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DTE Energy

10 CFR 50.90

October 7, 2004
NRC-04-0074

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington D C 20555-0001

References: 1) Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43

2) Letter from J. S. Post (General Electric Nuclear Energy) to USNRC (MFN 04-081), "Part 21 Reportable Condition and 60-Day Interim Report Notification: Non-conservative SLMCPR," dated August 24, 2004

3) Letter from N. K. Peterson (Detroit Edison) to USNRC (NRC-04-0065), "Transmittal of Cycle 10 Core Operating Limits Report, Revision 1," dated August 30, 2004

Subject: Proposed License Amendment Request to Revise Technical Specification 2.1, Safety Limit Minimum Critical Power Ratio

Pursuant to 10 CFR 50.90, Detroit Edison hereby proposes to amend the Fermi 2 Plant Operating License, Appendix A, Technical Specifications (TSs) by modifying TS Section 2.1.1.2. This application proposes to change the Safety Limit Minimum Critical Power Ratio (SLMCPR) in TS 2.1.1.2 to reflect results of cycle-specific calculations performed for Fermi 2 operating Cycles 10 and 11 by Global Nuclear Fuels (GNF) using NRC approved methodology and uncertainties. This application also addresses the 10 CFR 21 Notification issued by General Electric Nuclear Energy (GENE) in Reference 2.

Prior to the promulgation of Reference 2, cycle-specific analyses to determine the SLMCPR values for Fermi 2 were performed by GNF for both Cycles 10 and 11. Based upon these analyses, it was determined that no change to the TS SLMCPR values were required for Cycle 11. Upon receipt of the August 24, 2004 10 CFR 21 notification from GENE and in subsequent conversations with them, Detroit Edison

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determined that the existing TS SLMCPR values were incorrect and a license amendment was necessary.

In addition, Detroit Edison took prompt action in accordance with guidance contained in NRC Administrative Letter (AL) 98-10, "Dispositioning of Technical Specifications That Are Insufficient to Assure Plant Safety." Administrative controls, as described below, were implemented to preserve the SLMCPR pending development of supporting information for a license amendment request and evaluation for impact on Cycle 11 operation.

As a result of the analyses performed by GNF in support of the 10 CFR 21 Notification (Reference 2), the need to increase the dual loop operation SLMCPR from 1.07 to 1.08 was identified. The following administrative controls were put in place in order to raise the Minimum Critical Power Ratio (MCPR) operating limits to effectively implement the needed increase in the SLMCPR for the current operating cycle (Cycle 10):

- The Fermi 2 Cycle 10 Core Operating Limits Report (COLR) was revised to increase MCPR operating limits equivalent to an effective increase of the SLMCPR to 1.08. The revised COLR was submitted to the NRC in accordance with TS 5.6.5.d (Reference 3).

- The Core Performance Parameter Check procedure, 54.000.07, was revised to reflect the revised COLR values.

- The 3D Monicore databank was modified to adjust MCPR operating limits to an effective increase of the SLMCPR to 1.08.

The lowest operating MCPR value reached, for Cycle 10, to date was 1.325. For the remainder of the cycle, the steady state MCPR at rated power is projected to remain substantially above 1.36, which demonstrates sufficient margin to the revised SLMCPR value. Therefore the administrative controls described above provide adequate margin for the remainder of Cycle 10.

NRC AL 98-10 also states that an amendment to the Technical Specifications, with appropriate justification and schedule, be submitted in a timely fashion. Information required to support the SLMCPR TS change for Cycle 10 and Cycle 11 was received from GNF on September 24, 2004. Therefore, this license amendment constitutes timely submittal of an amendment request for both Cycle 10 and Cycle 11 operation.

Enclosure 1 provides an evaluation of the proposed license amendment, including an analysis of the issue of significant hazards consideration using the standards of 10 CFR 50.92. Detroit Edison has concluded that the change proposed in this submittal does not result in a significant hazards consideration. Enclosure 2 provides

a marked up page of the existing TS to show the proposed change. Enclosure 3 provides a typed version of the affected TS page with the proposed change incorporated. The GNF document provided as Attachment 1 contains additional information regarding the Cycle 11 SLMCPR analysis, including a comparison of the Fermi 2 Cycle 11 SLMCPR to the Cycle 10 SLMCPR values. Some of the information contained in the document is considered GNF proprietary information and should be withheld from public disclosure in accordance with 10 CFR 9.17(a)(4) and 10 CFR 2.390(a)(4). An affidavit attesting to this fact is provided as Attachment 2. A non-proprietary version of the GNF document is provided as Attachment 3.

Detroit Edison has reviewed the proposed change against the criteria of 10 CFR 51.22 and has concluded that it meets the criteria provided in 10 CFR 51.22(c)(9) for a categorical exclusion from the requirements for an Environmental Impact Statement or an Environmental Assessment.

This proposed license amendment is a required change for Fermi 2 operating Cycle 11. Therefore, approval of this amendment is requested by November 24, 2004 with implementation prior to startup from Refueling Outage 10, currently scheduled for November 27, 2004. Detroit Edison recognizes that the requested approval date provides a shorter than desirable review time. However, as is described in detail above, the circumstances surrounding the need for this amendment could not have reasonably been avoided and Detroit Edison has demonstrated best efforts in submitting a timely application for this amendment.

No commitments are being made in this letter.

Should you have any questions or require additional information, please contact Mr. Norman K. Peterson of my staff at (734) 586-4258.

Sincerely,

William J. O'Hara

Enclosures (3)
Attachments (3)

cc: D. P. Beaulieu
E. R. Duncan
NRC Resident Office
Regional Administrator, Region III
Supervisor, Electric Operators,
Michigan Public Service Commission

I, WILLIAM T. O'CONNOR, JR., do hereby affirm that the foregoing statements are based on facts and circumstances which are true and accurate to the best of my knowledge and belief.

WILLIAM T. O'CONNOR, JR.
Vice President - Nuclear Generation

On this 7th day of October, 2004 before me personally appeared William T. O'Connor, Jr., being first duly sworn and says that he executed the foregoing as his free act and deed.

Notary Public

NORMAN K. PETERSON
NOTARY PUBLIC MONROE CO., MI
MY COMMISSION EXPIRES Jul 24, 2006

ENCLOSURE 1
to NRC-04-0074

REQUEST TO REVISE TECHNICAL SPECIFICATION(S)
TS 2.1.1.2

Evaluation of the Proposed License Amendment Request

Evaluation of Proposed License Amendment Request

Subject: Technical Specification 2.1.1.2, Safety Limit Minimum Critical Power Ratio

1.0 Description

Pursuant to 10 CFR 50.90, Detroit Edison hereby proposes to amend the Fermi 2 Plant Operating License, Appendix A, Technical Specifications (TS) by modifying TS Section 2.1.1.2. This application proposes to change the dual recirculation loop operation Safety Limit Minimum Critical Power Ratio (SLMCPR) in TS 2.1.1.2 to reflect results of cycle-specific calculations performed for Fermi 2 operating Cycles 10 and 11 by Global Nuclear Fuels (GNF) using NRC approved methodology and uncertainties. This application addresses the Part 21 Notification (Reference 2) issued by GNF and General Electric Nuclear Energy (GENE).

2.0 Proposed Change

The proposed change modifies the SLMCPR value of TS 2.1.1.2 from 1.07 to 1.08 for dual recirculation loop operation. The single loop operation SLMCPR value remains unchanged at 1.09.

3.0 Background

GNF and GENE determined the current process for determination of SLMCPR values could result in a non-conservative SLMCPR. During performance of SLMCPR calculations for an extended operating domain condition, GNF discovered an apparent flow impact where a lower flow condition at rated power had a more limiting SLMCPR than the rated flow condition. Current procedures specified that the SLMCPR be calculated on the upper boundary of the power/flow operating map only at 100% power/100% flow (rated P/rated F). The SLMCPR is calculated at 3 operating points in the cycle: Beginning of Cycle (BOC), Peak Hot Excess (PHE), and End of Cycle (EOC) at rated P/rated F conditions. The SLMCPR calculation is dependent upon many fuel and cycle parameters and the most limiting SLMCPR may occur at any of the analyzed points. The SLMCPR is the most limiting bundle MCPR from these calculations that corresponds to 0.1% of fuel rods in the core being susceptible to boiling transition due to the postulated occurrence of the limiting Abnormal Operating Occurrence event.

In the instances where this concern was discovered, the control rod patterns used at the off-rated flow/rated power condition created a more limiting bundle-by-bundle MCPR distribution than the control rod patterns used at rated power/rated flow, even though both control rod patterns met the criterion defined in the GNF SLMCPR calculation process. These instances resulted in a more limiting SLMCPR. It should be noted that the control rod patterns used by GNF in the cycle-specific SLMCPR analyses are designed to produce MCPR distributions that bound possible MCPR distributions that can be obtained from plant/cycle-specific core designs by creating radial power distributions that will tend to maximize the number of bundles that are at or near the MCPR operating limit during rated power operation of the analyzed cycle. Nominal

operating control rod patterns are intentionally designed with margin to the MCPR operating limit. Therefore, it can be concluded that the Fermi 2 core is expected to operate with control rod patterns that are less limiting than the rod patterns that have been assumed in the SLMCPR analyses.

4.0 Technical Analysis

For Cycle 11 the core will be loaded with 192 fresh GE-14 fuel assemblies and 572 GE-11 fuel assemblies consisting of 212 once-burned bundles, 204 twice-burned bundles, and 156 thrice-burned bundles.

The SLMCPR is the minimum allowable MCPR during the most limiting Abnormal Operating Occurrence (AOO) transient under which at least 99.9% of the fuel rods in the core would be expected to avoid transition boiling. The criteria of transition boiling for determination of the SLMCPR is a conservative approach since this phenomena by itself does not signal the onset of fuel cladding failure. The revised SLMCPR for Fermi 2 was determined using plant and cycle-specific fuel and core parameters and NRC approved methodology, as discussed in Attachment 1 (proprietary version of GNF summary of technical basis for SLMCPR values) and Attachment 3 (non-proprietary version of GNF summary). Analysis of the limiting AOO provides the allowed operating condition, in terms of MCPR, of the core during the fuel cycle such that if the event were to occur, the transient MCPR would not be less than the SLMCPR. No plant hardware or operational changes are required with this proposed change.

5.0 Regulatory Safety Analysis

5.1 No Significant Hazards Consideration

In accordance with 10 CFR 50.92, Detroit Edison has made a determination that the proposed amendment involves no significant hazards consideration. The proposed change to TS 2.1.1.2 does not involve a significant hazards consideration for the following reasons:

1. The proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

   The basis of the Safety Limit Minimum Critical Power Ratio (SLMCPR) is to ensure no mechanistic fuel damage is calculated to occur if the limit is not violated. The new CPR value preserves the existing margin to transition boiling and probability of fuel damage is not increased. The derivation of the revised SLMCPR for Fermi 2 for incorporation into the Technical Specifications, and its use to determine plant and cycle-specific thermal limits, have been performed using NRC approved methods. These plant-specific calculations are performed each operating cycle and if necessary, will require future changes to these values based upon revised core designs. The revised SLMCPR values do not change the method of operating the plant and have no effect on the probability of an accident initiating event or transient. Therefore, this proposed amendment does not

involve a significant increase in the probability or consequences of an accident previously evaluated.

2. The proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

   The proposed change results only from a specific analysis for the Fermi 2 Cycle 10 and 11 cores. This change does not involve any new or different methods for operating the facility. No new initiating events or transients result from these changes. Therefore, this proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. The proposed change does not involve a significant reduction in the margin of safety.

   The new SLMCPR is calculated using NRC approved methods with plant and cycle-specific parameters for the Cycle 10 and 11 core designs. The SLMCPR value is established to ensure that greater than 99.9% of all fuel rods in the core will avoid transition boiling if the limit is not violated, thereby preserving the fuel cladding integrity. The operating MCPR limit is set appropriately above the safety limit value to ensure adequate margin when the cycle-specific transients are evaluated. Accordingly, the margin of safety is maintained with the revised values. Therefore, this proposed amendment does not involve a significant reduction in the margin of safety.

Based on the above, Detroit Edison has determined that the proposed license amendment does not involve a significant hazards consideration.

6.0 Environmental Considerations

Detroit Edison has reviewed the proposed change(s) against the criteria of 10 CFR 51.22 for environmental considerations. The proposed change does not involve a significant hazards consideration, nor does it significantly change the types or significantly increase the amounts of effluents that may be released offsite. The proposed change does not significantly increase individual or cumulative occupational radiation exposures. Based on the foregoing, Detroit Edison concludes that the proposed change meets the criteria provided in 10 CFR 51.22(c)(9) for a categorical exclusion from the requirements for an Environmental Impact Statement or an Environmental Assessment.

7.0 References

1) Fermi 2
   NRC Docket No. 50-341
   NRC License No. NPF-43

2) Letter from J. S. Post (General Electric Nuclear Energy) to USNRC (MFN 04-081), "Part 21 Reportable Condition and 60-Day Interim Report Notification: Non-conservative SLMCPR," dated August 24, 2004

ENCLOSURE 2
to NRC-04-0074

REQUEST TO REVISE TECHNICAL SPECIFICATION
TS 2.1.1.2

Marked-Up Page

2.0-1

2.0 SAFETY LIMITS (SLs)

2.1 SLs

2.1.1 Reactor Core SLs

2.1.1.1 With the reactor steam dome pressure < 785 psig or core flow < 10% rated core flow:

THERMAL POWER shall be ≤ 25% RTP.

2.1.1.2 With the reactor steam dome pressure ≥ 785 psig and core flow ≥ 10% rated core flow:

MCPR shall be ≥ ~~1.07~~ 1.08 for two recirculation loop operation or ≥ 1.09 for single recirculation loop operation.

2.1.1.3 Reactor vessel water level shall be greater than the top of active irradiated fuel.

2.1.2 Reactor Coolant System Pressure SL

Reactor steam dome pressure shall be ≤ 1325 psig.

2.2 SL Violations

With any SL violation, the following actions shall be completed within 2 hours:

2.2.1 Restore compliance with all SLs; and

2.2.2 Insert all insertable control rods.

ENCLOSURE 3
to NRC-04-0074

REQUEST TO REVISE TECHNICAL SPECIFICATION
TS 2.1.1.2

Typed Page

2.0-1

2.0 SAFETY LIMITS (SLs)

2.1 SLs

2.1.1 Reactor Core SLs

2.1.1.1 With the reactor steam dome pressure < 785 psig or core flow < 10% rated core flow:

THERMAL POWER shall be ≤ 25% RTP.

2.1.1.2 With the reactor steam dome pressure ≥ 785 psig and core flow ≥ 10% rated core flow:

MCPR shall be ≥ 1.08 for two recirculation loop operation or ≥ 1.09 for single recirculation loop operation.

2.1.1.3 Reactor vessel water level shall be greater than the top of active irradiated fuel.

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Reactor steam dome pressure shall be ≤ 1325 psig.

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With any SL violation, the following actions shall be completed within 2 hours:

2.2.1 Restore compliance with all SLs; and

2.2.2 Insert all insertable control rods.

Attachment 2
To NRC-04-0074

WITHHOLDING OF PROPRIETARY INFORMATION AFFIDAVIT

Affidavit

I, Margaret E. Harding, state as follows:

(1) I am Manager, Fuel Engineering Services, Global Nuclear Fuel – Americas, L.L.C. ("GNF-A") and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in the attachment, "Additional Information Regarding the Cycle Specific SLMCPR for Fermi-2 Cycle 11", September 22, 2004. GNF proprietary information is indicated by enclosing it in double brackets. In each case, the superscript notation [3] refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GNF-A relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4) and 2.390(a)(4) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information," and some portions also qualify under the narrower definition of "trade secret," within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GNF-A's competitors without license from GNF-A constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals cost or price information, production capacities, budget levels, or commercial strategies of GNF-A, its customers, or its suppliers;

d. Information which reveals aspects of past, present, or future GNF-A customer–funded development plans and programs, of potential commercial value to GNF-A;

e. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b., above.

(5) To address the 10 CFR 2.390 (b) (4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GNF-A, and is in fact so held. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in (6) and (7) following. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GNF-A, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or subject to the terms under which it was licensed to GNF-A. Access to such documents within GNF-A is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GNF-A are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2) is classified as proprietary because it contains details of GNF-A's fuel design and licensing methodology.

The development of the methods used in these analyses, along with the testing, development and approval of the supporting methodology was achieved at a significant cost, on the order of several million dollars, to GNF-A or its licensor.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GNF-A's competitive position and foreclose or reduce the availability of profit–making opportunities. The fuel design and licensing methodology is part of GNF-A's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC–approved methods.

The research, development, engineering, analytical, and NRC review costs comprise a substantial investment of time and money by GNF-A or its licensor.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GNF-A's competitive advantage will be lost if its competitors are able to use the results of the GNF-A experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GNF-A would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GNF-A of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed at Wilmington, North Carolina, this 23rd day of September, 2004.

Margaret E. Harding

Margaret E. Harding
Global Nuclear Fuel – Americas, LLC

Attachment 3
To NRC-04-0074

GNF SUMMARY OF TECHNICAL BASIS FOR REVISED SLMCPR VALUE
(Non-Proprietary Version)

Proprietary Information Notice

This document is the GNF non-proprietary version of the GNF proprietary report. From the GNF proprietary version, the information denoted as GNF proprietary (enclosed in double brackets) was deleted to generate this version.

References

[1] Letter, Frank Akstulewicz (NRC) 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," (TAC Nos. M97490, M99069 and M97491), March 11, 1999.

[2] Letter, Thomas H. Essig (NRC) 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," (TAC Nos. M99070 and M95081), January 11, 1999.

[3] General Electric BWR Thermal Analysis Basis (GETAB): Data, Correlation and Design Application, NEDO-10958-A, January 1977.

[4] Letter, Glen A. Watford (GNF-A) to U. S. Nuclear Regulatory Commission Document Control Desk with attention to R. Pulsifer (NRC), "Confirmation of 10x10 Fuel Design Applicability to Improved SLMCPR, Power Distribution and R-Factor Methodologies", FLN-2001-016, September 24, 2001.

[5] Letter, Glen A. Watford (GNF-A) to U. S. Nuclear Regulatory Commission Document Control Desk with attention to J. Donoghue (NRC), "Confirmation of the Applicability of the GEXL14 Correlation and Associated R-Factor Methodology for Calculating SLMCPR Values in Cores Containing GE14 Fuel", FLN-2001-017, October 1, 2001.

[6] Letter, Jason S. Post (GE Energy) to U.S. Nuclear Regulatory Commission Document Control Desk, "Part 21 Reportable Condition and 60-Day Interim Report Notification: Non-conservative SLMCPR", MFN-04-081, August 24, 2004.

[7] Letter, Glen A. Watford (GNF-A) to U. S. Nuclear Regulatory Commission Document Control Desk with attention to J. Donoghue (NRC), "Final Presentation Material for GEXL Presentation – February 11, 2002", FLN-2002-004, February 12, 2002.

Discussion

The Safety Limit Minimum Critical Power Ratio (SLMCPR) evaluations for the Fermi-2 Cycle 11 were performed using NRC approved methodology and uncertainties [1]. Table 1 summarizes the relevant input parameters and limiting results for the Cycle 11 evaluations and compares to those values for the Cycle 10 core evaluations. Additional information is provided in response to NRC questions related to similar submittals regarding changes in Technical Specification values of SLMCPR. NRC questions pertaining to how GE14 applications satisfy the conditions of the NRC SER[1] have been addressed in Reference [4]. Other generically applicable questions related to application of the GEXL14 correlation, and to the applicable range for the R-factor methodology, are addressed in Reference [5]. Items that require a plant/cycle specific response are presented below.

Previously, the SLMCPR was calculated on the upper boundary of the power/flow operating map only at 100% flow / 100% power (rated flow/rated power), which had been shown in NEDC-32601P-A to result in conservative SLMCPR evaluation values using the same control rod patterns used for rated flow/rated power evaluations. Recent evaluations for BWR plants fueled by GNF fuel bundle designs determined that limiting control blade patterns developed for less than rated flow at rated power condition sometimes yield more limiting bundle-by-bundle MCPR distributions and/or more limiting bundle axial power shapes than the limiting control blade patterns developed for a rated flow/rated power SLMCPR evaluation, as reported in Reference [6]. Therefore, to conservatively account for operation at lower flow / rated power conditions, SLMCPR evaluations were also performed at the lowest core flow rate (81% rated flow) at rated power condition for the same Fermi-2 Cycle 10 and 11 exposure points that were used for the rated flow/rated power evaluations.

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. Greater flatness in either parameter yields more rods susceptible to boiling transition and thus a higher calculated SLMCPR. The impact of these parameters on the Fermi-2 Cycle 11 and Cycle 10 SLMCPR values is summarized in Table 1 and explained further in Table 3.

The core loading information for Fermi-2 Cycle 10 is provided in Figure 1. For comparison the core loading information for Fermi-2 Cycle 11 is provided in Figure 2. The impact of the fuel loading pattern differences on the calculated SLMCPR is correlated to the values of [[

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The uncontrolled bundle pin-by-pin power distributions were compared between the Fermi-2 Cycle 11 bundles and the Cycle 10 bundles. Pin-by-pin power distributions are characterized in terms of R-factors

[1] EOC is used to denote a cycle exposure prior to the End of Rated (EOR) Flow / Rated Power cycle exposure point where the core is critical with control blades inserted to place the core on the MCPR operating limit. This cycle exposure point usually occurs between 1000 –2000 MWd/ST prior to the EOR cycle exposure point.

using the NRC approved methodology [2]. For the Fermi-2 Cycle 11 limiting case analyzed at EOC, [[

]] the Fermi-2 Cycle 11 bundles have a more peaked power distribution than the bundles used for the Cycle 10 SLMCPR analyses.

Table 1 summarizes the relevant input parameters and results of Cycle 11 evaluated at the limiting condition of 81% rated flow/100% rated power and Cycle 10 evaluated at both 100% and 81% rated flow/100% rated power for comparison. The SLMCPR values were calculated for Fermi-2 using uncertainties that have been previously reviewed and approved by the NRC as listed in Table 2a and described in Reference [1] and where warranted, higher plant-cycle-specific uncertainties as listed in Table 2b. In addition to using a larger uncertainty for the GEXL R-factor to account for increased channel bow consistent with current GNF fuel operation, for the lower flow evaluations the Core Flow Rate and Random effective TIP reading uncertainties were increased by the inverse of the core flow fraction to conservatively account for an increase in relative uncertainty that may occur as core flow decreases. Although justification may exist to continue to use the same uncertainties at lower flow as are specified for rated flow in the current GNF SLMCPR methodology, no such credit was taken for the Fermi-2 low flow Cycle 10 and Cycle 11 SLMCPR evaluations.

These calculations use the GEXL14 correlation for GE14 fuel. [[

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Table 3 provides a detailed breakdown into individual components of the SLMCPR for Cycle 10 and Cycle 11 evaluations and compares the summation of components to the calculated SLMCPR values. Estimated component values were based upon the magnitudes of components that have been observed in other plant SLMCPR evaluations. The components were added to base SLMCPR values that were calculated using a correlation that estimates SLMCPR values [[ ]], hence forward in this discussion referred to as "the correlation". Using the correlation for Fermi-2 core conditions consistently over estimates the monte carlo calculated SLMCPR values. [[

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Note that for Fermi-2 Cycle 11 the limiting dual loop operation (DLO) SLMCPR occurs at EOC for the 81% rated flow/100% rated power condition. In this case, the bundle-by-bundle MCPR distribution was not significantly flatter than for the 100% rated flow/100% rated power condition. However, the limiting control blade pattern used as the initial condition for the 81% rated flow/100% rated power evaluation produced [[ ]] that required incorporation of an evaluation penalty that

increased the SLMCPR value. Therefore, the 81% rated flow/100% rated power condition became the limiting DLO condition.

For single loop operations (SLO) the calculated safety limit MCPR for the limiting case is 1.09 as determined by specific calculations for Fermi-2 Cycle 11 at EOC. The DLO and SLO SLMCPR values calculated for Fermi-2 Cycle 11 are shown in Table 1.

Summary

The calculated 1.08 DLO SLMCPR and 1.09 SLO SLMCPR for Fermi-2 Cycle 11 are consistent with expectations [[

]] these values are appropriate when the approved methodology and the reduced uncertainties given in NEDC-32601P-A and NEDC-32694P-A are used.

Based on the information and discussion presented above, it is concluded that the calculated SLMCPR of 1.08 for DLO and 1.09 for SLO are appropriate for the Fermi-2 Cycle 11 core.

Table 1
Comparison of the Fermi-2 Cycle 11 and Cycle 10 SLMCPR

QUANTITY, DESCRIPTION	Fermi-2 Cycle 10	Fermi-2 Cycle 10	Fermi-2 Cycle 11
Number of Bundles in Core	764	764	764
Limiting Cycle Exposure Point	EOC	EOC	EOC
Cycle Exposure at Limiting Point (MWd/STU)	11500	11500	9000
% Rated Flow	100	81	81
Reload Fuel Type	GE11	GE11	GE14
Latest Reload Batch Fraction, %	27.7	27.7	25.1
Latest Reload Average Batch Weight % Enrichment	3.87	3.87	3.99
Core Fuel Fraction for GE14 (%)	0.0	0.0	25.1
Core Fuel Fraction for GE11 (%)	100.0	100.0	74.9
Core Average Weight % Enrichment	3.86	3.86	3.90
Core MCPR (for limiting rod pattern)	1.32	1.30	1.40
[[			]]
[[			]]
[[			]]
Power distribution methodology	Revised NEDC-32601P-A	Revised NEDC-32601P-A	Revised NEDC-32601P-A
Power distribution uncertainty	Reduced NEDC-32694P-A	Reduced NEDC-32694P-A	Reduced NEDC-32694P-A
Non-power distribution uncertainty	Revised NEDC-32601P-A	Revised NEDC-32601P-A	Revised NEDC-32601P-A
Calculated Safety Limit MCPR (DLO)	**1.07**	**1.08**	**1.08**
Calculated Safety Limit MCPR (SLO)	**1.09**	**1.09**	**1.09**

Table 2a

Standard Uncertainties

DESCRIPTION	Fermi-2 Cycle 10 100% Flow	Fermi-2 Cycle 10 81% Flow	Fermi-2 Cycle 11 81% Flow
Non-power Distribution Uncertainties	Revised NEDC-32601P-A	Revised NEDC-32601P-A	Revised NEDC-32601P-A
Core flow rate (derived from pressure drop)	2.5 DLO 6.0 SLO	2.5 DLO 6.0 SLO	2.5 DLO 6.0 SLO
Individual channel flow area	[[ ]]	[[ ]]	[[ ]]
Individual channel friction factor	5.0	5.0	5.0
Friction factor multiplier	[[ ]]	[[ ]]	[[ ]]
Reactor pressure	[[ ]]	[[ ]]	[[ ]]
Core inlet temperature	0.2	0.2	0.2
Feedwater temperature	[[ ]]	[[ ]]	[[ ]]
Feedwater flow rate	[[ ]]	[[ ]]	[[ ]]
Power Distribution Uncertainties	Reduced NEDC-32694P-A	Reduced NEDC-32694P-A	Reduced NEDC-32694P-A
GEXL R-factor	[[ ]]	[[ ]]	[[ ]]
Random effective TIP reading	1.2 DLO 2.85 SLO	1.2 DLO 2.85 SLO	1.2 DLO 2.85 SLO
Systematic effective TIP reading	[[ ]]	[[ ]]	[[ ]]
Integrated effective TIP reading	[[ ]]	[[ ]]	[[ ]]
Bundle power	[[ ]]	[[ ]]	[[ ]]
Effective total bundle power uncertainty	[[ ]]	[[ ]]	[[ ]]

Table 2b

Exceptions to the Standard Uncertainties

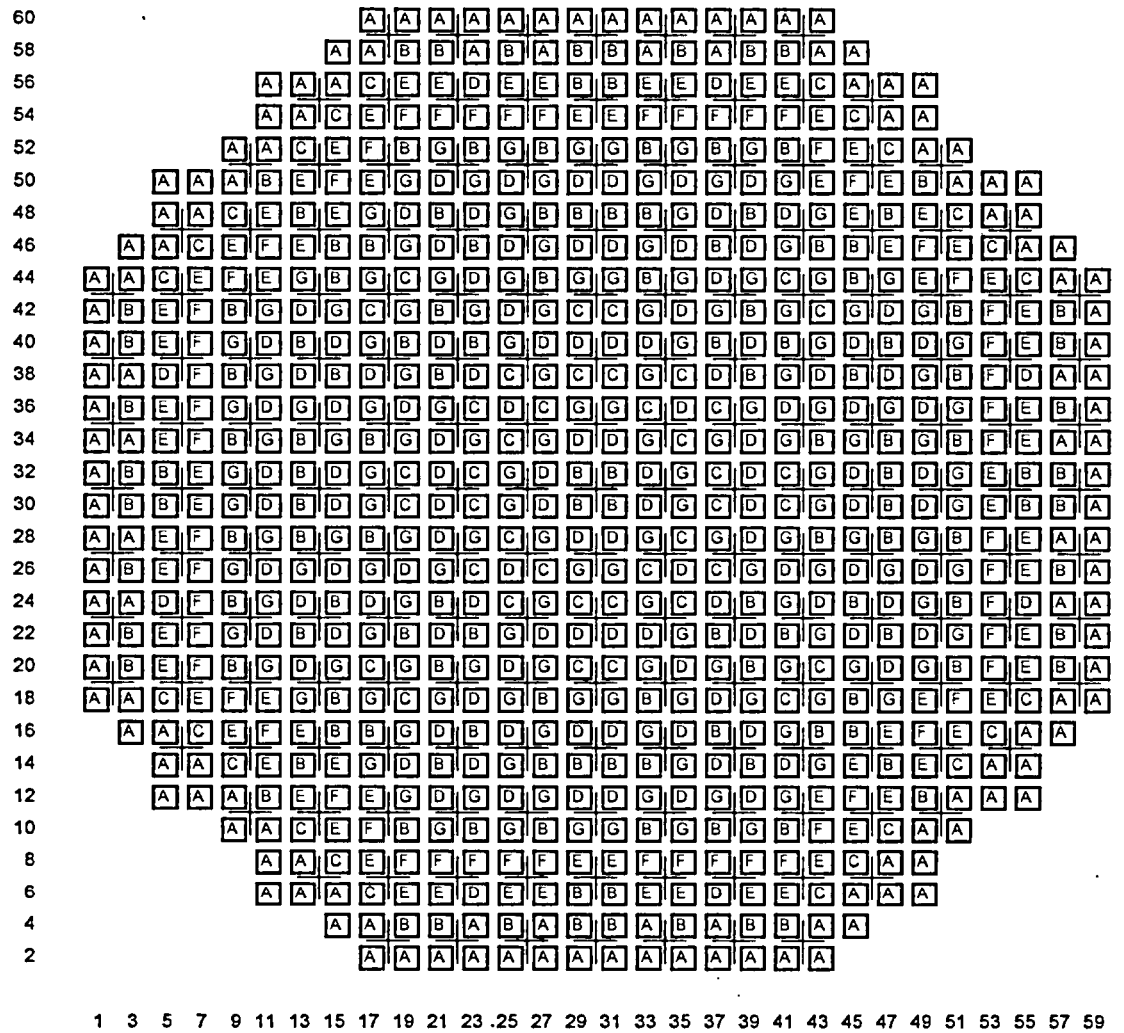
Core Flow Rate	[[ ]]
GEXL R-factor	[[ ]]
Random effective TIP reading	[[ ]]

Table 3

Monte Carlo Calculated SLMCPR vs. Estimate by Component Parameter

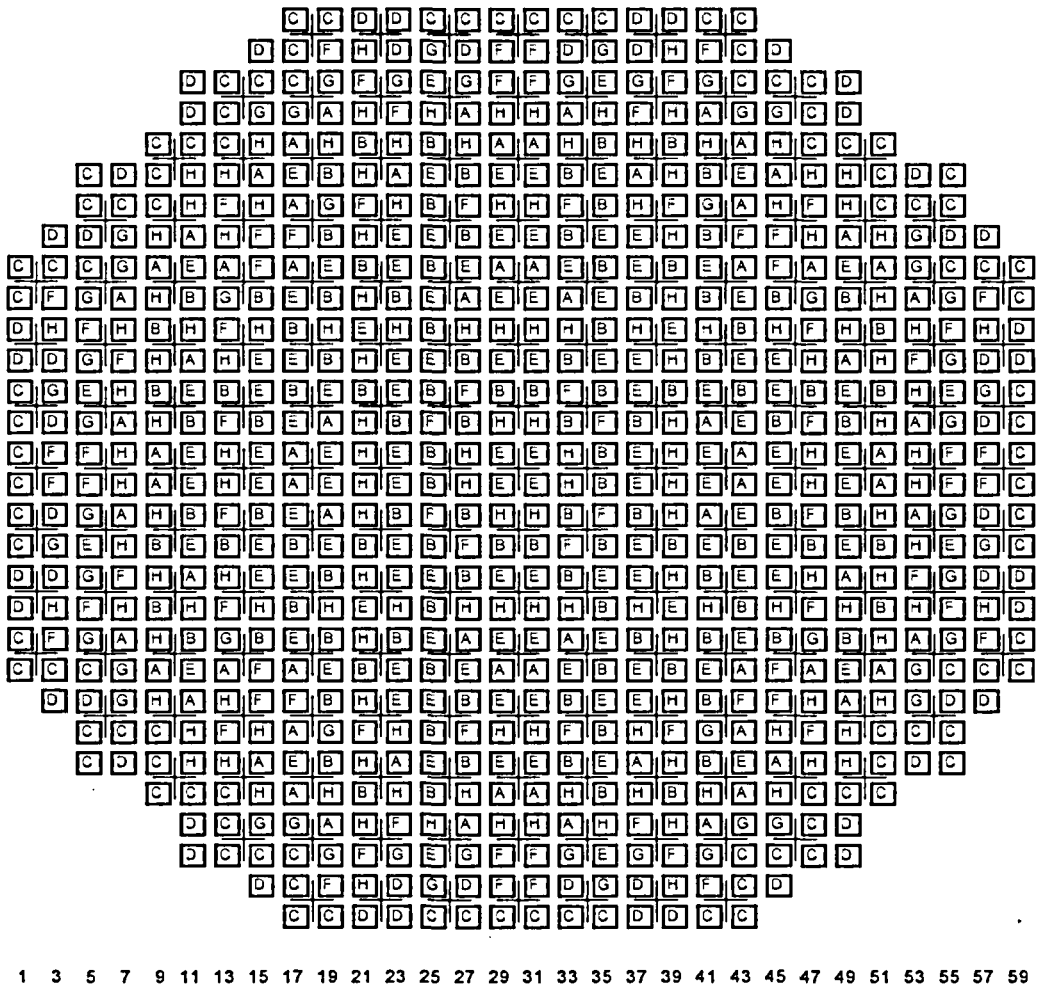
Component Parameter	Fermi-2 Cycle 10 100%Flow	Fermi-2 Cycle 10 81%Flow	Fermi-2 Cycle 11 81%Flow
Base SLMCPR Estimate – Using Correlation (Revised Meth. And Reduced Power Uncertainties)	[[		]]
Core Flow Rate and Random effective TIP reading Uncertainty Increase	N/A	[[	]]
GEXL R-factor Uncertainty Increase from [[ ]]	N/A	N/A	[[ ]]
Double Hump Axial Power Shape Penalty	N/A	N/A	[[ ]]
Total Estimated SLMCPR	[[		]]
Calculated SLMCPR	[[		]]
[redacted]			
Calculated – Estimated Delta	[[		]]

Figure 1
Reference Loading Pattern – Fermi-2 Cycle 10



Code	Bundle Name	Number Loaded	Cycle Loaded
A	GE11-P9CUB380-12GZ-100T-146-T6	140	7
B	GE11-P9CUB378-4G6.0/8G5.0-100T-146-T6-3955	144	8
C	GE11-P9CUB396-13GZ-100T-146-T6-3954	64	8
D	GE11-P9CUB380-11GZ-100T-146-T6-2542	124	9
E	GE11-P9CUB404-12GZ-100T-146-T6-2543	80	9
F	GE11-P9CUB408-12GZ-100T-146-T6-2604	56	10
G	GE11-P9CUB380-12GZ-100T-146-T6-2605	156	10

Figure 2
Reference Loading Pattern – Fermi-2 Cycle 11



Code	Bundle Name	Number Loaded	Cycle Loaded
A	GE14-P10CNAB400-16GZ-100T-150-T6-2787	76	11
B	GE14-P10CNAB399-16GZ-100T-150-T6-2788	116	11
C	GE11-P9CUB378-4G6.0/8G5.0-100T-146-T6-3955	100	8
D	GE11-P9CUB396-13GZ-100T-146-T6-3954	56	8
E	GE11-P9CUB380-11GZ-100T-146-T6-2542	124	9
F	GE11-P9CUB404-12GZ-100T-146-T6-2543	80	9
G	GE11-P9CUB408-12GZ-100T-146-T6-2604	56	10
H	GE11-P9CUB380-12GZ-100T-146-T6-2605	156	10