Exelon Generation

200 Exelon Way
Kennett Square, PA 19348

www.exeloncorp.com

INCLUDES PROPRIETARY INFORMATION – WITHHOLD UNDER 10 CFR 2.390
Unrestricted Upon Removal of Attachment 3

10 CFR 50.90

December 16, 2016

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

Limerick Generating Station, Unit 2
Renewed Facility Operating License No. NPF-85
NRC Docket No. 50-353

Subject: License Amendment Request - Safety Limit Minimum Critical Power Ratio Change

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," Exelon Generation Company, LLC (EGC) requests a proposed change to modify Technical Specifications (TS) 2.1 ("Safety Limits"). Specifically, this change incorporates revised Safety Limit Minimum Critical Power Ratios (SLMCPRs) due to the cycle specific analysis performed by Global Nuclear Fuel for Limerick Generating Station (LGS), Unit 2, Cycle 15.

The proposed changes have been reviewed by the Limerick Generating Station Plant Operations Review Committee in accordance with the requirements of the EGC Quality Assurance Program.

In order to support the upcoming refueling outage in Spring 2017 (Li2R14) for LGS, Unit 2, EGC requests approval of the proposed amendment by April 1, 2017. Once approved, this amendment shall be implemented prior to startup from the refueling outage.

There are no commitments contained within this letter.

There are five attachments to this letter. Attachment 1 contains the evaluation of the proposed changes. Attachment 2 provides the marked up TS page. Attachment 3 (letter from William C. Cline (Global Nuclear Fuel) to A. Johnson (Exelon Generation Company, LLC), 003N9595-R1-P dated November 18, 2016) specifies the new SLMCPRs for LGS, Unit 2, Cycle 15. Attachment 3 contains information proprietary to Global Nuclear Fuel. Global Nuclear Fuel requests that the document be withheld from public disclosure in

INCLUDES PROPRIETARY INFORMATION – WITHHOLD UNDER 10 CFR 2.390
Unrestricted Upon Removal of Attachment 3

accordance with 10 CFR 2.390. Attachment 4 contains a non-proprietary version of the Global Nuclear Fuel document, 003N9595-R1-NP. An affidavit supporting this request is contained in Attachment 5.

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), Exelon is notifying the Commonwealth of Pennsylvania of this application for license amendment by transmitting a copy of this letter and its attachments to the designated State Official.

Should you have any questions concerning this letter, please contact Stephanie J. Hanson at (610) 765-5143.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 16th day of December 2016.

Respectfully,

D. P. Helker

David P. Helker
Manager, Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Attachments:
1. Evaluation of Proposed Changes
2. Markup of Proposed Technical Specifications Page
3. Proprietary Version of Global Nuclear Fuel Letter 003N9595-R1-P
4. Non-Proprietary Version of Global Nuclear Fuel Letter 003N9595-R1-NP
5. GNF Affidavit in Support of Request to Withhold Information

cc: USNRC Region I, Regional Administrator
USNRC Senior Resident Inspector, LGS
USNRC Project Manager, LGS
Director, Bureau of Radiation Protection - Pennsylvania Department of Environmental Protection (w/o Attachment 3)

ATTACHMENT 1

License Amendment Request

Limerick Generating Station, Unit 2

Docket No. 50-353

EVALUATION OF PROPOSED CHANGES

Subject: License Amendment Request - Safety Limit Minimum Critical Power Ratio Change

1.0 SUMMARY DESCRIPTION

This evaluation supports a request to amend Renewed Facility Operating License No. NPF-85 for Limerick Generating Station (LGS), Unit 2.

The proposed change modifies Technical Specification (TS) 2.1 ("Safety Limits"). Specifically, this change incorporates revised Safety Limit Minimum Critical Power Ratios (SLMCPRs) due to the cycle specific analysis performed by Global Nuclear Fuel for LGS, Unit 2, Cycle 15.

2.0 DETAILED DESCRIPTION

The proposed change involves revising the SLMCPRs contained in TS 2.1 for two recirculation loop operation and single recirculation loop operation. The SLMCPR value for two recirculation loop operation is being changed from ≥ 1.09 to ≥ 1.10. The SLMCPR value for single recirculation loop operation is being changed from ≥ 1.12 to ≥ 1.14.

Marked up TS page 2-1 showing the requested change is provided in Attachment 2.

3.0 TECHNICAL EVALUATION

The proposed TS change will revise the SLMCPRs contained in TS 2.1 for two recirculation loop operation and single recirculation loop operation to reflect the changes in the cycle specific analysis performed by Global Nuclear Fuel for LGS, Unit 2, Cycle 15.

The new SLMCPRs are calculated using NRC-approved methodology described in NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel," Revision 23 (Reference 1). A listing of the associated NRC-approved methodologies for calculating the SLMCPRs is provided in Section 3.0 ("Methodology") of Attachment 3.

The SLMCPR analysis establishes SLMCPR values that will ensure that during normal operation and during abnormal operational transients, at least 99.9% of all fuel rods in the core do not experience transition boiling if the limit is not violated. The SLMCPRs are calculated to include cycle specific parameters and, in general, are dominated by two key parameters: 1) flatness of the core bundle-by-bundle MCPR distribution, and 2) flatness of the bundle pin-by-pin power/R-Factor distribution. Information supporting the cycle specific SLMCPRs is included in Attachment 3. That attachment summarizes the methodology, inputs, and results for the change in the SLMCPRs. The LGS, Unit 2, Cycle 15, core will consist of GNF2 fuel as described in Table 2 of Attachment 3.

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

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

10 CFR 50.36, "Technical specifications," paragraph (c)(1), requires that power reactor facility TS include safety limits for process variables that protect the integrity of certain physical barriers that guard against the uncontrolled release of radioactivity. The SLMCPR analysis establishes SLMCPR values that will ensure that during normal operation and during abnormal operational transients, at least 99.9% of all fuel rods in the core do not experience transition boiling if the limit is not violated. Thus, the SLMCPR is required to be contained in TS.

4.2 Precedents

The NRC has approved similar SLMCPR changes for a number of plants:

1. Letter from Richard B. Ennis (U.S. Nuclear Regulatory Commission) to Exelon Nuclear, "Limerick Generating Station, Unit 1 – Issuance of Amendment Re: Safety Limit Minimum Critical Power Ratio Change (CAC NO. MF7101)," dated March 15, 2016. (ADAMS Accession No. ML16041A021)

2. Letter from Alan B. Wang (U.S. Nuclear Regulatory Commission) to Entergy Operations, Inc. "Grand Gulf Nuclear Station, Unit 1, Issuance of Amendment Regarding Technical Specification Section 2.1.1, Reactor Core SLS (TAC NO. MF5304)," dated August 18, 2015. (ADAMS Accession Nos. Proprietary ML15203A071, Non-Proprietary ML15229A213)

3. Letter from Robert Martin (U.S. Nuclear Regulatory Commission) to C. R. Pierce (Southern Nuclear Operating Company, Inc.), "Edwin I. Hatch Nuclear Plant, Unit No. 2, Issuance of Amendment Regarding Minimum Critical Power Ratio (TAC NO. MF4588)," dated February 18, 2015. (ADAMS Accession No. ML15020A434)

4. Letter from P. Bamford (U.S. Nuclear Regulatory Commission) to M. J. Pacilio (Exelon Generation Company, LLC), "Limerick Generating Station, Unit 2 – Issuance of Amendment RE: Safety Limit Minimum Critical Power Ratio Changes (TAC NO. ME5182)," dated April 5, 2011. (ADAMS Accession No. ML110750446)

5. Letter from J. Hughey (U.S. Nuclear Regulatory Commission) to M. J. Pacilio (Exelon Generation Company, LLC), "Peach Bottom Atomic Power Station, Unit 2 – Issuance of Amendment RE: Safety Limit Minimum Critical Power Ratio Value Change (TAC NO. ME3994)," dated September 28, 2010. (ADAMS Accession No. ML102571768)

No Significant Hazards Consideration

Exelon Generation Company, LLC (EGC) has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

   The derivation of the cycle specific Safety Limit Minimum Critical Power Ratios (SLMCPRs) for incorporation into the Technical Specifications (TS), and their use to determine cycle specific thermal limits, has been performed using the methodology discussed in NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel," Revision 23.

   The basis of the SLMCPR calculation is to ensure that during normal operation and during abnormal operational transients, at least 99.9% of all fuel rods in the core do not experience transition boiling if the limit is not violated. The new SLMCPRs preserve the existing margin to transition boiling.

   The MCPR safety limit is reevaluated for each reload using NRC-approved methodologies. The analyses for LGS, Unit 2, Cycle 15, have concluded that a two recirculation loop MCPR safety limit of ≥ 1.10, based on the application of Global Nuclear Fuel's NRC-approved MCPR safety limit methodology, will ensure that this acceptance criterion is met. For single recirculation loop operation, a MCPR safety limit of ≥ 1.14 also ensures that this acceptance criterion is met. The MCPR operating limits are presented and controlled in accordance with the LGS, Unit 2, Core Operating Limits Report (COLR).

   The requested TS changes do not involve any plant modifications or operational changes that could affect system reliability or performance or that could affect the probability of operator error. The requested changes do not affect any postulated accident precursors, do not affect any accident mitigating systems, and do not introduce any new accident initiation mechanisms. Therefore, the proposed TS changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

The SLMCPR is a TS numerical value, calculated to ensure that during normal operation and during abnormal operational transients, at least 99.9% of all fuel rods in the core do not experience transition boiling if the limit is not violated. The new SLMCPRs are calculated using NRC-approved methodology discussed in NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel," Revision 23. The proposed changes do not involve any new modes of operation, any changes to setpoints, or any plant modifications. The proposed revised MCPR safety limits have been shown to be acceptable for Cycle 15 operation. The core operating limits will continue to be developed using NRC-approved methods. The proposed MCPR safety limits or methods for establishing the core operating limits do not result in the creation of any new precursors to an accident. Therefore, this change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed amendment involve a significant reduction in a margin of safety?

Response: No.

There is no reduction in the margin of safety previously approved by the NRC as a result of the proposed change to the SLMCPRs. The new SLMCPRs are calculated using methodology discussed in NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel," Revision 23. The SLMCPRs ensure that during normal operation and during abnormal operational transients, at least 99.9% of all fuel rods in the core do not experience transition boiling if the limit is not violated, thereby preserving the fuel cladding integrity. Therefore, the proposed TS changes do not involve a significant reduction in the margin of safety previously approved by the NRC.

Based on the above, EGC concludes that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of no significant hazards consideration is justified.

4.4 Conclusions

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a

significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 REFERENCE

1. NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel," Revision 23.

ATTACHMENT 2

Markup of Proposed Technical Specifications Page

Limerick Generating Station, Unit 2

Docket No. 50-353

License Amendment Request - Safety Limit Minimum Critical Power Ratio

Revised TS Page

2-1

2.0 SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

2.1 SAFETY LIMITS

THERMAL POWER, Low Pressure or Low Flow

2.1.1 THERMAL POWER shall not exceed 25% of RATED THERMAL POWER with the reactor vessel steam dome pressure less than 700 psia or core flow less than 10% of rated flow.

APPLICABILITY: OPERATIONAL CONDITIONS 1 and 2.

ACTION:

With THERMAL POWER exceeding 25% of RATED THERMAL POWER and the reactor vessel steam dome pressure less than 700 psia or core flow less than 10% of rated flow, be in at least HOT SHUTDOWN within 2 hours and comply with the requirements of Specification 6.7.1.

THERMAL POWER, High Pressure and High Flow

2.1.2 The MINIMUM CRITICAL POWER RATIO (MCPR) shall not be less than ~~1.09~~ 1.10 for two recirculation loop operation and shall not be less than ~~1.12~~ 1.14 for single recirculation loop operation with the reactor vessel steam dome pressure greater than 700 psia and core flow greater than 10% of rated flow.

APPLICABILITY: OPERATIONAL CONDITIONS 1 and 2.

ACTION:

With MCPR less than ~~1.09~~ 1.10 for two recirculation loop operation or less than ~~1.12~~ 1.14 for single recirculation loop operation and the reactor vessel steam dome pressure greater than 700 psia and core flow greater than 10% of rated flow, be in at least HOT SHUTDOWN within 2 hours and comply with the requirements of Specification 6.7.1.

REACTOR COOLANT SYSTEM PRESSURE

2.1.3 The reactor coolant system pressure, as measured in the reactor vessel steam dome, shall not exceed 1325 psig.

APPLICABILITY: OPERATION CONDITIONS 1, 2, 3, and 4.

ACTION:

With the reactor coolant system pressure, as measured in the reactor vessel steam dome, above 1325 psig, be in at least HOT SHUTDOWN with reactor coolant system pressure less than or equal to 1325 psig within 2 hours and comply with the requirements of Specification 6.7.1.

ATTACHMENT 4

Non-Proprietary Version of Global Nuclear Fuel Letter 003N9595-R1-NP

Limerick Generating Station, Unit 2

Docket No. 50-353

License Amendment Request - Safety Limit Minimum Critical Power Ratio

November 2016
003N9595-R1-NP
PLM Specification 003N9595 R1

Non-Proprietary Information – Class I (Public)

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

Limerick Unit 2 Cycle 15

Information Notice

This is a non-proprietary version of the document GNF-003N9595-R1-P, 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 providing information regarding the requested changes to the Technical Specification SLMCPR for Exelon Corporation Limerick Unit 2. The only undertakings of GNF-A with respect to information in this document are contained in the contract between GNF-A and Exelon Corporation, and nothing contained in this document shall be construed as changing that contract. The use of this information by anyone other than Exelon Corporation, or for 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.

Table of Contents

List of Tables

1.0 Summary

The requested changes to the Technical Specification (TS) Safety Limit Minimum Critical Power Ratio (SLMCPR) values are 1.10 for Two Loop Operation (TLO) and 1.14 for Single Loop Operation (SLO) for Limerick Unit 2 Cycle 15. Additional details are provided in Table 1.

The primary reason for the change is that the core bundle-by-bundle Minimum Critical Power Ratio (MCPR) distribution and the bundle pin-by-pin power/R-Factor distribution are flatter than the limiting case in the previous cycle. These flatter distributions are a result of different GNF2 fresh fuel designs being used for Cycle 15.

2.0 Regulatory Basis

10 Code of Federal Regulations (CFR) 50.36(c)(1), "Technical Specifications," requires that power reactor facility TS include Safety Limits (SLs) for process variables that protect the integrity of certain physical barriers that guard against the uncontrolled release of radioactivity. The fuel cladding is one of the physical barriers that separate the radioactive materials from the environment. SLs are established to protect the integrity of these barriers during normal plant operations and anticipated transients. The fuel cladding integrity SL is set such that no fuel damage is calculated to occur if the limit is not violated.

General Design Criterion (GDC) 10, "Reactor Design," of Appendix A to 10 CFR 50 states that the reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that Specified Acceptable Fuel Design Limits (SAFDLs) are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences.

Guidance on the acceptability of the reactivity control systems, the reactor core, and fuel system design is provided in NUREG-0800, "Standard Review Plan [SRP] for the Review of Safety Analysis Reports for Nuclear Power Plants." Specifically, SRP Section 4.2, "Fuel System Design," specifies all fuel damage criteria for evaluation of whether fuel designs meet the SAFDLs. SRP Section 4.4, "Thermal Hydraulic Design," provides guidance on the review of thermal-hydraulic design in meeting the requirement of GDC 10 and the fuel design criteria established in SRP Section 4.2.

3.0 Methodology

GNF performs the SLMCPR calculation in accordance with NEDE-24011-P-A "General Electric Standard Application for Reactor Fuel, (GESTAR II)" (Reference 1) for plants such as Limerick Unit 2 that are equipped with the GNF 3DMonicore core monitoring system, by 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)

These methodologies were used for the Limerick Unit 2 Cycle 14 and Cycle 15 SLMCPR calculations.

3.1. Methodology Restrictions

Four restrictions were identified on page 3 of NRC's Safety Evaluation (SE) relating to the General Electric (GE) Licensing Topical Reports (LTRs) NEDC-32601P, NEDC-32694P, and Amendment 25 to NEDE-24011-P-A (Reference 5).

The following statement was extracted from the generic compliance report for the GNF2 fuel assembly design (Reference 6) that GNF sent to the NRC in March of 2007:

> "The NRC Safety Evaluation (SE) for NEDC-32694P-A provides four actions to follow whenever a new fuel design is introduced. These four conditions are listed in Section 3 of the SE. In the last paragraph of Section 3.2.2 of the Technical Evaluation Report included in the SE are the statements "GE has evaluated this effect for the 8x8, 9x9, and 10x10 lattices and has indicated that the R-Factor uncertainty will be increased ... to account for the correlation of rod power uncertainties" and "it is noted that the effect of the rod-to-rod correlation has a significant dependence on the fuel lattice (e.g., 9x9 versus 10x10). Therefore, in order to insure the adequacy of the R-Factor uncertainty, the effect of the correlation of rod power calculation uncertainties should be reevaluated when the NEDC-32601P methodology is applied to a new fuel lattice." Therefore, the definition of a new fuel design is based on the lattice array dimensions (e.g., NxN). Because GNF2 is a 10x10, and the evaluations in NEDC-32694P-A include 10x10, then these four actions are not applicable to GNF2."

In an NRC audit report (Reference 7) for this 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."

Another methodology restriction is identified on page 4 of the NRC's SE relating to the GE LTR NEDC-32505P (Reference 8). Specifically, it states that "if new fuel is introduced, GENE must confirm that the revised R-factor method is still valid based on new test data." NEDC-32505P addressed the GE12 10x10 lattice design (i.e., how the R-Factor for a rod is calculated based upon its immediate surroundings (fuel rods, water rods or channel wall)). Validation is provided by the fact that the methodology generates accurate predictions of Critical Power Ratio (CPR) with reasonable bias and uncertainty. The applicability of the R-Factor method is coupled and documented (along with fuel specific additive constants) with the GEXL correlation development (Reference 9), which is submitted as a part of GESTAR II compliance for each new fuel product line.

4.0 Discussion

In this discussion, the TLO nomenclature is used for two recirculation loops in operation, and the SLO nomenclature is used for one recirculation loop in operation.

Table 2 provides the description of the current cycle and previous cycle for the reference loading pattern as defined by NEDE-24011-P-A (Reference 1).

4.1. Major Contributors to SLMCPR Change

In general, for a given power-flow statepoint, the calculated safety limit is dominated by two key parameters: (1) flatness of the core bundle-by-bundle 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. Therefore, the calculated SLMCPR may change whenever there are changes to the core configuration or to the fresh fuel designs. The plant-cycle specific SLMCPR methodology accounts for these factors.

The current cycle core design is similar to the previous cycle core design in terms of reload batch size and type, arrangement of the batches in the core, and operating strategy. However, the current cycle fresh fuel batch average enrichment is lower than the previous cycle. This will tend to allow for more flexibility in the core and bundle designs which then can result in lower peaking values.

For the minimum core flow TLO case, the current cycle core bundle-by-bundle MCPR distribution is flatter than the previous cycle core bundle-by-bundle MCPR distribution. In addition, the current cycle fresh bundle pin-by-pin power/R-Factor distribution is flatter than the previous cycle fresh bundle pin-by-pin power/R-Factor distribution. Because both key parameters are flatter in the current cycle than in the previous cycle, the resulting SLMCPR calculations will tend to be greater than the previous cycle.

For the rated core flow TLO case, both key parameters are flatter in the current cycle than in the previous cycle but not nearly as much as for the minimum core flow TLO case; hence, the

resulting SLMCPR calculations will still tend to be greater than the previous cycle but not to the same extent as the minimum core flow TLO case.

The current cycle change in the Monte Carlo SLO SLMCPR from the previous cycle is consistent with the Monte Carlo TLO SLMCPR change between the two cycles. The SLO values are greater than the TLO values as expected due to the increase in uncertainties used for the SLO case.

4.2. Deviations from Standard Uncertainties

Table 3 provides a list of deviations from NRC-approved uncertainties (References 2 and 3). A discussion of deviations from these NRC-approved values follows, all of which are conservative relative to NRC-approved values.

4.2.1. R-Factor

GNF has generically increased the GEXL R-Factor uncertainty from [[ ]] to account for an increase in channel bow due to the 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. Reference 10 technically justifies that a GEXL R-Factor uncertainty of [[ ]] accounts for a channel bow uncertainty of up to [[ ]]. The Limerick Unit 2 Cycle 15 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. The effect of this change is considered not significant (i.e., < 0.005 increase on SLMCPR).

4.2.2. Core Flow Rate and Random Effective TIP Reading

In Reference 11 GNF committed to the expansion of the state points used in the determination of the SLMCPR. Consistent with the Reference 11 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 82.9% core flow, the approved uncertainty values for the core flow rate (2.5%) and the random effective Traversing In-Core Probe (TIP) reading (1.2%) are conservatively adjusted by dividing them by 82.9/100.

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.

4.2.3. Flow Area Uncertainty

GNF has calculated the flow area uncertainty for GNF2 using the process described in Section 2.7 of Reference 2. It was determined that the flow area uncertainty for GNF2 is conservatively bounded by a value of [[ ]]. Because this is larger than the Reference 2 value of [[ ]], the bounding value was used in the SLMCPR calculations. The effect of this change is considered not significant (i.e., < 0.005 increase on SLMCPR).

4.2.4. LPRM Update Interval and Calculated Bundle Power

To address the Local Power Range Monitor (LPRM) update/calibration interval in the Limerick Unit 2 TS, GNF has increased the LPRM update uncertainty in the SLMCPR analysis for Limerick Unit 2 Cycle 15. The approved uncertainty values for the contribution to bundle power uncertainty due to LPRM update, [[ ]], and the resulting total uncertainty in calculated bundle power, [[ ]], are conservatively increased, as shown in Table 3. The effect of this change is considered not significant (i.e., < 0.005 increase on SLMCPR).

[[

]] The total bundle power uncertainty is a function of the LPRM update uncertainty as detailed in Section 3.3 of NEDC-32694P-A (Reference 3).

4.2.5. Fuel Axial Power Shape Penalty

The GEXL correlation critical power uncertainty and bias are established for each fuel product line according to a process described in NEDE-24011-P-A (Reference 1).

GNF determined that higher uncertainties and non-conservative biases in the GEXL correlations for certain types of axial power shapes could exist relative to the NRC-approved methodology values (References 12, 13, and 14). The GNF2 product line is potentially affected in this manner only by Double-Hump (D-H) axial power shapes.

The D-H axial shape did not occur on any of the limiting bundles (i.e., those contributing to the 0.1% rods susceptible to transition boiling) in the current and/or prior cycle limiting cases. Therefore, D-H power shape penalties were not applied to the GEXL critical power uncertainty or bias.

5.0 References

1. Global Nuclear Fuel, "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A, Revision 23, September 2016.

2. GE Nuclear Energy, "Methodology and Uncertainties for Safety Limit MCPR Evaluations," NEDC-32601P-A, August 1999.

3. GE Nuclear Energy, "Power Distribution Uncertainties for Safety Limit MCPR Evaluations," NEDC-32694P-A, August 1999.

4. GE Nuclear Energy, "R-Factor Calculation Method for GE11, GE12 and GE13 Fuel," NEDC-32505P-A, Revision 1, July 1999.

5. Letter, Frank Akstulewicz (NRC) to Glen A. Watford (GNF-A), "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)," MFN-003-099, March 11, 1999.

6. Letter, Andrew A. Lingenfelter (GNF-A) to NRC Document Control Desk with cc to MC Honcharik (NRC), "GNF2 Advantage Generic Compliance with NEDE-24011P-A (GESTAR II), NEDC-33270P, March 2007, and GEXL17 Correlation for GNF2 Fuel, NEDC-33292P, March 2007," FLN-2007-011, March 14, 2007.

7. Memorandum, Michelle C. Honcharik (NRC) to Stacy L. Rosenberg (NRC), "Audit Report for Global Nuclear Fuels GNF2 Advantage Fuel Assembly Design GESTAR II Compliance Audit," September 25, 2008. (ADAMS Accession Number ML081630579)

8. Letter, Thomas H. Essig (NRC) to Glen A. Watford (GNF-A), "Acceptance for Referencing of Licensing Topical Report NEDC-32505P, Revision 1, 'R-factor Calculation Method for GE11, GE12 and GE13 Fuel' (TAC No. M99070 and M95081)," MFN-046-98, January 11, 1999.

9. Global Nuclear Fuel, "GEXL17 Correlation for GNF2 Fuel," NEDC-33292P, Revision 3, April 2009.

10. Letter, John F. Schardt (GNF-A) to NRC Document Control Desk with attention to Mel B. Fields (NRC), "Shadow Corrosion Effects on SLMCPR Channel Bow Uncertainty," FLN-2004-030, November 10, 2004.

11. Letter, Jason S. Post (GENE) to NRC Document Control Desk with attention to Chief, Information Management Branch, et al. (NRC), "Part 21 Final Report: Non-Conservative SLMCPR," MFN 04-108, September 29, 2004.

12. Letter, Glen A. Watford (GNF-A) to NRC Document Control Desk with attention to Joseph E. Donoghue (NRC), "Final Presentation Material for GEXL Presentation – February 11, 2002," FLN-2002-004, February 12, 2002.

13. Letter, Glen A. Watford (GNF-A) to NRC Document Control Desk with attention to Alan Wang (NRC), "NRC Technology Update – Proprietary Slides – July 31 – August 1, 2002," FLN-2002-015, October 31, 2002.

14. Letter, Jens G. Munthe Andersen (GNF-A) to NRC Document Control Desk with attention to Alan Wang (NRC), "GEXL Correlation for 10X10 Fuel," FLN-2003-005, May 31, 2003.

Table 1. Monte Carlo SLMCPR

Description	Previous Cycle Limiting Cases		Current Cycle Limiting Cases	
	Rated Power Minimum Core Flow	**Rated Power Rated Core Flow**	**Rated Power Minimum Core Flow**	**Rated Power Rated Core Flow**
Limiting Cycle Exposure Point (Beginning of Cycle (BOC)/Middle of Cycle (MOC)/End of Cycle (EOC))	EOC	MOC	EOC	MOC
Cycle Exposure at Limiting Point (MWd/STU)	13400	7500	12650	6500
[[				
				]]
Requested Change to the TS SLMCPR	N/A		1.10 (TLO) / 1.14 (SLO)	

Table 2. Description of Core

Description	Previous Cycle	Current Cycle
Core Rated Power (MWt)	3515.0	3515.0
Minimum Flow at Rated Power (% rated core flow)	82.9	82.9
Number of Bundles in the Core	764	764
Batch Sizes and Types: (Number of Bundles in the Core) Fresh Once-Burnt Twice-Burnt	 268 GNF2 272 GNF2 224 GNF2	 268 GNF2 268 GNF2 228 GNF2
Fresh Fuel Batch Average Enrichment (Weight%)	3.92	3.77
Core Monitoring System	3DMonicore	3DMonicore

Table 3. Deviations from Standard Uncertainties

Description	NRC Approved Value ± σ (%)	Previous Cycle	Current Cycle
Power Distribution Uncertainties			
GEXL R-Factor	[[ ]]	[[ ]]	[[ ]]
Random Effective TIP Reading All TLO Cases at Rated Power and Minimum Flow	1.2	1.448	1.448
Contribution to Bundle Power Uncertainty Due to LPRM Update	[[ ]]	[[ ]]	[[ ]]
Total Uncertainty in Calculated Bundle Power	[[ ]]	[[ ]]	[[ ]]
Non-Power Distribution Uncertainties			
Channel Flow Area Variation	[[ ]]	[[ ]]	[[ ]]
Total Core Flow Measurement All TLO Cases at Rated Power and Minimum Flow	2.5	3.016	3.016

ATTACHMENT 5

GNF Affidavit in Support of Request to Withhold Information

Limerick Generating Station, Unit 2

Docket No. 50-353

License Amendment Request - Safety Limit Minimum Critical Power Ratio

Global Nuclear Fuel – Americas

AFFIDAVIT

I, Brian R. Moore, state as follows:

(1) I am Engineering Manager, Core & Fuel Engineering, Global Nuclear Fuel – Americas, LLC (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 Enclosure 1 of GNF's letter, WCC-EXN-HH2-16-081, W. Cline (GNF-A) to A. Johnson (Exelon Generation Company), entitled "GNF Additional Information for SLMCPR Technical Specification Submittal Letter for Limerick Unit 2 Cycle 15," dated November 18, 2016. GNF-A proprietary information in Enclosure 1, which is entitled "GNF Additional Information Regarding the Requested Changes to the Technical Specification SLMCPR, Limerick Unit 2 Cycle 15," is identified by a dotted underline inside double square brackets. [[This sentence is an example.{3}]] A "[[" marking at the beginning of a table, figure, or paragraph closed with a "]]" marking at the end of the table, figure or paragraph is used to indicate that the entire content between the double brackets is proprietary. 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" (Exemption 4). The material for which exemption from disclosure is here sought 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, 975 F2d 871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F2d 1280 (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 aspects of past, present, or future GNF-A customer-funded development plans and programs, resulting in potential products to GNF-A;

d. 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 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. 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. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(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.

(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 this methodology, along with the testing, development and approval was achieved at a significant cost to GNF-A.

The development of the fuel design and licensing methodology along with the interpretation and application of the analytical results is derived from an extensive experience database that constitutes a major GNF-A asset.

(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 information 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.

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 is true and correct.

Executed on this 17th day of November 2016.

Brian R. Moore
Engineering Manager, Core & Fuel Engineering
Global Nuclear Fuel – Americas, LLC
3901 Castle Hayne Road
Wilmington, NC 28401
Brian.Moore@ge.com