Entergy Nuclear Northeast
Entergy Nuclear Operations, Inc.
James A. FitzPatrick NPP
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Lawrence M. Coyle
Site Vice President - JAF

JAFP-14-0047
May 1, 2014

United States Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

SUBJECT: Proposed Change to the James A. FitzPatrick Nuclear Power Plant's Technical Specification Concerning the Safety Limit Minimum Critical Power Ratio

James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
License No. DPR-59

REFERENCES:

1. GNF Additional Information Regarding the Requested Changes to the Technical Specification SLMCPR, FitzPatrick Cycle 22, Proprietary Version, GNF-PLM-000N6458-R0-P, dated March 2014
2. GNF Additional Information Regarding the Requested Changes to the Technical Specification SLMCPR, FitzPatrick Cycle 22, Non-Proprietary Version, GNF-PLM-000N6458-R0-NP, dated March 2014

Dear Sir or Madam:

Pursuant to 10 CFR 50.90, Entergy Nuclear Operations Inc. (ENO), hereby proposes to amend the James A. FitzPatrick Nuclear Power Plant (JAF) Facility Operating License (FOL), DPR-59, by incorporating the attached proposed change into the JAF Technical Specifications (TS). This proposed change provides revised values for the Safety Limit Minimum Critical Power Ratio (SLMCPR) for both single and dual recirculation loop operation.

Attachment 1 to this letter contains the application for amendment, the determination of no significant hazards consideration and the environmental impact assessment. Attachment 2 provides the marked-up version of the current FOL and TS pages. Attachment 3 contains the re-typed FOL and TS pages. Attachment 4 is a summary of the technical bases for the SLMCPR values and is considered proprietary information by Global Nuclear Fuels – Americas, LLC (GNF). In accordance with 10 CFR 2.390(b)(1), an affidavit attesting to the proprietary nature of the enclosed information and requesting withholding from public disclosure is included with Attachment 4. Attachment 5 is the same GNF summary with the proprietary information removed, and is provided for public disclosure.

JAF has reviewed the proposed Technical Specification change in accordance with 10 CFR 50.92 and concludes that the proposed change does not involve a significant hazards consideration.

JAF has evaluated the proposed amendment against the criteria of 10 CFR 51.22 for environmental considerations and believes that the proposed change is eligible for categorical exclusion from the requirements for an environmental review in accordance with 10 CFR 51.22(c)(9).

Regarding our proposed schedule for this amendment, we request your review and approval of the revised SLMCPR by October 20, 2014, with a 30-day implementation period, to coincide with start-up from our refueling outage.

This submittal contains no new regulatory commitments.

Questions concerning this amendment application may be addressed to Mr. Chris M. Adner, Regulatory Assurance Manager, at (315) 349-6766.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on the 1st day of May 2014.

Sincerely,

Lawrence M. Coyle
Site Vice President - JAF

LMC/CA/ds

Attachments:
1. Application for Amendment to Modify the Technical Specifications Requirements Concerning the Safety Limit Minimum Critical Power Ratio
2. Proposed Technical Specification Changes (on current marked-up page)
3. Proposed Technical Specification Changes (on typed final format page)
4. GNF Additional Information Regarding the Requested Changes to the Technical Specification SLMCPR, FitzPatrick Cycle 22, GNF-PLM-000N6458-R0-P, dated March 2014 (Proprietary Version with Affidavit)
5. GNF Additional Information Regarding the Requested Changes to the Technical Specification SLMCPR, FitzPatrick Cycle 22, GNF-PLM-000N6458-R0-NP, dated March 2014 (Non-Proprietary Version)

cc: next page

Attachment 4 to this letter contains Proprietary Information that should be withheld from public disclosure per 10 CFR 2.390. When separated from Attachment 4 there are no withholding criteria.

cc:

Regional Administrator, Region I
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Attachment 1

Application for Amendment to Modify the Technical Specifications Requirements Concerning the Safety Limit Minimum Critical Power Ratio

(3 Pages)

Application for Amendment to Modify the Technical Specifications Requirements Concerning the Safety Limit Minimum Critical Power Ratio

Description of the Proposed Change

Pursuant to 10 CFR 50.90, Entergy Nuclear Operations Inc. (ENO), proposes to amend the James A. FitzPatrick Nuclear Power Plant (JAF) Technical Specifications (TS) Section 2.1.1.2, Safety Limit Minimum Critical Power Ratio (SLMCPR). The proposed changes to the Technical Specifications are as follows:

Page 2.0-1, Specification 2.1.1.2 – Replace the listed SLMCPR values of 1.08 for two recirculation loop operation (TLO) and 1.11 for single recirculation loop operation (SLO) with new values of 1.10 and 1.13 respectively.

Reason for the Proposed Change

The current SLMCPR values for TLO and SLO contained in the JAF Technical Specifications (1.08 and 1.11, respectively) are not applicable for the upcoming operating cycle due to core loading design changes. Based upon the core loading, the cycle specific SLMCPR values were determined to be 1.10 for TLO and 1.13 for SLO.

Safety Assessment of Proposed Change

The purpose of the SLMCPR is to ensure that specified acceptable fuel design limits are not exceeded during steady state operation and analyzed transients. The fuel cladding is one of the physical barriers that separate the radioactive materials from the environment. The integrity of this cladding barrier is related to its relative freedom from perforations or cracking. Fuel cladding perforations can result from thermal stresses, which can occur from reactor operation significantly above design conditions. 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 have been used to mark the beginning of the region in which fuel cladding damage could occur. Although it is recognized that the onset of transition boiling would not result in damage to the BWR fuel rod cladding, the critical power at which boiling transition is calculated to occur has been adopted as a convenient and conservative limit. However, the uncertainties in monitoring the core operating state and in the procedures used to calculate the critical power, result in an uncertainty in the value of the critical power. Therefore, the SLMCPR is defined as the critical power ratio in the limiting fuel assembly (with margin) for which more than 99.9% of the fuel rods in the core are expected to avoid boiling transition, considering the power distribution within the core and all uncertainties.

The revised SLMCPR for JAF was determined using cycle-specific fuel and core parameters, with NRC approved methodology, as discussed in Attachment 4 (GNF Additional Information Regarding the Requested Changes to the Technical Specification SLMCPR) and Attachment 5 (a non-proprietary version of GNF summary). Analysis of the limiting Abnormal Operational Transients (AOT) provides the allowed operating conditions in terms of MCPR during the fuel cycle such that if an event were to occur, the transient MCPR would not be less than the SLMCPR. The SLMCPR value for SLO is increased to account for the increased core flow and random effective TIP reading uncertainties.

Application for Amendment to Modify the Technical Specifications Requirements Concerning the Safety Limit Minimum Critical Power Ratio

No plant hardware or operational changes are required with this proposed change.

Determination Of No Significant Hazards Considerations

Pursuant to 10 CFR 50.92, JAF has reviewed the proposed change and concludes that the change does not involve a significant hazards consideration since the proposed change satisfies the criteria in 10 CFR 50.92(c). These criteria require that operation of the facility in accordance with the proposed amendment will not: (1) involve a significant increase in the probability or consequences of an accident previously evaluated, (2) create the possibility of a new or different kind of accident from any accident previously evaluated, or (3) involve a significant reduction in a margin of safety. The discussion below addresses each of these criteria and demonstrates that the proposed amendment does not constitute a significant hazard.

The proposed change does not involve a significant hazards consideration because:

1. The operation of JAF in accordance with the proposed amendment will 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 SLMCPR values preserve the existing margin to transition boiling and probability of fuel damage is not increased. The derivation of the revised SLMCPR for JAF, for incorporation into the Technical Specifications and its use to determine plant and cycle-specific thermal limits, has 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.

   Based on the above, JAF has concluded that the proposed change will not result in a significant increase in the probability or consequences of an accident previously evaluated.

2. The operation of JAF in accordance with the proposed amendment will not create the possibility of a new or different kind of accident from any accident previously evaluated.

   The proposed changes result only from a specific analysis for the JAF core reload design. These changes do not involve any new or different methods for operating the facility. No new initiating events or transients result from these changes.

   Based on the above, JAF has concluded that the proposed change will not create the possibility of a new or different kind of accident from those previously evaluated.

Application for Amendment to Modify the Technical Specifications Requirements Concerning the Safety Limit Minimum Critical Power Ratio

3. The operation of JAF in accordance with the proposed amendment will not involve a significant reduction in a margin of safety.

   The new SLMCPR is calculated using NRC approved methods with plant and cycle specific parameters for the current core design. The SLMCPR value remains conservative enough 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.

   As a result, JAF has determined that the proposed change will not result in a significant reduction in a margin of safety.

   On the basis of the above, JAF has determined that operation of the facility in accordance with the proposed change does not involve a significant hazards consideration as defined in 10 CFR 50.92(c), in that it: (1) does not involve a significant increase in the probability or consequences of an accident previously evaluated; (2) does not create the possibility of a new or different kind of accident from any accident previously evaluated; and (3) does not involve a significant reduction in a margin of safety.

ENVIRONMENTAL IMPACT

The proposed Technical Specification changes were reviewed against the criteria of 10 CFR 51.22 for environmental considerations. The proposed changes do not involve a significant hazards consideration, a significant increase in the amounts of effluents that may be released offsite, or a significant increase in individual or cumulative occupational radiation exposure. Based on the foregoing, Entergy concludes the proposed Technical Specifications meet the criteria in 10 CFR 51.22(c)(9) for a categorical exclusion from the requirements for an Environmental Impact Statement.

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Attachment 2

Proposed Technical Specification Changes
(on current marked-up page)

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(4) ENO pursuant to the Act and 10 CFR Parts 30, 40, and 70 to receive, possess, and use, at any time, any byproduct, source and special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration; or associated with radioactive apparatus, components or tools..

(5) Pursuant to the Act and 10 CFR Parts 30 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility.

C. This renewed operating license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations in 10 CFR Chapter I: Part 20, Section 30.34 of Part 30, Section 40.41 of Part 40, Sections 50.54 and 50.59 of Part 50, and Section 70.32 of Part 70; and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

ENO is authorized to operate the facility at steady state reactor core power levels not in excess of 2536 megawatts (thermal).

(2) Technical Specifications

The Technical Specifications contained in Appendix A , as revised through Amendment No. ~~304~~, are hereby incorporated in the renewed operating license. The licensee shall operate the facility in accordance with the Technical Specifications.

(3) Fire Protection

ENO shall implement and maintain in effect all provisions of the approved fire protections program as described in the Final Safety Analysis Report for the facility and as approved in the SER dated November 20, 1972; the SER Supplement No. 1 dated February 1, 1973; the SER Supplement No. 2 dated October 4, 1974; the SER dated August 1, 1979; the SER Supplement dated October 3, 1980; the SER Supplement dated February 13, 1981; the NRC Letter dated February 24, 1981; Technical Specification Amendments 34 (dated January 31, 1978), 80 (dated May 22, 1984), 134 (dated July 19, 1989), 135 (dated September 5, 1989), 142 (dated October 23, 1989), 164 (dated August 10, 1990), 176 (dated January 16, 1992), 177 (dated February 10, 1992), 186 (dated February 19, 1993), 190 (dated June 29, 1993), 191 (dated July 7, 1993), 206 (dated February 28, 1994) and 214 (dated June 27, 1994); and NRC Exemptions and associated safety evaluations dated April 26, 1983, July 1, 1983, January 11, 1985, April 30, 1986, September 15, 1986 and September 10, 1992 subject to the following provision:

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~~ 1.10 for two recirculation loop operation

or

≥ ~~1.11~~ 1.13 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.

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Attachment 3

Proposed Technical Specification Changes
(on typed final format page)

Pages

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(4) ENO pursuant to the Act and 10 CFR Parts 30, 40, and 70 to receive, possess, and use, at any time, any byproduct, source and special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration; or associated with radioactive apparatus, components or tools..

(5) Pursuant to the Act and 10 CFR Parts 30 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility.

C. This renewed operating license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations in 10 CFR Chapter I: Part 20, Section 30.34 of Part 30, Section 40.41 of Part 40, Sections 50.54 and 50.59 of Part 50, and Section 70.32 of Part 70; and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

ENO is authorized to operate the facility at steady state reactor core power levels not in excess of 2536 megawatts (thermal).

(2) Technical Specifications

The Technical Specifications contained in Appendix A , as revised through Amendment No. , are hereby incorporated in the renewed operating license. The licensee shall operate the facility in accordance with the Technical Specifications.

(3) Fire Protection

ENO shall implement and maintain in effect all provisions of the approved fire protections program as described in the Final Safety Analysis Report for the facility and as approved in the SER dated November 20, 1972; the SER Supplement No. 1 dated February 1, 1973; the SER Supplement No. 2 dated October 4, 1974; the SER dated August 1, 1979; the SER Supplement dated October 3, 1980; the SER Supplement dated February 13, 1981; the NRC Letter dated February 24, 1981; Technical Specification Amendments 34 (dated January 31, 1978), 80 (dated May 22, 1984), 134 (dated July 19, 1989), 135 (dated September 5, 1989), 142 (dated October 23, 1989), 164 (dated August 10, 1990), 176 (dated January 16, 1992), 177 (dated February 10, 1992), 186 (dated February 19, 1993), 190 (dated June 29, 1993), 191 (dated July 7, 1993), 206 (dated February 28, 1994) and 214 (dated June 27, 1994); and NRC Exemptions and associated safety evaluations dated April 26, 1983, July 1, 1983, January 11, 1985, April 30, 1986, September 15, 1986 and September 10, 1992 subject to the following provision:

2.0 SAFETY LIMITS (SLs)

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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 ≥ 1.10 for two recirculation loop operation or ≥ 1.13 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.

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Attachment 5

GNF Additional Information Regarding the Requested Changes to the Technical Specification SLMCPR, FitzPatrick Cycle 22, GNF-PLM-000N6458-R0-NP, dated March 2014

(Non-Proprietary Version)

(25 Pages)

Global Nuclear Fuel

GNF-PLM-000N6458-R0-NP
PLM 000N6458 R1
March 2014

Non-Proprietary Information – Class I (Public)

GNF Additional Information Regarding the Requested Changes to the Technical Specification SLMCPR

FitzPatrick Cycle 22

Information Notice

This is a non-proprietary version of the document GNF-PLM-000N6458-R0-P, Revision 0, which has the proprietary information removed. Portions of the document that have been removed are indicated by an open and closed bracket as shown here [[ ]].

Important Notice Regarding Contents of this Report

Please Read Carefully

The design, engineering, and other information contained in this document is furnished for the purpose of supporting Entergy in proceedings before the U.S. Nuclear Regulatory Commission. The only undertakings of GNF-A with respect to information in this document are contained in contracts between GNF-A and its customers, and nothing contained in this document shall be construed as changing those contracts. The use of this information by anyone for any purposes other than those for which it is intended is not authorized; and with respect to any unauthorized use, GNF-A makes no representation or warranty, and assumes no liability as to the completeness, accuracy, or usefulness of the information contained in this document.

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1.0 Methodology

Global Nuclear Fuel (GNF) performs Safety Limit Minimum Critical Power Ratio (SLMCPR) calculation in accordance to NEDE-24011-P-A "General Electric Standard Application for Reactor Fuel," Revision 20 (Reference 1) using the following Nuclear Regulatory Commission (NRC)-approved methodologies and uncertainties:

- NEDC-32601P-A "Methodology and Uncertainties for Safety Limit MCPR Evaluations," August 1999. (Reference 2)
- NEDC-32694P-A "Power Distribution Uncertainties for Safety Limit MCPR Evaluations," August 1999 (Reference 3)
- NEDC-32505P-A "R-Factor Calculation Method for GE11, GE12 and GE13 Fuel," Revision 1, July 1999. (Reference 4)

Table 2 identifies the actual methodologies used for the FitzPatrick Cycle 21 and the Cycle 22 SLMCPR calculations.

2.0 Discussion

In this discussion, the Two Loop Operation (TLO) nomenclature is used for two recirculation loops in operation, and the Single Loop Operation (SLO) nomenclature is used for one recirculation loop in operation.

2.1. Major Contributors to SLMCPR Change

In general, the calculated safety limit is dominated by two key parameters: (1) flatness of the core bundle-by-bundle Minimum Critical Power Ratio (MCPR) distribution, and (2) flatness of the bundle pin-by-pin power/R-Factor distribution. Greater flatness in either parameter yields more rods susceptible to boiling transition and thus a higher calculated SLMCPR. MCPR Importance Parameter (MIP) measures the core bundle-by-bundle MCPR distribution and R-Factor Importance Parameter (RIP) measures the bundle pin-by-pin power/R-Factor distribution. The effect of the fuel loading pattern on the calculated TLO SLMCPR using rated core power and rated core flow conditions has been correlated to the parameter MIPRIP, which combines the MIP and RIP values.

Table 3 presents the MIP and RIP parameters for the previous cycle and the current cycle along with the TLO SLMCPR estimate using the MIPRIP correlation. If the minimum core flow case is applicable, the TLO SLMCPR estimate is also provided for that case although the MIPRIP correlation is only applicable to the rated core flow case. This is done only to provide some reasonable assessment basis of the minimum core flow case trend. In addition, Table 3 presents estimated effects on the TLO SLMCPR due to methodology deviations, penalties, and/or uncertainty deviations from approved values. Based on the MIPRIP correlation and any effects due to deviations from approved values, a final estimated TLO SLMCPR is determined. Table 3 also provides the actual calculated Monte Carlo SLMCPRs. Given the bias and uncertainty in the MIPRIP correlation [[ ]] and the inherent variation in the Monte Carlo results [[ ]], the change in the FitzPatrick Cycle 22 calculated Monte

Carlo TLO SLMCPR using rated core power and rated core flow conditions is consistent with the corresponding estimated TLO SLMCPR value.

The intent of the final estimated TLO SLMCPR is to provide an estimate to check the reasonableness of the Monte Carlo result. It is not used for any other purpose. The methodology and final SLMCPR is based on the rigorous Monte Carlo analysis.

The items in Table 3 that result in the increase of the estimated SLMCPR are discussed in Section 2.2.

2.2. Deviations in NRC-Approved Uncertainties

Tables 4 and 5 provide a list of NRC-approved uncertainties along with values actually used. A discussion of deviations from these NRC-approved values follows; all of which are conservative relative to NRC-approved values. Also, the estimated effect on the SLMCPR is provided in Table 3 for each deviation.

2.2.1. R-Factor

At this time, GNF has generically increased the GEXL R-Factor uncertainty from [[ ]] to account for an increase in channel bow due to the emerging unforeseen phenomena called control blade shadow corrosion-induced channel bow, which is not accounted for in the channel bow uncertainty component of the approved R-Factor uncertainty. The step "σ RPEAK" in Figure 4.1 from NEDC-32601P-A (Reference 2), which has been provided for convenience in Figure 3 of this attachment, is affected by this deviation. Reference 5 technically justifies that a GEXL R-Factor uncertainty of [[ ]] accounts for a channel bow uncertainty of up to [[ ]].

FitzPatrick has experienced control blade shadow corrosion-induced channel bow to the extent that an increase in the NRC-approved R-Factor uncertainty [[ ]] is deemed prudent to address its effect. Accounting for the control blade shadow corrosion-induced channel bow, the FitzPatrick Cycle 22 analysis shows an expected channel bow uncertainty of [[ ]], which is bounded by a GEXL R-Factor uncertainty of [[ ]]. Thus the use of a GEXL R-Factor uncertainty of [[ ]] adequately accounts for the expected control blade shadow corrosion-induced channel bow for FitzPatrick Cycle 22.

2.2.2. Core Flow Rate and Random Effective TIP Reading

In Reference 6 GNF committed to the expansion of the state points used in the determination of the SLMCPR. Consistent with the Reference 6 commitments, GNF performs analyses at the rated core power and minimum licensed core flow point in addition to analyses at the rated core power and rated core flow point. The approved SLMCPR methodology is applied at each state point that is analyzed.

For the TLO calculations performed at 79.8% core flow, the approved uncertainty values for the core flow rate (2.5%) and the random effective TIP reading (1.2%) are conservatively adjusted by dividing them by 79.8/100. The steps "σ CORE FLOW" and "σ TIP (INSTRUMENT)" in

Figure 4.1 from NEDC-32601P-A (Reference 2), which has been provided for convenience in Figure 3 of this attachment, are affected by this deviation, respectively.

Historically, these values have been construed to be somewhat dependent on the core flow conditions as demonstrated by the fact that higher values have always been used when performing SLO calculations. It is for this reason that GNF determined that it is appropriate to consider an increase in these two uncertainties when the core flow is reduced. The amount of increase is determined in a conservative way. For both parameters it is assumed that the absolute uncertainty remains the same as the flow is decreased so that the percentage uncertainty increases inversely proportional to the change in core flow. This is conservative relative to the core flow uncertainty because the variability in the absolute flow is expected to decrease somewhat as the flow decreases. For the random effective TIP uncertainty, there is no reason to believe that the percentage uncertainty should increase as the core flow decreases for TLO. Nevertheless, this uncertainty is also increased as is done in the more extreme case for SLO primarily to preserve the historical precedent established by the SLO evaluation. Note that the TLO condition is different than the SLO condition because for TLO there is no expected tilting of the core radial power shape.

The treatment of the core flow and random effective TIP reading uncertainties is based on the assumption that the signal to noise ratio deteriorates as core flow is reduced. GNF believes this is conservative and may in the future provide justification that the original uncertainties (non-flow dependent) are adequately bounding.

The core flow and random TIP reading uncertainties used in the SLO minimum core flow SLMCPR analysis remain the same as in the rated core flow SLO SLMCPR analysis because these uncertainties (which are substantially larger than used in the TLO analysis) already account for the effects of operating at reduced core flow.

2.3. Departure from NRC-Approved Methodology

No departures from NRC-approved methodologies were used in the FitzPatrick Cycle 22 SLMCPR calculations.

2.4. Fuel Axial Power Shape Penalty

At this time, GNF has determined that higher uncertainties and non-conservative biases in the GEXL correlations for the various types of axial power shapes (i.e., inlet, cosine, outlet and double hump) could potentially exist relative to the NRC-approved methodology values (References 7, 8, 9 and 10). The following table identifies, by marking with an "X", this potential for each GNF product line currently being offered:

[[				
				]]

Axial bundle power shapes corresponding to the limiting SLMCPR control blade patterns are determined using the PANACEA 3D core simulator. These axial power shapes are classified in accordance with the following table:

[[	

]]

If the limiting bundles in the SLMCPR calculation exhibit an axial power shape identified by this table, GNF penalizes the GEXL critical power uncertainties to conservatively account for the effect of the axial power shape. Table 6 provides a list of the GEXL critical power uncertainties determined in accordance to the NRC-approved methodology contained in NEDE-24011-P-A (Reference 1) along with values actually used.

For the limiting bundles, the fuel axial power shapes in the SLMCPR analysis were examined to determine the presence of axial power shapes identified in the above table. These power shapes were not found; therefore, no power shape penalties were applied to the calculated FitzPatrick Cycle 22 SLMCPR values.

2.5. Methodology Restrictions

The four restrictions identified on page 3 of NRC's Safety Evaluation (SE) relating to the General Electric Licensing Topical Reports NEDC-32601P (Reference 2), NEDC-32694P (Reference 3), and Amendment 25 to NEDE-24011-P-A (Reference 1) are addressed in References 11, 12, 7, and 13.

The four restrictions for GNF2 were determined to be acceptable by the NRC review of "GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II), NEDC-33270P, Revision 0," (Reference 14). Specifically, in the NRC audit report (Reference 15) for the said document, Section 3.4.1 page 59 states:

> "The NRC staff's SE of NEDC-32694P-A (Reference 19 of NEDC-33270P) provides four actions to follow whenever a new fuel design is introduced. These four conditions are listed in Section 3.0 of the SE. The analysis and evaluation of the GNF2 fuel design was evaluated in accordance with the limitations and conditions stated in the NRC staff's SE, and is acceptable."

GNF's position is that GNF2 is an evolutionary fuel product based on GE14. It is not considered a new fuel design as it maintains the previously established 10x10 array and two water rod makeup, as stated by the NRC audit report (Reference 15), Section 3.4.2.2.1, page 59:

> "The NRC staff finds that the calculational methods, evaluations and applicability of the OLMCPR and SLMCPR are in accordance with existing NRC-approved methods and thus valid for use with GNF2 fuel."

As such, no new GNF fuel designs are being introduced in FitzPatrick Cycle 22; therefore, the NEDC-32505P-A (Reference 4) statement "…if new fuel is introduced, GENE must confirm that the revised R-Factor method is still valid based on new test data" is not applicable.

2.6. Minimum Core Flow Condition

For FitzPatrick Cycle 22, the minimum core flow SLMCPR calculation performed at 79.8% core flow and rated core power condition was limiting as compared to the rated core flow and rated core power condition. At low core flows, the search spaces for the limiting rod pattern and the nominal rod pattern are essentially the same. Additionally, the condition that MIP [[ ]] establishes a reasonably bounding limiting rod pattern. Hence, the rod pattern used to calculate the SLMCPR at 100% rated power/79.8% rated flow reasonably assures that at least 99.9% of the fuel rods in the core would not be expected to experience boiling transition during normal operation or anticipated operational occurrences during the operation of FitzPatrick Cycle 22. Consequently, the SLMCPR value calculated from the 79.8% core flow and rated core power condition limiting MCPR distribution reasonably bounds this mode of operation for FitzPatrick Cycle 22.

2.7. Limiting Control Rod Patterns

The limiting control rod patterns used to calculate the SLMCPR reasonably assures that at least 99.9% of the fuel rods in the core would not be expected to experience boiling transition during normal operation or anticipated operational occurrences during the operation of FitzPatrick Cycle 22.

2.8. Core Monitoring System

For FitzPatrick Cycle 22, the 3D Monicore system will be used as the core monitoring system.

2.9. Power/Flow Map

The utility has provided the current and previous cycle power/flow map in a separate attachment.

2.10. Core Loading Diagram

Figures 1 and 2 provide the core-loading diagram for the current and previous cycle respectively, which are the Reference Loading Pattern as defined by NEDE-24011-P-A (Reference 1). Table 1 provides a description of the core.

2.11. Figure References

Figure 3 is Figure 4.1 from NEDC-32601P-A (Reference 2). Figure 4 is Figure III.5-1 from NEDC-32601P-A (Reference 2). Figure 5 is based on Figure III.5-2 from NEDC-32601P-A (Reference 2), and has been updated with GE14 and GNF2 data.

2.12. Additional SLMCPR Licensing Conditions

For FitzPatrick Cycle 22, no additional SLMCPR licensing conditions are included in the analysis.

2.13. 10 CFR Part 21 Evaluation

There are no known 10 Code of Federal Regulations (CFR) Part 21 factors that affect the FitzPatrick Cycle 22 SLMCPR calculations.

2.14. Summary

The requested changes to the Technical Specification SLMCPR values are 1.10 for TLO and 1.13 for SLO for FitzPatrick Cycle 22.

3.0 References

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52									16	16	14	16	16	12	16	14	16	16								
50								16	12	13	13	16	13	13	16	13	13	16	16							
48					12	16	16	14	14	16	17	17	19	19	17	17	16	14	14	16	12	12				
46				16	16	16	12	17	4	4	4	4	4	4	4	4	4	4	17	12	16	16	16			
44			16	16	17	16	4	4	19	3	17	3	20	20	3	17	3	19	4	4	16	17	16	16		
42			14	16	16	20	4	20	3	20	3	18	1	1	18	3	20	3	20	4	20	16	16	14		
40			16	12	4	4	20	3	18	3	18	1	18	18	1	18	3	18	3	20	4	4	12	16		
38		16	14	17	4	20	3	20	3	18	17	18	2	2	18	17	18	3	20	3	20	4	17	14	16	
36	16	12	14	4	19	3	18	3	20	3	20	2	20	20	2	20	3	20	3	18	3	19	4	14	16	16
34	16	14	16	4	3	20	3	18	3	20	2	19	2	2	19	2	20	3	18	3	20	3	4	16	14	16
32	13	13	17	4	17	3	18	17	20	2	20	2	18	18	2	20	2	20	17	18	3	17	4	17	13	13
30	16	16	17	4	3	18	1	18	2	19	2	20	14	14	20	2	19	2	18	1	18	3	4	17	16	16
28	14	13	19	4	20	1	18	2	20	2	18	14	20	20	14	18	2	20	2	18	1	20	4	19	13	14
26	14	13	19	4	20	1	18	2	20	2	18	14	20	20	14	18	2	20	2	18	1	20	4	19	13	14
24	16	16	17	4	3	18	1	18	2	19	2	20	14	14	20	2	19	2	18	1	18	3	4	17	16	16
22	14	13	17	4	17	3	18	17	20	2	20	2	18	18	2	20	2	20	17	18	3	17	4	17	13	16
20	16	14	16	4	3	20	3	18	3	20	2	19	2	2	19	2	20	3	18	3	20	3	4	16	14	16
18	16	12	14	4	19	3	18	3	20	3	20	2	20	20	2	20	3	20	3	18	3	19	4	14	12	16
16		16	14	17	4	20	3	20	3	18	17	18	2	2	18	17	18	3	20	3	20	4	17	14	16	
14			16	12	4	4	20	3	18	3	18	1	18	18	1	18	3	18	3	20	4	4	12	16		
12			14	16	16	20	4	20	3	20	3	18	1	1	18	3	20	3	20	4	20	16	16	14		
10			16	16	17	16	4	4	19	3	17	3	20	20	3	17	3	19	4	4	16	17	16	16		
8				16	16	16	12	17	4	4	4	4	4	4	4	4	4	4	17	12	16	16	16			
6					12	16	16	14	14	16	17	17	19	19	17	17	16	14	14	16	16	12				
4								16	12	13	13	16	13	13	16	13	13	12	16							
2									16	16	16	16	13	16	16	14	13	16								
	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51

Fuel Type			
1=GNF2-P10DG2B371-14GZ-100T2-150-T6-4280	(Cycle 22)	14=GNF2-P10DG2B404-12GZ-100T2-150-T6-3297	(Cycle 20)
2=GNF2-P10DG2B378-16GZ-100T2-150-T6-4281	(Cycle 22)	16=GNF2-P10DG2B390-14GZ-100T2-150-T6-3300	(Cycle 20)
3=GNF2-P10DG2B378-14GZ-100T2-150-T6-4282	(Cycle 22)	17=GNF2-P10DG2B404-12GZ-100T2-150-T6-3297	(Cycle 21)
4=GNF2-P10DG2B408-13G5.0-100T2-150-T6-4283	(Cycle 22)	18=GNF2-P10DG2B378-16GZ-100T2-150-T6-3299	(Cycle 21)
12=GNF2-P10DG2B378-16GZ-100T2-150-T6-3299	(Cycle 20)	19=GNF2-P10DG2B390-14GZ-100T2-150-T6-3300	(Cycle 21)
13=GNF2-P10DG2B380-16GZ-100T2-150-T6-3298	(Cycle 20)	20=GNF2-P10DG2B388-14GZ-100T2-150-T6-4114	(Cycle 21)

Figure 1. Current Cycle Core Loading Diagram

52									9	8	10	9	9	7	9	8	8	7								
50								8	10	7	7	7	6	6	7	7	7	7	7							
48					8	7	9	9	7	14	16	13	16	16	13	16	14	9	10	9	10	8				
46				10	9	7	7	16	17	17	14	17	14	14	17	14	17	17	16	9	7	9	10			
44			9	7	9	12	16	20	19	13	20	19	19	19	19	20	13	19	20	16	12	9	7	8		
42			10	7	12	17	17	17	16	20	14	18	16	16	18	14	20	16	17	17	17	12	9	10		
40			7	9	16	17	20	13	18	16	18	12	18	18	12	18	16	18	13	20	17	16	9	7		
38		10	9	16	20	17	16	20	16	18	12	18	16	16	18	12	18	16	20	16	17	20	16	7	7	
36	9	10	7	17	19	16	18	16	20	16	20	16	20	20	16	20	16	20	16	18	16	19	17	7	10	9
34	8	7	14	17	13	20	16	18	16	20	12	18	16	16	18	12	20	16	18	16	20	13	17	14	7	8
32	8	7	16	14	20	13	18	16	20	12	20	16	20	20	16	20	12	20	16	18	13	20	14	16	7	9
30	7	7	13	17	19	18	12	18	12	18	16	20	14	14	20	16	18	12	18	12	18	19	17	13	7	7
28	7	6	16	14	19	14	18	16	20	16	20	14	7	7	14	20	16	20	16	18	14	19	14	16	6	8
26	8	7	16	14	19	14	18	16	20	16	20	14	7	7	14	20	16	20	16	18	14	19	14	16	9	10
24	8	7	13	17	19	18	12	18	12	18	16	20	14	14	20	16	18	12	18	12	18	19	17	13	7	8
22	7	8	16	14	20	13	18	16	20	12	20	16	20	20	16	20	12	20	16	18	13	20	14	16	7	8
20	8	7	14	17	13	20	16	18	16	20	12	18	16	16	18	12	20	16	18	16	20	13	17	14	7	9
18	9	10	7	17	19	16	18	16	20	16	20	16	20	20	16	20	16	20	16	18	16	19	17	7	10	9
16		7	10	16	20	17	16	20	16	18	12	18	16	16	18	12	18	16	20	16	17	20	16	9	7	
14			7	9	16	17	20	13	18	16	18	12	18	18	12	18	16	18	13	20	17	16	7	7		
12			10	9	12	17	17	17	16	20	14	18	16	16	18	14	20	16	17	17	17	12	9	10		
10			8	7	7	12	16	20	19	13	20	19	19	19	19	20	13	19	20	16	12	9	7	9		
8				10	7	7	6	16	17	17	14	17	14	14	17	14	17	17	16	6	7	7	8			
6					10	10	6	9	9	14	16	13	16	16	13	16	14	9	6	9	10	9				
4								7	10	7	7	7	7	7	7	10	7	7	7							
2									9	8	8	9	9	10	8	8	8	9								
	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51

Fuel Type			
6=GNF2-P10DG2B377-13GZ-100T2-150-T6-3073	(Cycle 19)	14=GNF2-P10DG2B404-12GZ-100T2-150-T6-3297	(Cycle 20)
7=GNF2-P10DG2B379-14GZ-100T2-150-T6-3074	(Cycle 19)	16=GNF2-P10DG2B390-14GZ-100T2-150-T6-3300	(Cycle 20)
8=GNF2-P10DG2B396-15GZ-100T2-150-T6-3075	(Cycle 19)	17=GNF2-P10DG2B404-12GZ-100T2-150-T6-3297	(Cycle 21)
9=GNF2-P10DG2B407-6G6.0/6G5.0-100T2-150-T6-3076	(Cycle 19)	18=GNF2-P10DG2B378-16GZ-100T2-150-T6-3299	(Cycle 21)
10=GNF2-P10DG2B394-13GZ-100T2-150-T6-3077	(Cycle 19)	19=GNF2-P10DG2B390-14GZ-100T2-150-T6-3300	(Cycle 21)
12=GNF2-P10DG2B378-16GZ-100T2-150-T6-3299	(Cycle 20)	20=GNF2-P10DG2B388-14GZ-100T2-150-T6-4114	(Cycle 21)
13=GNF2-P10DG2B380-16GZ-100T2-150-T6-3298	(Cycle 20)		

Figure 2. Previous Cycle Core Loading Diagram

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Figure 3. Figure 4.1 from NEDC-32601P-A

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Figure 4. Figure III.5-1 from NEDC-32601P-A

[[

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Figure 5. Relationship Between MIP and CPR Margin

Table 1. Description of Core

Description	Previous Cycle Minimum Core Flow Limiting Case	Previous Cycle Rated Core Flow Limiting Case	Current Cycle Minimum Core Flow Limiting Case	Current Cycle Rated Core Flow Limiting Case
Number of Bundles in the Core	560		560	
Limiting Cycle Exposure Point (i.e., Beginning of Cycle (BOC)/Middle of Cycle (MOC)/End of Cycle (EOC))	EOC	EOC	EOC	EOC
Cycle Exposure at Limiting Point (MWd/STU)	11,909	11,909	12,000	12,000
% Rated Core Flow	79.8	100	79.8	100
Reload Fuel Type	GNF2		GNF2	
Latest Reload Batch Fraction, %	35.0		32.9	
Latest Reload Average Batch Weight % Enrichment	3.89		3.88	
Core Fuel Fraction: %GNF2	100%		100%	
Core Average Weight % Enrichment	3.90		3.89	

Table 2. SLMCPR Calculation Methodologies

Description	Previous Cycle Minimum Core Flow Limiting Case	Previous Cycle Rated Core Flow Limiting Case	Current Cycle Minimum Core Flow Limiting Case	Current Cycle Rated Core Flow Limiting Case
Non-Power Distribution Uncertainty	NEDC-32601P-A		NEDC-32601P-A	
Power Distribution Methodology	NEDC-32694P-A		NEDC-32694P-A	
Power Distribution Uncertainty	NEDC-32694P-A		NEDC-32694P-A	
Core Monitoring System	3DMONICORE		3DMONICORE	
R-Factor Calculation Methodology	NEDC-32505P-A		NEDC-32505P-A	

Table 3. Monte Carlo Calculated SLMCPR vs. Estimate

Description	Previous Cycle Minimum Core Flow Limiting Case	Previous Cycle Rated Core Flow Limiting Case	Current Cycle Minimum Core Flow Limiting Case	Current Cycle Rated Core Flow Limiting Case
[[				

Table 3. Monte Carlo Calculated SLMCPR vs. Estimate

Description	Previous Cycle Minimum Core Flow Limiting Case	Previous Cycle Rated Core Flow Limiting Case	Current Cycle Minimum Core Flow Limiting Case	Current Cycle Rated Core Flow Limiting Case
				]]

Table 4. Non-Power Distribution Uncertainties

	Nominal (NRC-Approved) Value ± σ (%)	Previous Cycle Minimum Core Flow Limiting Case	Previous Cycle Rated Core Flow Limiting Case	Current Cycle Minimum Core Flow Limiting Case	Current Cycle Rated Core Flow Limiting Case
GETAB					
Feedwater Flow Measurement	1.76	N/A	N/A	N/A	N/A
Feedwater Temperature Measurement	0.76	N/A	N/A	N/A	N/A
Reactor Pressure Measurement	0.50	N/A	N/A	N/A	N/A
Core Inlet Temperature Measurement	0.20	N/A	N/A	N/A	N/A
Total Core Flow Measurement	6.0 SLO/2.5 TLO	N/A	N/A	N/A	N/A
Channel Flow Area Variation	3.0	N/A	N/A	N/A	N/A
Friction Factor Multiplier	10.0	N/A	N/A	N/A	N/A
Channel Friction Factor Multiplier	5.0	N/A	N/A	N/A	N/A

Table 4. Non-Power Distribution Uncertainties

	Nominal (NRC-Approved) Value ± σ (%)	Previous Cycle Minimum Core Flow Limiting Case	Previous Cycle Rated Core Flow Limiting Case	Current Cycle Minimum Core Flow Limiting Case	Current Cycle Rated Core Flow Limiting Case
NEDC-32601P-A					
Feedwater Flow Measurement	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Feedwater Temperature Measurement	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Reactor Pressure Measurement	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Core Inlet Temperature Measurement	0.2	0.2	0.2	0.2	0.2
Total Core Flow Measurement	6.0 SLO/2.5 TLO	6.0 SLO/3.1 TLO	6.0 SLO/2.5 TLO	6.0 SLO/3.1 TLO	6.0 SLO/2.5 TLO
Channel Flow Area Variation	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Friction Factor Multiplier	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Channel Friction Factor Multiplier	5.0	5.0	5.0	5.0	5.0

Table 5. Power Distribution Uncertainties

Description	Nominal (NRC-Approved) Value ± σ (%)	Previous Cycle Minimum Core Flow Limiting Case	Previous Cycle Rated Core Flow Limiting Case	Current Cycle Minimum Core Flow Limiting Case	Current Cycle Rated Core Flow Limiting Case
GETAB/NEDC-32601P-A					
GEXL R-Factor	[[ ]]	N/A	N/A	N/A	N/A
Random Effective TIP Reading	2.85 SLO/1.2 TLO	N/A	N/A	N/A	N/A
Systematic Effective TIP Reading	8.6	N/A	N/A	N/A	N/A
NEDC-32694P-A, 3DMONICORE					
GEXL R-Factor	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Random Effective TIP Reading	2.85 SLO/1.2 TLO	2.85 SLO/1.5 TLO	2.85 SLO/1.2 TLO	2.85 SLO/1.5 TLO	2.85 SLO/1.2 TLO
TIP Integral	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Four Bundle Power Distribution Surrounding TIP Location	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Contribution to Bundle Power Uncertainty Due to Local Power Range Monitor (LPRM) Update	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]

Table 5. Power Distribution Uncertainties

Description	Nominal (NRC-Approved) Value ± σ (%)	Previous Cycle Minimum Core Flow Limiting Case	Previous Cycle Rated Core Flow Limiting Case	Current Cycle Minimum Core Flow Limiting Case	Current Cycle Rated Core Flow Limiting Case
Contribution to Bundle Power Due to Failed TIP	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Contribution to Bundle Power Due to Failed LPRM	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Total Uncertainty in Calculated Bundle Power	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Uncertainty of TIP Signal Nodal Uncertainty	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]

Table 6. Critical Power Uncertainties

Description	Nominal Value ± σ (%)	Previous Cycle Minimum Core Flow Limiting Case	Previous Cycle Rated Core Flow Limiting Case	Current Cycle Minimum Core Flow Limiting Case	Current Cycle Rated Core Flow Limiting Case
			[[		
					]]