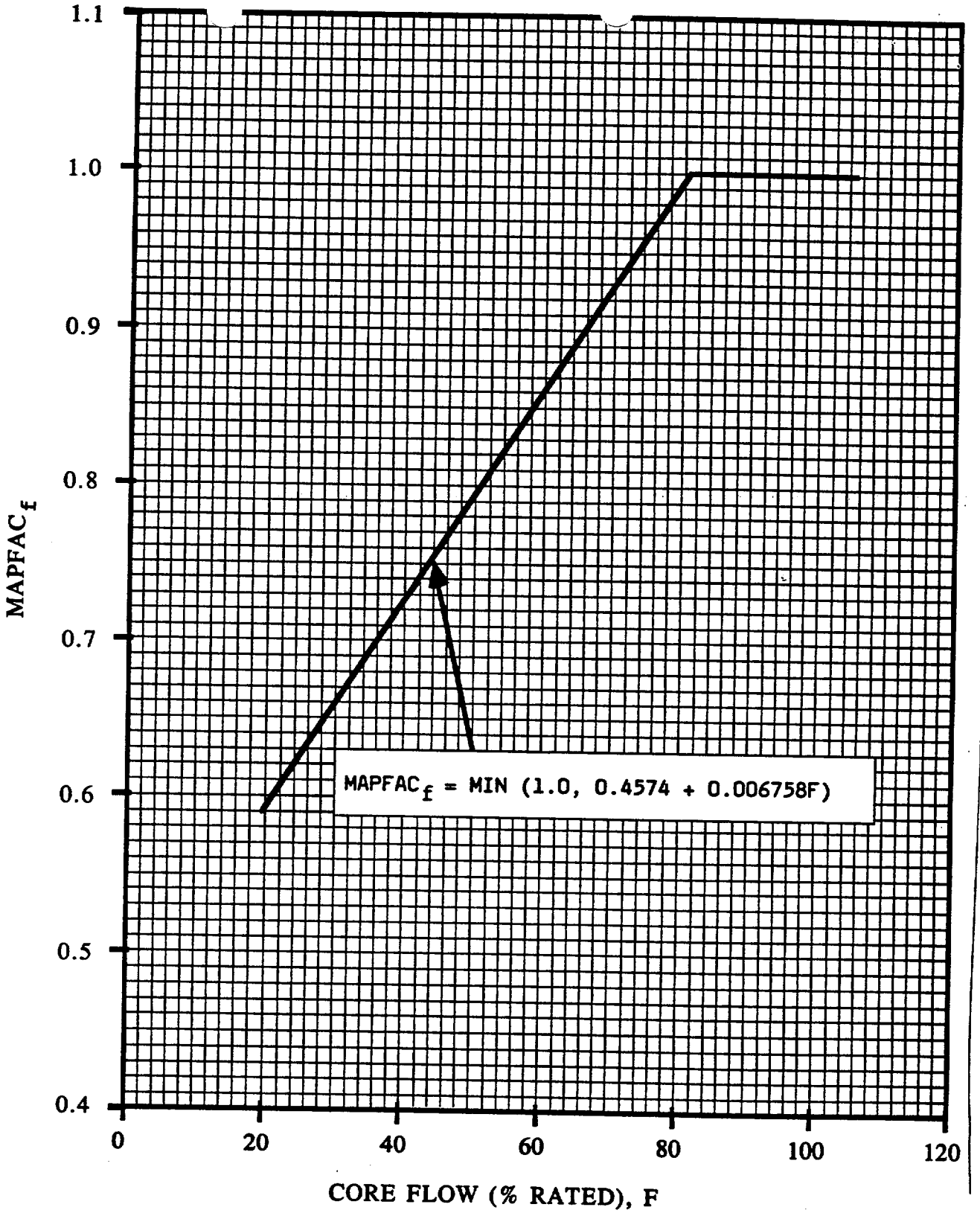

FLOW DEPENDENT MAPLHGR FACTOR
(MAPFAC$_f$)

FIGURE 3.2.1–1

3/4.2 POWER DISTRIBUTION LIMITS

BASES

The specifications of this section assure that the peak cladding temperature following the postulated design basis loss-of-coolant accident will not exceed the 2200°F limit specified in 10 CFR 50.46.

3/4.2.1 AVERAGE PLANAR LINEAR HEAT GENERATION RATE

This specification assures that the peak cladding temperature (PCT) following the postulated design basis Loss-of-Coolant Accident (LOCA) will not exceed the limits specified in 10 CFR 50.46 and that the fuel design analysis limits specified in GESTAR-II (Reference 1) will not be exceeded.

The peak cladding temperature (PCT) following a postulated loss-of-coolant accident is primarily a function of the average heat generation rate of all the rods of a fuel assembly at any axial location and is dependent only secondarily on the rod to rod power distribution within an assembly. The peak clad temperature is calculated assuming a LHGR for the highest powered rod which is equal to or less than the design LHGR corrected for densification. This LHGR times 1.02 is used in the heatup code along with the exposure dependent steady state gap conductance and rod-to-rod local peaking factor. The Technical Specification AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR) is this LHGR of the highest powered rod divided by its local peaking factor. The MAPLHGR limits of Figures 3.2.1-1, 3.2.1-2, and 3.2.1-3 are multiplied by the smaller of either the flow dependent MAPLHGR factor ($MAPFAC_f$) or the power dependent MAPLHGR factor ($MAPFAC_p$) corresponding to existing core flow and power state to assure the adherence to fuel mechanical design bases during the most limiting transient. $MAPFAC_f$'s are determined using the three-dimensional BWR simulator code to analyze slow flow runout transients. $MAPFAC_p$'s are generated using the same data base as the $MCPR_p$ to protect the core from plant transients other than core flow increases.

The Technical Specification MAPLHGR value is the most limiting composite of the fuel mechanical design analysis MAPLHGR and the ECCS MAPLHGR.

Fuel Mechanical Design Analysis: NRC approved methods (specified in Reference 1) are used to demonstrate that all fuel rods in a lattice, operating at the bounding power history, meet the fuel design limits specified in Reference 1. This bounding power history is used as the basis for the fuel design analysis MAPLHGR value.

LOCA Analysis: A LOCA analysis is performed in accordance with 10 CFR Part 50 Appendix K to demonstrate that the MAPLHGR values comply with the ECCS limits specified in 10 CFR 50.46. The analysis is performed for the most limiting break size, break location, and single failure combination for the plant.

AVERAGE PLANAR LINEAR HEAT GENERATION RATE (Continued)

Only the most limiting MAPLHGR values are shown in the Technical Specification figures for multiple lattice fuel. When hand calculations are required, these Technical Specification MAPLHGR figure values for that fuel type are used for all lattices in that bundle.

For some GE fuel bundle designs MAPLHGR depends only on bundle type and burnup. Other GE fuel bundles have MAPLHGRs that vary axially depending upon the specific combination of enriched uranium and gadolinia that comprises a fuel bundle cross section at a particular axial node. Each particular combination of enriched uranium and gadolinia, for these fuel bundle types, is called a lattice type by GE. These particular fuel bundle types have MAPLHGRs that vary by lattice type (axially) as well as with fuel burnup.

Approved MAPLHGR values (limiting values of APLHGR) as a function of fuel and lattice types, and as a function of the average planar exposure are provided in Technical Specification Figures 3.2.1-3 through 3.2.1-6.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 20 TO FACILITY OPERATING LICENSE NO. NPF-58

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY, ET AL.

PERRY NUCLEAR POWER PLANT, UNIT NO. 1

DOCKET NO. 50-440

1.0 INTRODUCTION

By letters dated November 28, 1988 and December 29, 1988, the Cleveland Electric Illuminating Company, the licensee for the Perry Unit 1 Nuclear Generating Station, proposed to amend the Technical Specifications for the Cycle 2 reload and operation (Refs. 1, 2 and 7). The reload includes 272 new assemblies of GE manufacture. The reload design has no unusual features. The proposed Technical Specification changes are related to the Minimum Critical Power Ratio (MCPR), the Maximum Average Planar Linear Heat Generation Rate (MAPLHGR), and updating the bases and references associated with certain cycle-dependent limits. The December 29, 1988 submittal also proposed TS changes to specify values for flow-dependent MAPLHGR factor ($MAPFAC_f$) and $MCPR_f$ for off-rated conditions of operation. The new fuel is of slightly increased enrichment designed for extended burnup.

2.0 EVALUATION

2.1 Reload Description

The licensee requests to be allowed to use GE fuel types BS301E and BS301F which have slightly higher enrichment than the present fuel types and will allow higher burnup. The core loading is the conventional new assembly scatter pattern, with low reactivity (old) assemblies located on the periphery. The new assembly types are not described in GESTAR II (Ref. 3).

2.2 Fuel Design

The new fuel for Cycle 2 is the GE fuel designated BS301E and BS301F. This fuel is in the same class with approved designs but not for the enrichments used here. The specific description of this fuel is presented in Reference 4. This fuel description is acceptable.

For Cycle 2 operation, appropriate MAPLHGR have been determined by approved thermal, mechanical and Loss-of-Coolant Accident (LOCA) analyses calculations. The most limiting MAPLHGR's as a function of burnup for the new core loading are presented in the proposed Technical Specifications (Ref. 1) for the old and the new fuel types present in Cycle 2.

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2.3 Nuclear Design

The nuclear design for Cycle 2 has been performed by GE using the approved GESTAR II methodology (Ref. 3). The results of these analyses are given in the GE reload report (Ref. 2) in the GESTAR II format. The results are within the usual reload range. The shutdown margin is 2.9% delta-k/k at beginning of cycle (BOC) with the strongest rod out and 1.2% delta-k/k at the exposure with the minimum shutdown margin. Both meet the 0.38% delta-k/k margin required by the Technical Specifications. The standby liquid control system also meets the shutdown requirements with a shutdown margin of 4.0% delta-k/k. Because these and other nuclear characteristics of the reload have been computed with previously-approved methods (outlined in GESTAR II) and their values are within the allowed range, the nuclear design is acceptable.

2.4 Thermal-Hydraulic Design

The thermal-hydraulic design for Cycle 2 has been calculated using the approved methods described in GESTAR II. The results are given in the standard GESTAR II format in the reload report (Ref. 2). The parameters and initial values used for the calculations are those approved in GESTAR II for the BWR/6 class of reactors. The GEMINI set of methods (Refs. 5 and 6) have been approved for the relevant transient analyses. The Technical Specification values for scram speed, which are conservative, were used.

The operating limits of the MCPR values are determined by the limiting transient among the following: local rod withdrawal error, feedwater controller failure, load rejection without bypass and loss of 100°F feedwater heating. The analyses of these events for Cycle 2 used approved methods. The loss of 100°F feedwater heating transient is limiting. The delta-CPR results of these analyses are reflected in the requested Technical Specification changes. The MCPR for Cycle 2 has been increased from 1.06 to 1.07 to account for Cycle 2 uncertainties. The results are within expected ranges and, hence, they are acceptable.

For the Perry Unit 1, Cycle 2, no cycle-specific stability analysis is required because the Technical Specifications have standard NRC-approved provisions for incore neutron detector monitoring of thermal-hydraulic stability according to the recommendations of the General Electric SIL-380. Nevertheless, effective December 1, 1988, the licensee instituted procedures for the instance of loss of one or both recirculation pumps to prevent the reactor from entering an unstable mode of operation. This is responsive to Bulletin 88-07 and thus is acceptable.

2.5 Transient and Accident Analyses

The accident and transient analysis methods used for Cycle 2 are described in GESTAR II. The GEMINI set of codes was used. The MCPR operating limit was determined from the loss of 100°F feedwater heating transient, delta-CPR = 0.11 added to the MCPR of 1.07 for a cycle operating MCPR limit of 1.18. The core-wide transient analyses methodologies have been approved and the results fall within expected ranges and are acceptable.

The mislocated assembly event is not analyzed, because the NRC approved the non-applicability of loading errors to BWR/6 plants as documented in Ref. 3.

The limiting overpressurization event analysis, i.e., main isolation valve closure with flux scram, was performed using the GEMINI methods (Ref. 5 and 6) at 102% of power level to account for the power level uncertainties specified in Regulatory Guide 1.49. The results show that the peak steam dome and vessel pressures of 1,235 and 1,266 psig are under 1375 psig, i.e., the required limit. The methodology and the results of the overpressurization event analysis are acceptable (Ref. 2).

LOCA analyses, using approved (SAFE/REFLOOD) methods and parameter values were performed to provide MAPLHGR values versus average planar exposure, peak clad temperature and oxidation fraction for both new fuel type assemblies for Cycle 2, i.e., BS301E and BS301F. The results show compliance with 10 CFR 50.46 and the LHGR limits as listed in the Technical Specifications and, therefore, are acceptable.

2.6 Selected Margin Improvement and Operating Flexibility Options

The licensee has included in its reload analyses several assumptions regarding equipment operability/inoperability which will allow operating flexibility. Equipment credited in the analyses include recirculation pump trip, rod withdrawal limiter, and the thermal power monitor. In addition, the licensee has considered in its determination of operating limits and technical specifications the effects of feedwater heaters being out of service, single loop operation, maximum extended operating domain conditions, and increased core flow. These options have been approved on a generic basis and have been demonstrated as applicable to Perry in its reload submittal. The staff will evaluate technical specification changes related to single loop operation when they are submitted at a later date.

2.7 Evaluation of Changes to $MCPR_f$ and $MAPFAC_f$ Values

During off-rated power-flow operation, $MCPR_f$ values of MCPR are required to ensure that the established safety limit value is met during inadvertent core flow increase. The $MCPR_f$ were calculated as a function of flow. For each value of the flow the limiting bundle's relative power is adjusted until the MCPR is slightly above the safety limit MCPR. In this manner a power-flow line is defined to assure that the safety limit will be met.

The revision of these curves for Cycle 2 was necessitated by the non-conservative behavior at low flows of the GEXL-Plus critical power correlation used in the analysis of Cycle 2. The staff requires additional conservatism for flows below 40% of the rated flow (GESTAR, Amendment 15, Ref. 8). This conservatism is given in the form of a flow-dependent factor, $MAPFAC_f$ and the value of the flow dependent $MCPR_f$. These quantities are specified in Figures 3.2.1-1 and 3.2.2-1 which are part of the proposed Technical Specifications. These curves have been extended to 20% of rated core flow to cover potential core flow shortfall.

As pointed out above, the calculational methodology was based on GEXL-Plus and an NRC-approved code. The calculational results assure that the safety limit MCPR is met, therefore, the proposed Technical Specification changes are acceptable.

2.8 Proposed Technical Specification Changes

The following Technical Specifications (and corresponding bases) are proposed to be changed:

1. 2.1.2, Thermal Power, High Pressure and High Flow

   The MCPR has been increased in the Technical Specification and the bases. Tables B2.1.2-1 and B2.1.2-2 are eliminated. These changes are acceptable as discussed in the evaluation.

2. 3/4.2.1, Average Planar Linear Heat Generation Rate

   Modification of the MAPLHGR versus average exposure for each fuel type in Cycle 2. Figures 3.2.1-1, 3.2.1-2, 3.2.1-4 and 3.2.1-5 were renumbered, Figure 3.2.1-3 was deleted. Figures 3.2.1-5 and 3.2.1-6 were added. These changes have been discussed above and are acceptable. Also, as discussed above, the new Figure 3.2.1-1 was modified to extend the curve to the 20% of rated core flow line. This change is acceptable.

3. 3/4.2.2, Minimum Critical Power Ratio

   Changes in Figure 3.2.2-2 as discussed above reflect the revised MCPR. The changes are acceptable.

4. 3/4.2.3, Linear Heat Generation Rate

   Changes to reflect explicitly the linear heat generation limits for all assemblies present in Cycle 2. This change is acceptable as discussed in the evaluation.

5. Figure 3.2.2-1 has been revised for the flow dependent minimum critical power ration, $MCPR_f$, to correct the extrapolated value for Cycle 2 operation. As discussed above, this change is acceptable.

3.0 SUMMARY AND CONCLUSIONS

We have reviewed the information submitted for the Cycle 2 operation of the Perry Unit 1 plant. Based on this review, we conclude that the fuel design, the nuclear design, the thermal-hydraulic design and the accident and transient analyses are acceptable. The proposed Technical Specifications submitted for the Cycle 2 reload represent the necessary modifications for this cycle.

4.0 ENVIRONMENTAL CONSIDERATION

This amendment involves a change to a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The 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 this amendment involves no significant hazards consideration. 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. Comments were received dated February 22, 1988 with respect to the proposed issuance of this amendment and are addressed below.

5.0 PUBLIC COMMENTS RECEIVED

On February 22, 1989 Susan L. Hiatt, representing Ohio Citizens for Responsible Energy (OCRE), submitted comments with regard to the licensees' license amendment application dated November 28, 1988 as amended December 29, 1988. Notice of Consideration of Issuance had been published in the Federal Register on February 1, 1989. Ms. Hiatt stated that the amendment request is deficient in that a stability analysis had not been conducted by the licensees. She further stated that the licensees should be required to conduct a stability analysis for the second operating cycle demonstrating compliance with GDC-10 and -12 as a condition of restart. Ms. Hiatt identified her concerns as being related to the La Salle Unit 2 power oscillation event of March 9, 1988. The staff has evaluated Ms. Hiatt's comments and provides the following discussion.

Following the March 9, 1988 power oscillation event at La Salle Unit 2, the staff issued NRC Bulletin 88-07 - "Power Oscillations in Boiling Water Reactors (BWR's)" and Supplement 1 to that bulletin on June 22, 1988 and December 30, 1988, respectively. The bulletin states a modified staff position wherein stability analyses are no longer acceptable for demonstrating that a BWR core is stable. Instead, the staff requested that explicit modifications to operating procedures be implemented by licensees in order to ensure that power

oscillations are avoided or promptly detected and suppressed. The General Electric (GE) SIL-380 guidance regarding operating procedures was modified by the BWR Owners Group. The changes were further modified and endorsed by Supplement 1 to NRC Bulletin 88-07. By letter dated February 15, 1989, the licensees confirmed that actions requested in NRC Bulletin 88-07 Supplement 1 have been completed and implemented. Therefore, the staff has determined that the licensees have taken appropriate measures to avoid, detect and suppress power oscillations for Perry Unit 1 in accordance with NRC Bulletin 88-07 and Supplement 1. Further, the staff maintains that stability analyses are neither necessary nor sufficient for demonstrating that a BWR core is stable.

6.0 CONCLUSION

The 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, and (2) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

6.0 REFERENCES

1. Letter from A. Kaplan, Cleveland Electric Illuminating Company, to USNRC, dated November 18, 1988.

2. 23A5948 GE Report, "Supplemental Reload Licensing Submittal for Perry Nuclear Power Station, Unit 1, Reload 1, Cycle 2," dated November 1988.

3. NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel, GESTAR II," as amended, dated May 1986 and NEDE-24011PA9-US dated September 1988.

4. 23A5948A, Rev. 0 Supplement 1, "Supplemental Reload Licensing Submittal for Perry Nuclear Power Plant Unit 1, Reload 1, Cycle 2," GE Report dated October 1988.

5. Letter from J. S. Charnley, General Electric, to M. W. Hodges, NRC, "GEMINI ODYN Adjustment Factors for BWR/6," dated July 6, 1987.

6. Letter from Ashok C. Thadani to J. S. Charnley, General Electric, "Acceptance for Referencing of Licensing Topical Report NEDE-24011-P-A, GE Generic Licensing Reload Report, of Amendment 15," May 5, 1988.

7. Letter from A. Kaplan, Cleveland Electric Illuminating Company, to USNRC, "Technical Specification Change Request - Reload Submittal," dated December 29, 1988.

8. NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel, GESTAR-II" Amendment 15, dated May 5, 1988.

Principal Contributor: Lambros Lois

Dated: May 18, 1989