UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 29, 2017

Mr. Bryan C. Hanson
President and Chief Nuclear Officer
Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: LIMERICK GENERATING STATION, UNIT 2 – ISSUANCE OF AMENDMENT RE: SAFETY LIMIT MINIMUM CRITICAL POWER RATIO CHANGE (CAC NO. MF8943)

Dear Mr. Hanson:

The U.S. Nuclear Regulatory Commission (Commission) has issued the enclosed Amendment No. 187 to Renewed Facility Operating License No. NPF-85 for the Limerick Generating Station, Unit 2. This amendment consists of changes to the technical specifications (TSs) in response to your application dated December 16, 2016. The amendment revises the TSs related to the safety limit minimum critical power ratios.

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

Sincerely,

V. Sreenivas, Project Manager
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-353

Enclosures:
1. Amendment No. 187 to NPF-85
2. Safety Evaluation

cc w/enclosures: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

EXELON GENERATION COMPANY, LLC

DOCKET NO. 50-353

LIMERICK GENERATING STATION, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 187
Renewed License No. NPF-85

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

   A. The application for amendment by Exelon Generation Company, LLC (the licensee), dated December 16, 2016, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

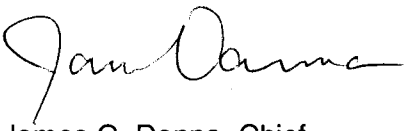
2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-85 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No. 187, are hereby incorporated into this renewed license. Exelon Generation Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of its date of issuance and shall be implemented prior to startup from the spring 2017 refueling outage.

FOR THE NUCLEAR REGULATORY COMMISSION



James G. Danna, Chief
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Renewed Facility Operating License and Technical Specifications

Date of Issuance: March 29, 2017

ATTACHMENT TO LICENSE AMENDMENT NO. 187

LIMERICK GENERATING STATION, UNIT 2

RENEWED FACILITY OPERATING LICENSE NO. NPF-85

DOCKET NO. 50-353

Replace the following page of the Renewed Facility Operating License with the revised page. The revised page is identified by amendment number and contains a marginal line indicating the area of change.

Remove	Insert
Page 3	Page 3

Replace the following page of the Appendix A Technical Specifications with the attached revised page. The revised page is identified by amendment number and contains marginal lines indicating the areas of change.

Remove	Insert
2-1	2-1

(2) Pursuant to the Act and 10 CFR Part 70, to receive, possess and to use at any time special nuclear material as reactor fuel, in accordance with the limitations for storage and amounts required for reactor operation, as described in the Final Safety Analysis Report, as supplemented and amended;

(3) 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 as sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;

(4) Pursuant to the Act and 10 CFR Parts 30, 40, 70, to receive, possess, and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; and

(5) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility, and to receive and possess, but not separate, such source, byproduct, and special nuclear materials as contained in the fuel assemblies and fuel channels from the Shoreham Nuclear Power Station.

C. This renewed license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations set forth in 10 CFR Chapter I (except as exempted from compliance in Section 2.D. below) 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

Exelon Generation Company is authorized to operate the facility at reactor core power levels of 3515 megawatts thermal (100 percent rated power) in accordance with the conditions specified herein.

(2) Technical Specifications

The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No. 187, are hereby incorporated into this renewed license. Exelon Generation Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

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 1.10 for two recirculation loop operation and shall not be less than 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 1.10 for two recirculation loop operation or less than 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.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 187

TO RENEWED FACILITY OPERATING LICENSE NO. NPF-85

EXELON GENERATION COMPANY, LLC

LIMERICK GENERATING STATION, UNIT 2

DOCKET NO. 50-353

1.0 INTRODUCTION

By application dated December 16, 2016 (Reference 1), Exelon Generation Company, LLC (the licensee) submitted a license amendment request (LAR) for the Limerick Generating Station (LGS), Unit 2.

The proposed amendment revises the technical specifications (TSs) related to the safety limit minimum critical power ratio (SLMCPR). Specifically, the proposed LAR would revise TS 2.1, "Safety Limits," for minimum critical power ratio (MCPR) due to the cycle-specific analysis performed by Global Nuclear Fuel-Americas, LLC (GNF) for LGS, Unit 2, Cycle 15. LGS, Unit 2, is a General Electric (GE) Boiling-Water Reactor (BWR/4) Mark II design.

2.0 REGULATORY EVALUATION

The U.S. Nuclear Regulatory Commission (NRC or the Commission) used the following requirements and guidance documents in evaluating the LAR:

- Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.36, "Technical specifications," in which the NRC established its regulatory requirements related to the contents of TSs. Section 50.36 of 10 CFR 50.36 is the Commission's regulatory requirement that TSs are needed and that TSs are required to include items in five specific categories related to facility operation. One of the five categories is paragraph 50.36(c)(1), "Safety limits, limiting safety system settings, and limiting control settings." Paragraph 50.36(d)(1)(i)(A) requires safety limits upon important process variables that are found to be necessary to reasonably protect the integrity of certain of the physical barriers that guard against the uncontrolled release of radioactivity.

- Appendix A, "General Design Criteria for Nuclear Power Plants" (GDC), to 10 CFR Part 50, Criterion 10, "Reactor design," which states:

  > The reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences.

  In this regard, the fuel cladding integrity safety limit is set such that no fuel damage occurs if the limit is not violated. Because fuel damage is not directly observable, a step back approach is used to establish a safety limit such that the MCPR is not less than the limit specified in TSs for fuel assembly. MCPR greater than the specified limit (i.e., SLMCPR), represents a conservative margin relative to the conditions required to maintain fuel cladding integrity.

- Standard Review Plan (SRP) Section 4.4, "Thermal and Hydraulic Design" (Reference 2), of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," which states that the critical power ratio is to be established such that at least 99.9 percent of the fuel rods in the core would not be expected to experience departure from nucleate boiling or boiling transition during normal operation or anticipated operational occurrences. The guidance provided within the SRP forms the basis of the NRC staff's review and ensures that the criteria of GDC 10 are met.

- Generic Letter 88-16, "Removal of Cycle-Specific Parameter Limits from Technical Specifications" (Reference 3), which provides guidance on modifying cycle-specific parameter limits in TSs. For each fuel vendor licensee, the NRC approves the licensing and analytical method and codes used to perform the safety analyses. For each operating cycle, the licensee or the fuel vendor performs the cycle-specific safety analyses using the NRC-approved licensing methodology and the NRC-approved analytical methods and codes. The cycle core operating limits report provides the cycle-specific core operating parameter. Section 5.0 of the TSs references the applicable documents that describe the NRC-approved licensing and analytical methods. Therefore, the licensee can perform the reload analyses and establish the cycle operating parameters under 10 CFR 50.59 because (1) the required reload analyses are specified in the NRC-approved licensing methodology, and (2) the analyses are performed using NRC-approved analytical methods and codes. However, any significant changes or modifications to the NRC-approved licensing methodology, analytical methods or codes, or the use of a code or analytical method that do not meet the 10 CFR 50.59 criteria would require NRC review and approval before using these analytical methods or codes to perform the reload safety analyses. A change of SLMCPR constitutes a significant change that will require NRC review and approval.

3.0 TECHNICAL EVALUATION

3.1 Proposed TS Change

Current TS 2.1, "Safety Limits," Section 2.1.2, states:

> The MINIMUM CRITICAL POWER RATIO (MCPR) shall not be less than 1.09 for two recirculation loop operation and shall not be less than 1.12 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 for two recirculation loop operation or less than 1.12 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.

Revised TS 2.1, "Safety Limits," Section 2.1.2, states:

The MINIMUM CRITICAL POWER RATIO (MCPR) shall not be less than 1.10 for two recirculation loop operation and shall not be less than 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 1.10 for two recirculation loop operation or less than 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.

3.2 LGS, Unit 2, Cycle 15 Core

LGS, Unit 2, is a BWR/4 that has two recirculation loops. For Cycle 15, the licensee proposed to change the SLMCPR value in TS Section 2.1.2 from 1.09 to 1.10 for two recirculation loop operation, and from 1.10 to 1.14 for single recirculation loop operation. This requirement would be in effect when the reactor vessel steam dome pressure is greater than 700 pounds per square inch absolute (psia) and the core flow is greater than 10 percent of rated core flow.

The LGS, Unit 2, Cycle 15 core loading will consist of 268 GNF2 fresh fuel bundles, 268 GNF2 once burnt fuel bundles, and 228 twice burnt GNF2 fuel bundles in the core. All fuel design types are manufactured by GNF.

Since the proposed changes in the Cycle 15 SLMCPR are significant, in accordance with Generic Letter 88-16, the NRC staff finds that the request to require the NRC to review and approve the proposed changes are acceptable

3.3 Methodology

The licensee developed the LGS, Unit 2, Cycle 15 SLMCPR values using the following NRC-approved methodologies and uncertainties:

- NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel," September 2016 (Reference 4)
- NEDC-32601 P-A, "Methodology and Uncertainties for Safety Limit MCPR Evaluations," August 1999 (Reference 5)
- NEDC-32694P-A, "Power Distribution Uncertainties for Safety Limit MCPR Evaluations," August 1999 (Reference 6)
- NEDC-32505P-A, "R-Factor Calculation Method for GE11, GE12, and GE13 Fuel," July 1999 (Reference 7)

Plant-specific use of these methodologies must adhere to certain restrictions.

3.3.1 Methodology Restrictions

Based on the review of Topical Reports (TRs) NEDC-32601P-A, NEDC-32694P-A, and Amendment 25 to NEDE-24011-P-A, the NRC staff identified the following restrictions for the use of these TRs:

1. The TGBLA (lattice physics code) fuel rod power calculation uncertainty should be verified when applied to fuel designs not included in the benchmark comparisons of Table 3.1 of NEDC-32601P, since changes in fuel design can have a significant effect on calculation accuracy.

2. The effect of the correlation of rod power calculation uncertainties should be reevaluated to insure the accuracy of R-Factor uncertainty when the methodology is applied to a new fuel lattice.

3. In view of the importance of minimum critical power ratio importance parameter (MIP) criterion and its potential sensitivity to changes in fuel bundle designs, core loading, and operating strategies, the MIP criterion should be reviewed periodically as part of the procedural review process to insure that the specific value recommended in NEDC-32601P is applicable to future designs and operating strategies.

4. The 3D-MONICORE bundle power calculation uncertainty should be verified when applied to fuel and core designs not included in the benchmark comparisons in Tables 3.1 and 3.2 of NEDC-32694P.

3.3.1.1 Restrictions (1) and (2)

NEDE-24011-P-A provides a fuel design and core reload process that allows licensees to modify fuel assembly designs without undergoing a formal NRC submittal and review, as long as they provide written notification to the NRC outlining the new design and acknowledging

compliance with the requirements of NEDE-24011-P-A. On March 14, 2007, GNF sent the NRC the aforementioned notification and generic compliance report for the GNF2 fuel assembly design (Reference 8). As part of an NRC audit related to this report, the analysis and evaluation of the GNF2 fuel design was verified to have been evaluated in accordance with the above restrictions (Reference 9). The NRC subsequently issued a finding that upon incorporation of Amendment 33, NEDE-24011-P (Reference 10) was acceptable for use with the GNF2 fuel design without any restriction.

Based on the above, the NRC staff finds that Restrictions (1) and (2) to the plant-specific application of the NEDE-24011-P-A methodology have been addressed for the GNF2 fuel design and conformed to SRP Section 4.4. The staff concludes that there is assurance that the GDC 10 criteria will continue to be met. Therefore, the NRC staff finds the disposition of Restrictions (1) and (2) is acceptable.

3.3.1.2 Restrictions (3) and (4)

The third restriction in the safety evaluation (SE) associated with the SLMCPR methodology is applied not only to fuel bundle designs but also core configuration, while the fourth restriction requires a verification of the 3D-MONICORE bundle power calculation uncertainty. Since they involve the methodology and uncertainty deviations to be discussed in Section 3.4 of this SE, the evaluation of these restrictions will be deferred to Section 3.5 of this SE, after the evaluation of those deviations is completed.

In summary, the NRC staff finds that the licensee has adequately addressed the four restrictions of the following TRs: NEDC-32601P-A, NEDC-32694P-A, Amendment 25 to NEDE-24011-P-A, and NEDC-32505P-A, and conformed to SRP Section 4.4. The NRC staff concludes that there is assurance that the GDC 10 criteria will continue to be met. Therefore, the staff finds the disposition of Restrictions (3) and (4) is acceptable.

3.4 Deviations from the NRC-Approved Methodology and Uncertainties

3.4.1 R-Factor Uncertainty Due to Channel Bow

The R-factor is an input into the GEXL correlation used to describe the local pin-by-pin power distribution and the fuel assembly and channel geometry on the fuel assembly critical power.

The R-factor uncertainty analysis includes an allowance for power peaking modeling uncertainty, manufacturing uncertainty, and channel bow uncertainty. GNF has generically increased the GEXL R-Factor uncertainty to account for an increase in channel bow due to a previously unforeseen phenomenon 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 11).

As a result, the licensee has increased this uncertainty for all SLMCPR calculations to account for the potential impact of control blade shadow corrosion induced bow. The LGS, Unit 2, Cycle 15 analysis showed that the expected channel bow uncertainty for LGS, Unit 2, is bounded by the increase in R-Factor uncertainty as technically justified in Reference 12. Thus, the NRC staff finds that the use of the higher GEXL R-Factor uncertainty described in Reference 12 adequately accounts for the expected control blade shadow corrosion-induced

channel bow for LGS, Unit 2, Cycle 15, and conforms to SRP Section 4.4. The NRC staff concludes that there is assurance that the GDC 10 criteria will continue to be met. Therefore, the staff finds the disposition of R-factor uncertainty due to channel bow is acceptable.

3.4.2 Core Flow Rate and Random Effective Traverse In-core Probe Reading

GNF agreed to expand the state points used in the determination of the SLMCPR as described in GE Nuclear Energy letter dated August 24, 2004 (Reference 13). Consistent with Reference 13, the applicant 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 NRC-approved SLMCPR methodology is applied at each state point.

For two-loop operation calculations performed at 82.9 percent of rated core flow, the NRC-approved uncertainty values for the core flow rate (2.5 percent) and the random effective traverse in-core probe (TIP) reading (1.2 percent) are adjusted by dividing them by 0.829. The treatment of the core flow and random effective TIP reading uncertainties are based on the assumption that the signal-to-noise ratio deteriorates as core flow is reduced. The licensee stated that this treatment is conservative, based on the expectation that the variability in the absolute flow will decrease as flow decreases.

The core flow and random TIP reading uncertainties used in single-loop operation minimum core flow SLMCPR analysis remain the same as in the rated core flow SLMCPR analysis because these uncertainties, which are substantially larger than used in two-loop operation analysis, already account for the effects of operating at reduced core flow.

Since the increase in the uncertainty described above bounds the original non-flow dependent uncertainties in conformance with SRP Section 4.4, the NRC staff concludes that it is acceptable for LGS, Unit 2, Cycle 15, by meeting GDC 10 criteria.

3.4.3 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. 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. 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 percent 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.

The licensee determined that none of the limiting bundles had one of these types of axial power shapes. Therefore, no power shape penalties were applied to the calculated LGS, Unit 2, Cycle 15 SLMCPR values. This approach is consistent with prior precedent for NRC approval of SLMCPR LAR submittals using the Reference 4 methodology.

The NRC staff determined that the licensee adequately considered the potential for a higher SLMCPR value resulting from non-conservatisms in the GEXL correlation due to certain axial power shapes within limiting bundles. This consideration conforms to the SRP Section 4.4

and meets the GDC 10 criteria. The staff concludes that there is assurance that the GDC 10 criteria will continue to be met. Therefore, the staff finds that the use of no axial power shape penalties is acceptable.

3.4.4 Flow Area Uncertainty

GNF has calculated the flow area uncertainty for GNF2 using the process described in Section 2.7 of Reference 5. The flow area uncertainty for GNF2 is conservatively set by a bounding value. Because this is larger than the value approved in Reference 5, the bounding value was used in the SLMCPR calculations.

The NRC staff finds that the channel flow area uncertainty value applied to GNF2 fuel conservatively bound the reference value when utilizing the same calculation methodology and conforms to SRP Section 4.4. The NRC staff concludes that there is assurance that the GDC 10 criteria will continue to be met. Therefore, the staff finds that the proposed SLMCPR limits adequately address the uncertainties in channel flow areas for the GNF2 fuel design.

3.4.5 Local Power Range Monitor Update Interval and Calculated Bundle Power

To address the local power range monitor (LPRM) update/calibration interval in the LGS, Unit 2, TSs, GNF has increased the LPRM update uncertainty in the SLMCPR analysis for LGS, Unit 2, Cycle 15. The NRC staff has found the GNF calculated bundle power uncertainty due to the increase in the LPRM update uncertainty as being appropriately considered in accordance with NEDC-32694P-A and conformed to SRP Section 4.4. The NRC staff concludes that there is assurance that the GDC 10 criteria will continue to be met. Therefore, the staff finds the disposition of local power range monitor update interval and calculated bundle power is acceptable.

3.5 Evaluation of Restrictions (3) and (4)

Restriction (3) states that the MIP criterion should be reviewed periodically as part of the procedural review process to insure that the specific value recommended in NEDC-32601P is applicable to future designs and operating strategies. The NRC staff evaluated the licensee's response to Restriction (3) by taking into account (1) the factors discussed in Section 3.4 of this SE that affect the evaluation of Restriction (3); (2) the use of 82.9 percent of rated flow, and (3) the sensitivity to changes in fuel bundle designs, core loading, and operating strategies.

In Section 3.4 of this SE, the NRC staff reviewed the factors that affect the MIP, which are the R-factor (Section 3.4.1), core flow rate (Sections 3.4.2 and 3.4.4), and random effective TIP reading (Section 3.4.2). As stated in each of those sections, the NRC staff has found that these factors are acceptable for use by the licensee.

Restriction (4) requires a verification of the 3D-MONICORE bundle power calculation uncertainty when applied to fuel and core designs not included in the benchmark comparisons in Tables 3.1 and 3.2 of NEDC-32694P. Such a verification as described in Section 4.2.4 of Reference 13 has been performed since the previous cycle. Based on the evaluation made in Section 3.4.5 for that verification, the NRC staff finds that Restriction (4) has been addressed and found acceptable.

In summary, the primary reason for the proposed TS change is that the core bundle-by-bundle 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 (e.g., difference in the batch average enrichment).

3.6 NRC Staff Conclusion

Upon evaluation, the NRC staff concludes that the licensee's proposed Cycle 15 SLMCPR values of 1.10 for two recirculation loop operation and 1.14 for single recirculation loop operation are acceptable for LGS, Unit 2, Cycle 15, because LGS, Unit 2, has used the NRC-approved licensing methodologies and analytical methods and codes for determination of the SLMCPR values for Cycle 15. These methodologies and analytical methods and codes are consistent with previous applications associated with determining SLMCPR values for the specific fuel utilized by LGS, Unit 2, in Cycle 15. They are applied in conformance to SRP Section 4.4 and in meeting GDC 10 criteria. The NRC staff finds that the revised TS 2.1 continues to impose the appropriate limit upon important process variables that is necessary to reasonably protect the integrity of the fuel cladding, one of the physical barriers that guards against the uncontrolled release or radioactivity. Therefore, the requirements of 10 CFR 50.36(d)(1)(i)(A) continue to be met, and the proposed changes are acceptable.

4.0 FINAL NO SIGNIFICANT HAZARDS CONSIDERATION

The NRC's regulation in 10 CFR 50.92(c) states that the NRC may make a final determination, under the procedures in 10 CFR 50.91, that a license amendment involves no significant hazards consideration if operation of the facility, in accordance with the amendment, would not (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) Involved a significant reduction in a margin of safety. An evaluation of the issue of no significant hazards consideration provided by the licensee is presented below, with NRC staff edits in square brackets:

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 [ADAMS Accession No. ML16250A047].

   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 [minimum critical power ratio] 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 [the] 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.

2. Does the proposed amendment involve a significant reduction in a margin 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 evaluation, the NRC staff concludes that the three standards of 10 CFR 50.92(c) are satisfied. Therefore, the NRC staff has made a final determination that no significant hazards consideration is involved for the proposed amendment and that the amendment should be issued as allowed by the criteria contained in 10 CFR 50.91.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Pennsylvania State official was notified of the proposed issuance of the amendment on January 23, 2017. The State official had no comments.

6.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (82 FR 9605). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that 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.

8.0 REFERENCES

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3. U.S. NRC Generic Letter 88-16, "Removal of Cycle-Specific Parameter Limits from Technical Specifications," October 4, 1988 (ADAMS Accession No. ML031200485).

4. Global Nuclear Fuel-Americas, LLC Licensing Topical Report NEDE-24011-P-A, Revision 23, "General Electric Standard Application for Reactor Fuel (GESTAR II, Main)" September 2016 (ADAMS Accession No. ML16250A047).

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6. GE Nuclear Energy Licensing Topical Report NEDC-32694P-A, Class III, "Power Distribution Uncertainties for Safety Limit MCPR Evaluations," August 1999 (non-public/proprietary information).

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8. Letter from Andrew Lingenfelter, Global Nuclear Fuel-Americas, LLC, to U.S. NRC, "GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II), NEDC-33270P, March 2007, and GEXL 17 Correlation for GNF2 Fuel, NEDC-33292P, March 2007," March 14, 2007 (ADAMS Accession No. ML070780335).

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11. Letter from John Schardt, GNF, to U.S. NRC, "Shadow Corrosion Effects on SLMCPR Channel Bow Uncertainty," November 10, 2004 (ADAMS Accession No. ML043480033).

12. Global Nuclear Fund, GNF-003N9595-R1-P, "GNF Additional Information Regarding the Requested Changes to the Technical Specification SLMCPR, Limerick Unit 2 Cycle 15" (non-public/proprietary).

13. Letter from John Post, General Electric Company/GE Nuclear Energy, to U.S. NRC, "Part 21 Reportable Condition and 60-Day Interim Report, Notification: Non-Conservative SLMCPR," August 24, 2004 (ADAMS Accession No. ML042720293).

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Date: March 29, 2017

SUBJECT: LIMERICK GENERATING STATION, UNIT 2 – ISSUANCE OF AMENDMENT RE: SAFETY LIMIT MINIMUM CRITICAL POWER RATIO CHANGE (CAC NO. MF8943) DATED MARCH 29, 2017

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