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10 CFR 50.90

December 22, 2003

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

Limerick Generating Station, Unit 1
Facility Operating License No. NPF-39
NRC Docket No. 50-352

SUBJECT: License Amendment Request: AR A1443067
Safety Limit Minimum Critical Power Ratio (SLMCPR) Change

Pursuant to 10 CFR 50.90 Exelon Generation Company, LLC (Exelon), hereby requests the following amendment to the Technical Specifications (TS), Appendix A of Operating License No. NPF-39 for Limerick Generating Station (LGS), Unit 1. This proposed change will revise Technical Specification (TS) Section 2.1. This Section will be revised to incorporate revised Safety Limit Minimum Critical Power Ratios (SLMCPRs) due to the cycle specific analysis performed by Global Nuclear Fuel for LGS, Unit 1, Cycle 11, which will include the use of the GE-13 and GE-14 fuel product lines. This information is being submitted under unsworn declaration.

Information supporting this License Amendment Request is contained in Attachment 1 to this letter, and the proposed marked up TS pages and final TS pages are contained in Attachments 2 and 3, respectively. Attachment 4 (letter from C. P. Paone (Global Nuclear Fuel) to J. Tusar (Exelon Generation Company, LLC), dated November 11, 2003) specifies the new SLMCPRs for LGS, Unit 1, Cycle 11. Attachment 4 contains information proprietary to Global Nuclear Fuel. Global Nuclear Fuel requests that the document be withheld from public disclosure in accordance with 10 CFR 2.790(a)(4). An affidavit supporting this request is also contained in Attachment 4. Attachment 5 contains a non-proprietary version of the Global Nuclear Fuel document.

In order to support the upcoming refueling outage at LGS, Unit 1, Exelon requests approval of the proposed amendment by March 1, 2004.

Once approved, this amendment shall be implemented within 30 days of issuance.

Additionally, there are no commitments contained within this letter.

APO1

A copy of this License Amendment Request, including the reasoned analysis about a no significant hazards consideration, is being provided to the appropriate Pennsylvania State official in accordance with the requirements of 10 CFR 50.91(b)(1).

If you have any questions or require additional information, please contact Tom Loomis at (610) 765-5510.

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

Respectfully,

12-22-03
Executed on

Michael P. Gallagher
Director, Licensing and Regulatory Affairs

Attachments: 1-Licensee's Evaluation
2-Markup of Technical Specification Pages
3-Camera Ready Technical Specification Pages
4-Proprietary Global Nuclear Fuels Letter
5-Non-proprietary Version of Global Nuclear Fuels Letter

cc:	H. J. Miller, Administrator, Region I, USNRC	w/Attachments 1, 2, 3, & 5 ONLY
	A. L. Burritt, USNRC Senior Resident Inspector, LGS	w/Attachments 1, 2, 3, & 5 ONLY
	S. Wall, Senior Project Manager, USNRC	w/Attachments 1-5
	R. R. Janati, Commonwealth of Pennsylvania	w/Attachments 1, 2, 3, & 5 ONLY

ATTACHMENT 1

LIMERICK GENERATING STATION
UNIT 1

DOCKET NO. 50-352

LICENSE NO. NPF-39

LICENSE AMENDMENT REQUEST: AR A1443067

"Revision of SLMCPRs"

ATTACHMENT 1 CONTENTS

SAFETY LIMIT MINIMUM CRITICAL POWER RATIO (SLMCPR) CHANGE

1.0 DESCRIPTION

Exelon Generation Company, LLC, (Exelon) Licensee under Facility Operating License No. NPF-39 for Limerick Generating Station (LGS), Unit 1, requests that the Technical Specifications (TS) contained in Appendix A to the Operating License be amended to revise TS 2.1 to reflect a change in the Safety Limit Minimum Critical Power Ratios (SLMCPRs) due to the cycle specific analysis performed by Global Nuclear Fuel for LGS, Unit 1, Cycle 11, which includes the use of the GE-13 and GE-14 fuel product lines. The marked up Technical Specification pages and final Technical Specification pages are contained in Attachments 2 and 3, respectively. Attachment 4 (letter from C. J. Paone (Global Nuclear Fuel) to J. Tusar (Exelon Generation Company, LLC), dated November 10, 2003) specifies the new SLMCPRs for LGS, Unit 1, Cycle 11.

2.0 PROPOSED CHANGE

The proposed change involves revising the Safety Limit Minimum Critical Power Ratio (SLMCPR) values contained in TS 2.1 for two recirculation loop operation and single recirculation loop operation. The SLMCPR value for two loop operation is being changed from 1.10 to 1.07. The SLMCPR value for single loop operation is being changed from 1.11 to 1.08.

Marked up Technical Specification page 2-1, and the associated Bases page B 2-1 showing the requested changes are provided in Attachment 2.

3.0 BACKGROUND

The proposed change involves revising the Safety Limit Minimum Critical Power Ratio (SLMCPR) values contained in TS 2.1 for two recirculation loop operation and single recirculation loop operation. The SLMCPR values are being revised for LGS, Unit 1 based on the reload core design for Cycle 11, which will use the second reload of the GE-14 fuel product line. GE-14 fuel has previously been loaded at the Limerick Generating Station in Unit 1 for Cycle 10. The SLMCPRs have been determined in accordance with NRC approved methodology described in "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A-14 (GESTAR-II), and U. S. Supplement, NEDE-24011-P-A-14-US, June, 2000, which incorporates Amendment 25. Amendment 25 provides the methodology for determining the cycle specific MCPR safety limits that replace the former generic fuel type dependent values. Amendment 25 was used for determining the upcoming Cycle 11 SLMCPRs. Future SLMCPRs determined in accordance with Amendment 25 will not need prior NRC approval for each cycle unless the value changes. The NRC safety evaluation approving Amendment 25 is contained in a letter from the NRC to General Electric Company, dated March 11, 1999 (F. Akstulewicz (NRC) to G. A. Watford (GE), "Acceptance for Referencing of Licensing Topical Reports NEDC-32601P, Methodology and Uncertainties for Safety Limit MCPR Evaluations; NEDC-32694P, Power Distribution Uncertainties for Safety Limit MCPR Evaluation; and Amendment 25 to NEDE-24011-P-A on Cycle Specific Safety Limit MCPR (TAC Nos. M97490, M99069 and M97491)"). The SLMCPRs have been calculated using the revised methodology of NEDC-32601P-A and the reduced power distribution uncertainties from NEDC-32694P-A as shown in Tables 1 and 2 of Attachment 4. Furthermore, additional conservatism has been incorporated into the calculation of the SLMCPR in consideration of the impact of fuel channel bowing.

Global Nuclear Fuel has designed GE-14 fuel to be in compliance with Amendment 22 incorporated in "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A-14 (GESTAR-II), and U. S. Supplement, NEDE-24011-P-A-14-US, June, 2000. Amendment 22 was the basis for compliance for GE-13, which is currently installed at LGS, Unit 1.

4.0 TECHNICAL ANALYSIS

The proposed TS change will revise TS 2.1 to reflect the changes in the cycle specific analysis performed by Global Nuclear Fuel for LGS, Unit 1, Cycle 11, which includes the use of the GE-13 and GE-14 fuel product lines.

The new SLMCPRs are calculated using NRC approved methodology described in "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A-14 (GESTAR-II), and U.S. Supplement, NEDE-24011-P-A-14-US, June, 2000, which incorporates Amendment 25. Amendment 25 is used for determining the upcoming Cycle 11 SLMCPRs. Future SLMCPRs determined in accordance with Amendment 25 will not need prior NRC approval for each cycle unless a value changes. The NRC safety evaluation approving Amendment 25 is contained in a letter from the NRC to General Electric Company, dated March 11, 1999.

Global Nuclear Fuel has designed GE-14 fuel to be in compliance with Amendment 22 to "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A-14 (GESTAR-II), and U. S. Supplement, NEDE-24011-P-A-14-US, June, 2000. Amendment 22 was the basis for compliance for GE-13 fuel.

The SLMCPR analysis establishes SLMCPR values that will ensure that greater than 99.9% of all fuel rods in the core avoid transition boiling provided the limit is not violated. The SLMCPRs are calculated to include cycle specific parameters which include: 1) the actual core loading, 2) conservative variations of projected control blade patterns, 3) the actual bundle parameters (e.g., local peaking), and 4) the full cycle exposure range. The new SLMCPRs at LGS, Unit 1, Cycle 11 are 1.07 (two-loop operation) and 1.08 (single-loop operation) as shown in Attachment 4. Additional information regarding the 1.07 and 1.08 cycle specific SLMCPRs for LGS, Unit 1, Cycle 11 are contained in the Attachment 4 letter.

5.0 REGULATORY ANALYSIS

5.1 No Significant Hazards Consideration

We have concluded that the proposed change to the LGS, Unit 1 Technical Specifications (TS), which will revise TS 2.1, does not involve a Significant Hazards Consideration. In support of this determination, an evaluation of each of the three (3) standards set forth in 10 CFR 50.92(c) is provided 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 "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A-14 (GESTAR-II), and U.S. Supplement, NEDE-24011-P-A-14-US, June, 2000, which incorporates Amendment 25. Amendment 25 was approved by the NRC in a March 11, 1999 safety evaluation report.

   The basis of the SLMCPR calculation is to ensure that greater than 99.9% of all fuel rods in the core avoid transition boiling provided the limit is not violated. The new SLMCPRs preserve the existing margin to transition boiling. The GE-14 fuel is in compliance with Amendment 22 to "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A-14 (GESTAR-II), and U. S. Supplement, NEDE-24011-P-A-14-US, June, 2000, which provides the fuel licensing acceptance criteria. Amendment 22 was the basis for compliance for GE-13 fuel. The probability of fuel damage will not be increased as a result of this change. Therefore, the proposed TS change does 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 greater than 99.9% of all fuel rods in the core avoid transition boiling provided the limit is not violated. The new SLMCPRs are calculated using NRC approved methodology discussed in "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A-14 (GESTAR-II), and U.S. Supplement, NEDE-24011-P-A-14-US, June, 2000, which incorporates Amendment 25. Additionally, the GE-14 fuel is in compliance with Amendment 22 to "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A-14 (GESTAR-II), and U. S. Supplement, NEDE-24011-P-A-14-US, June, 2000, which provides the fuel licensing acceptance criteria. Amendment 22 was the basis for compliance for GE-13 fuel. The SLMCPR is not an accident initiator, and its revision will not create the possibility of a new or different kind of accident from any accident previously evaluated.

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

   Response: No.

   There is no significant reduction in the margin of safety previously approved by the NRC as a result of the proposed change to the SLMCPRs, which includes the use of GE-13 and GE-14 fuel product lines. The new SLMCPRs are calculated using methodology discussed in "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-

A-14 (GESTAR-II), and U.S. Supplement, NEDE-24011-P-A-14-US, June, 2000, which incorporates Amendment 25. The SLMCPRs ensure that greater than 99.9% of all fuel rods in the core avoid transition boiling provided the limit is not violated, thereby preserving the fuel cladding integrity. Therefore, the proposed TS change will not involve a significant reduction in the margin of safety previously approved by the NRC.

Based on the above, Exelon Generation Company, LLC, concludes that the proposed amendment presents no 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.

5.2 Applicable Regulatory Requirements/Criteria

Safety limits are required to be included in the Technical Specifications by 10 CFR 50.36. The SLMCPR ensures sufficient conservatism in the operating MCPR limit 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 considering the power distribution within the core and all uncertainties.

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.

6.0 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.

7.0 REFERENCES

a) NEDE-24011-P-A-14 (GESTAR-II), "General Electric Standard Application for Reactor Fuel", and U. S. Supplement, NEDE-24011-P-A-14-US, June, 2000, which incorporates Amendment 25.

b) NRC Safety Evaluation Report dated March 11, 1999 (F. Akstulewicz (NRC) to G. A. Watford (GE), "Acceptance for Referencing of Licensing Topical Reports NEDC-32601P, Methodology and Uncertainties for Safety Limit MCPR Evaluations; NEDC-32694P, Power Distribution Uncertainties for Safety Limit MCPR Evaluation; and Amendment 25 to NEDE-24011-P-A on Cycle Specific Safety Limit MCPR (TAC Nos. M97490, M99069, and M97491)").

c) NEDC-32601P-A, Methodology and Uncertainties for Safety Limit MCPR Evaluations.

d) NEDC-32694P-A, Power Distribution Uncertainties for Safety Limit MCPR Evaluation.

e) Letter from C. P. Paone (Global Nuclear Fuel) to J. Tusar (Exelon Generation Company, LLC) dated November 10, 2003 (Proprietary).

Precedence

In a letter dated December 21, 2001 (letter from M. P. Gallagher (Exelon Generation Company, LLC) to U. S. Nuclear Regulatory Commission), Exelon, submitted Technical Specifications Change Request Application 01-01092 for Limerick Generating Station (LGS), Unit 1. This submittal incorporated the revised dual- and single-loop SLMCPR values into the Technical Specifications for LGS, Unit 1 Cycle 10 in a similar manner that this submittal is requesting to incorporate the revised values for SLMCPR in the Technical Specifications for LGS, Unit 1, Cycle 11. This Technical Specifications Change Request was approved in a Safety Evaluation Report dated March 12, 2002 (letter from C. Gratton (U. S. Nuclear Regulatory Commission) to O. D. Kingsley (Exelon)). The revised SLMCPR values for LGS, Unit 1 Cycle 11 were calculated using the methodology discussed in "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A (GESTAR-II), and U.S. Supplement, NEDE-24011-P-A-US, similar to the SLMCPR values for LGS, Unit 1, Cycle 10. The main difference in the determination between the LGS, Unit 1 Cycle 10 SLMCPR and the LGS, Unit 1, Cycle 11 SLMCPR is in the use of the reduced power distribution uncertainty as described in NEDC-32694P-A rather than the GETAB power distribution uncertainty used in the previous submittal.

ATTACHMENT 2

LIMERICK GENERATING STATION
UNIT 1

DOCKET NO. 50-352

LICENSE NO. NPF-39

LICENSE AMENDMENT REQUEST: AR A1443067

"Revision of SLMCPRs"

MARKED UP TECHNICAL SPECIFICATION AND BASES PAGES

UNIT 1

Page 2 -1
Page B 2-1

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 785 psig 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 785 psig 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 (1.07) for two recirculation loop operation and shall not be less than 1.11 (1.08) for single recirculation loop operation with the reactor vessel steam dome pressure greater than 785 psig and core flow greater than 10% of rated flow.

APPLICABILITY: OPERATIONAL CONDITIONS 1 and 2.

ACTION:

With MCPR less than 1.10 (1.07) for two recirculation loop operation or less than 1.11 (1.08) for single recirculation loop operation and the reactor vessel steam dome pressure greater than 785 psig 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: OPERATIONAL 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 the reactor coolant system pressure less than or equal to 1325 psig within 2 hours and comply with the requirements of Specification 6.7.1.

2.0 INTRODUCTION

The fuel cladding, reactor pressure vessel and primary system piping are the principal barriers to the release of radioactive materials to the environs. Safety Limits are established to protect the integrity of these barriers during normal plant operations and anticipated transients. The fuel cladding integrity Safety Limit is set such that no fuel damage is calculated to occur 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 1.10 for two recirculation loop operation and 1.11 for single recirculation loop operation. MCPR greater than 1.10 for two recirculation loop operation and 1.11 for single recirculation loop operation represents a conservative margin relative to the conditions required to maintain fuel cladding integrity. The fuel cladding is one of the physical barriers which separate the radioactive materials from the environs. The integrity of this cladding barrier is related to its relative freedom from perforations or cracking. Although some corrosion or use related cracking may occur during the life of the cladding, fission product migration from this source is incrementally cumulative and continuously measurable. Fuel cladding perforations, however, can result from thermal stresses which occur from reactor operation significantly above design conditions and the Limiting Safety System Settings. While fission product migration from cladding perforation is just as measurable as that from use related cracking, the thermally caused cladding perforations signal a threshold beyond which still greater thermal stresses may cause gross rather than incremental cladding deterioration. Therefore, the fuel cladding Safety Limit is defined with a margin to the conditions which would produce onset of transition boiling, MCPR of 1.0. These conditions represent a significant departure from the condition intended by design for planned operation.

2.1.1 THERMAL POWER, Low Pressure or Low Flow

The use of the (GEXL) correlation is not valid for all critical power calculations at pressures below 785 psig or core flows less than 10% of rated flow. Therefore, the fuel cladding integrity Safety Limit is established by other means. This is done by establishing a limiting condition on core THERMAL POWER with the following basis. Since the pressure drop in the bypass region is essentially all elevation head, the core pressure drop at low power and flows will always be greater than 4.5 psi. Analyses show that with a bundle flow of 28 x 10^3 lb/h, bundle pressure drop is nearly independent of bundle power and has a value of 3.5 psi. Thus, the bundle flow with a 4.5 psi driving head will be greater than 28 x 10^3 lb/h. Full scale ATLAS test data taken at pressures from 14.7 psia to 800 psia indicate that the fuel assembly critical power at this flow is approximately 3.35 MWt. With the design peaking factors, this corresponds to a THERMAL POWER of more than 50% of RATED THERMAL POWER. Thus, a THERMAL POWER limit of 25% of RATED THERMAL POWER for reactor pressure below 785 psig is conservative.

ATTACHMENT 3

LIMERICK GENERATING STATION
UNIT 1

DOCKET NO. 50-352

LICENSE NO. NPF-39

LICENSE AMENDMENT REQUEST: AR A1443067

"Revision of SLMCPRs"

CAMERA-READY TECHNICAL SPECIFICATION AND BASES PAGES

UNIT 1

Page 2.0-1
Page B 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 785 psig 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 785 psig 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 1.07 for two recirculation loop operation and shall not be less than 1.08 for single recirculation loop operation with the reactor vessel steam dome pressure greater than 785 psig and core flow greater than 10% of rated flow.

APPLICABILITY: OPERATIONAL CONDITIONS 1 and 2.

ACTION:

With MCPR less than 1.07 for two recirculation loop operation or less than 1.08 for single recirculation loop operation and the reactor vessel steam dome pressure greater than 785 psig 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: OPERATIONAL 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 the reactor coolant system pressure less than or equal to 1325 psig within 2 hours and comply with the requirements of Specification 6.7.1.

2.0 INTRODUCTION

The fuel cladding, reactor pressure vessel and primary system piping are the principal barriers to the release of radioactive materials to the environs. Safety Limits are established to protect the integrity of these barriers during normal plant operations and anticipated transients. The fuel cladding integrity Safety Limit is set such that no fuel damage is calculated to occur 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 1.07 for two recirculation loop operation and 1.08 for single recirculation loop operation. MCPR greater than 1.07 for two recirculation loop operation and 1.08 for single recirculation loop operation represents a conservative margin relative to the conditions required to maintain fuel cladding integrity. The fuel cladding is one of the physical barriers which separate the radioactive materials from the environs. The integrity of this cladding barrier is related to its relative freedom from perforations or cracking. Although some corrosion or use related cracking may occur during the life of the cladding, fission product migration from this source is incrementally cumulative and continuously measurable. Fuel cladding perforations, however, can result from thermal stresses which occur from reactor operation significantly above design conditions and the Limiting Safety System Settings. While fission product migration from cladding perforation is just as measurable as that from use related cracking, the thermally caused cladding perforations signal a threshold beyond which still greater thermal stresses may cause gross rather than incremental cladding deterioration. Therefore, the fuel cladding Safety Limit is defined with a margin to the conditions which would produce onset of transition boiling, MCPR of 1.0. These conditions represent a significant departure from the condition intended by design for planned operation.

2.1.1 THERMAL POWER, Low Pressure or Low Flow

The use of the (GEXL) correlation is not valid for all critical power calculations at pressures below 785 psig or core flows less than 10% of rated flow. Therefore, the fuel cladding integrity Safety Limit is established by other means. This is done by establishing a limiting condition on core THERMAL POWER with the following basis. Since the pressure drop in the bypass region is essentially all elevation head, the core pressure drop at low power and flows will always be greater than 4.5 psi. Analyses show that with a bundle flow of 28 x 10^3 lb/h, bundle pressure drop is nearly independent of bundle power and has a value of 3.5 psi. Thus, the bundle flow with a 4.5 psi driving head will be greater than 28 x 10^3 lb/h. Full scale ATLAS test data taken at pressures from 14.7 psia to 800 psia indicate that the fuel assembly critical power at this flow is approximately 3.35 MWt. With the design peaking factors, this corresponds to a THERMAL POWER of more than 50% of RATED THERMAL POWER. Thus, a THERMAL POWER limit of 25% of RATED THERMAL POWER for reactor pressure below 785 psig is conservative.

ATTACHMENT 5

LIMERICK GENERATING STATION
UNIT 1

Docket No. 50-352

License No. NPF-39

LICENSE AMENDMENT REQUEST: AR A1443067

NON-PROPRIETARY VERSION

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Proprietary information of Global Nuclear Fuel is indicated by enclosing it in double brackets, e.g., [[proprietary information {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 the enclosed affidavit, which provides the basis for the proprietary determination. Specific information that is not so marked is not GNF proprietary.

References

[1] Letter, Frank Akstulewicz (NRC) to Glen A. Watford (GE), "Acceptance for Referencing of Licensing Topical Reports NEDC-32601P, *Methodology and Uncertainties for Safety Limit MCPR Evaluations*; NEDC-32694P, *Power Distribution Uncertainties for Safety Limit MCPR Evaluation*; and Amendment 25 to NEDE-24011-P-A on Cycle Specific Safety Limit MCPR," (TAC Nos. M97490, M99069 and M97491), March 11, 1999.

[2] Letter, Thomas H. Essig (NRC) to Glen A. Watford (GE), "Acceptance for Referencing of Licensing Topical Report NEDC-32505P, Revision 1, *R-Factor Calculation Method for GE11, GE12 and GE13 Fuel*," (TAC Nos. M99070 and M95081), January 11, 1999.

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

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

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

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

Comparison of Limerick 1 Cycle 11 and 10 SLMCPR Values

Table 1 summarizes the relevant input parameters and results of the SLMCPR determination for the Limerick 1 Cycle 11 and 10 cores. The bases for the power distribution uncertainties are also indicated in Table 1. Table 2 provides a more detailed presentation of the bases and results for the Cycle 11 and Cycle 10 analyses. The affect on the calculated SLMCPR of the change from GETAB to Reduced power uncertainties is summarized in Table 2. The SLMCPR evaluations were performed using NRC approved methods and uncertainties[1]. These evaluations yield different calculated SLMCPR values because different inputs were used. The quantities that have been shown to have some impact on the determination of the safety limit MCPR (SLMCPR) are provided.

In comparing the Limerick 1 Cycle 11 and 10 SLMCPR values it is important to note the impact of the differences in the core and bundle designs. These differences are summarized in Table 1. The GETAB and reduced power distribution uncertainty columns for Cycle 11 are both provided for comparison to the Cycle 10 GETAB power distribution uncertainty column.

In general, the calculated safety limit is dominated by two key parameters: (1) flatness of the core bundle-by-bundle MCPR distributions and (2) flatness of the bundle pin-by-pin power/R-factor distributions. Greater flatness in either parameter yields more rods susceptible to boiling transition and thus a higher calculated SLMCPR.

[[

[3]]].

The uncontrolled bundle pin-by-pin power distributions were compared between the Limerick 1 Cycle 11 bundles and the Cycle 10 bundles. Pin-by-pin power distributions are characterized in terms of R-factors using the NRC approved methodology[2]. For the Limerick 1 Cycle 11 limiting case analyzed at EOC-1.1K, [[

[3]]] the Limerick 1 Cycle 11 bundles are flatter than the bundles used for the Cycle 10 SLMCPR analysis.

As indicated in Table 1, the NRC approved[1] revised non-power distribution uncertainties have been assumed for the Limerick 1 Cycle 11 analyses.

With a more peaked core MCPR distribution in Cycle 11 than in Cycle 10, and a more flat bundle R-factor distribution in Cycle 11 relative to the Cycle 10 bundles, it is expected that the Cycle 11 SLMCPR result would be somewhat higher than the Cycle 10 result. Table 1 shows that when using the same uncertainties the Cycle 11 SLMCPR is somewhat lower than the Cycle 10 SLMCPR. However, the SLMCPR difference between Cycle 11, and Cycle 10 is within the [[
]]. Table 2 shows these same values to greater precision.

As indicated in Table 1, the NRC approved[1] standard GETAB uncertainties and reduced power distribution uncertainties have both been assumed for the Limerick 1 Cycle 11 analyses. For the

Cycle 10 case, the standard GETAB power distribution uncertainties were used. Use of the reduced power distribution uncertainties results in a reduction of the SLMCPR by approximately [[ ]]. The net reduction is less because the increase in R-factor uncertainty from [[ ]] caused the SLMCPR to increase by approximately [[ ]].

Comparison of the GETAB and Reduced Uncertainties

The power distribution and other uncertainties that are the bases for the proposed Technical Specifications (TS) safety limit for Limerick 1 Cycle 11 are identified in Table 2. Column 2 of Table 2 shows the power distribution and other uncertainties that are the bases for the current TS safety limit for Limerick 1 Cycle 10. The revised bases to support the proposed change in TS safety limit for Limerick 1 Cycle 11 are identified in column 3b of Table 2. The GETAB bases and values for Cycle 11 are provided for comparison purposes in column 3a. By comparing the values from column 2 for Cycle 10 and column 3a for Cycle 11, one may see that the calculated SLMCPR for Cycle 11 is lower [[[3]]] than the value for Cycle 10 when using the same GETAB model and uncertainties for both calculations. Thus, the focus for Table 2 is on how the revised model and reduced power distribution uncertainties affect the calculated SLMCPR for Limerick 1, Cycle 11 (only).

The revised model and reduced power distribution uncertainties affect the calculated SLMCPR for Limerick 1 Cycle 11 as indicated in Table 2. Bases that have not changed are not reported in either table except where it is important to indicate that the bases have not changed. For these exceptions, the impact on the SLMPCR is indicated as "None" in the rightmost column of Table 2. For the other items where a change in basis is indicated, the calculated impact that each item has on the calculated SLMCPR is indicated.

The impacts from the changes in bases have been grouped into three categories. In each category the shaded cells contain values that sum to produce the total impact for that category indicated in the cell immediately below the shaded cells.

In Section 1 of Table 2 the impact of using the "revised uncertainties not related to power distribution" is indicated as "None" since the same revised uncertainties were used for both the GETAB calculation (Column 3a) and the revised calculation (Column 3b).

The largest change in the calculated SLMCPR is the reduction that is due to use of the NRC-approved revised power distribution model and its associated reduced uncertainties as described in NEDC-32694P-A. For Limerick 1 Cycle 11 the calculated SLMCPR was reduced by [[[3]]] as indicated in Section 2 of Table 2.

For Limerick 1 Cycle 11, both the GETAB calculation and the revised calculation use the same limiting rod patterns, [[[3]]] Therefore, In Section 3 of Table 2 the "Secondary impact on SLMCPR because reduced SLMCPR causes a lower OLMCPR" is indicated as [[[3]]].

The total impact is that the SLMCPR as calculated using NRC-approved methods, inputs and procedures decreases by [[{3}]]. This amount of improvement is consistent with the expected improvements as presented to the NRC in Table 4.3 of NEDC-32694P-A. Of this improvement, about [[{3}]] is attributed to the reduced uncertainties themselves and the remaining [[{3}]] is attributed to the methodology improvements described in NEDC-32694P-A.

Reduction in the Tech Spec SLMCPRs by these calculated amounts is warranted since the old GETAB value is overly conservative. The excessive conservatism in the GETAB model and inputs is primarily due to the higher [[{3}]] uncertainty [[{3}]] These limitations are not applicable to the 3D-MONICORE (3DM) monitoring system. The revised power distribution model and reduced uncertainties associated with 3DM have been justified, reviewed and approved by the NRC (reference NEDC-32601P-A and NEDC-32694P-A). The conservatism that remains even when applying the revised model and reduced uncertainties to calculate a lower SLMCPR was documented as part of the NRC review and approval. It was noted on page A-24 of NEDC-32601P-A [[{3}]]

Summary

[[{3}]] have been used to compare quantities that impact the calculated SLMCPR value. Based on these comparisons, the conclusion is reached that the Limerick 1 Cycle 11 core/cycle has a more peaked core MCPR distribution [[{3}]] and less peaked in-bundle power distributions [[{3}]] than what was used to perform the Cycle 10 SLMCPR evaluation.

Utilizing the same GETAB bases used for Cycle 10, the calculated [[{3}]] Monte Carlo SLMCPR for Limerick 1 Cycle 11 is consistent with what one would expect [[{3}]] the [[{3}]] SLMCPR value is appropriate in light of the uncertainty of the correlation.

The reduction in SLMCPR to 1.07 associated with the change in basis to the reduced power distribution uncertainties for Limerick 1 Cycle 11 is consistent with what one would expect for a change to this basis.

Based on all of the facts, observations and arguments presented above, it is concluded that the calculated SLMCPR value of 1.07 for the Limerick 1 Cycle 11 core is appropriate. It is reasonable that this value is about 0.03 lower than the 1.10 value calculated for the previous cycle.

For SLO the calculated safety limit MCPR for the limiting case is 1.08 as determined by specific calculations for Limerick 1 Cycle 11.

[[

. [3]]]

Supporting Information

The following information is provided in response to NRC questions on similar submittals regarding changes in Technical Specification values of SLMCPR. NRC questions pertaining to how GE14 applications satisfy the conditions of the NRC SER[1] have been addressed in Reference [4]. Other generically applicable questions related to application of the GEXL14 correlation and the applicable range for the R-factor methodology are addressed in Reference [5]. Only those items that require a plant/cycle specific response are presented below since all the others are contained in the references that have already been provided to the NRC.

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

(3)]]

The power and non-power distribution uncertainties that are used in the analyses are indicated in Table 1. The referenced document numbers have previously been reviewed and approved by the NRC.

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Table 1

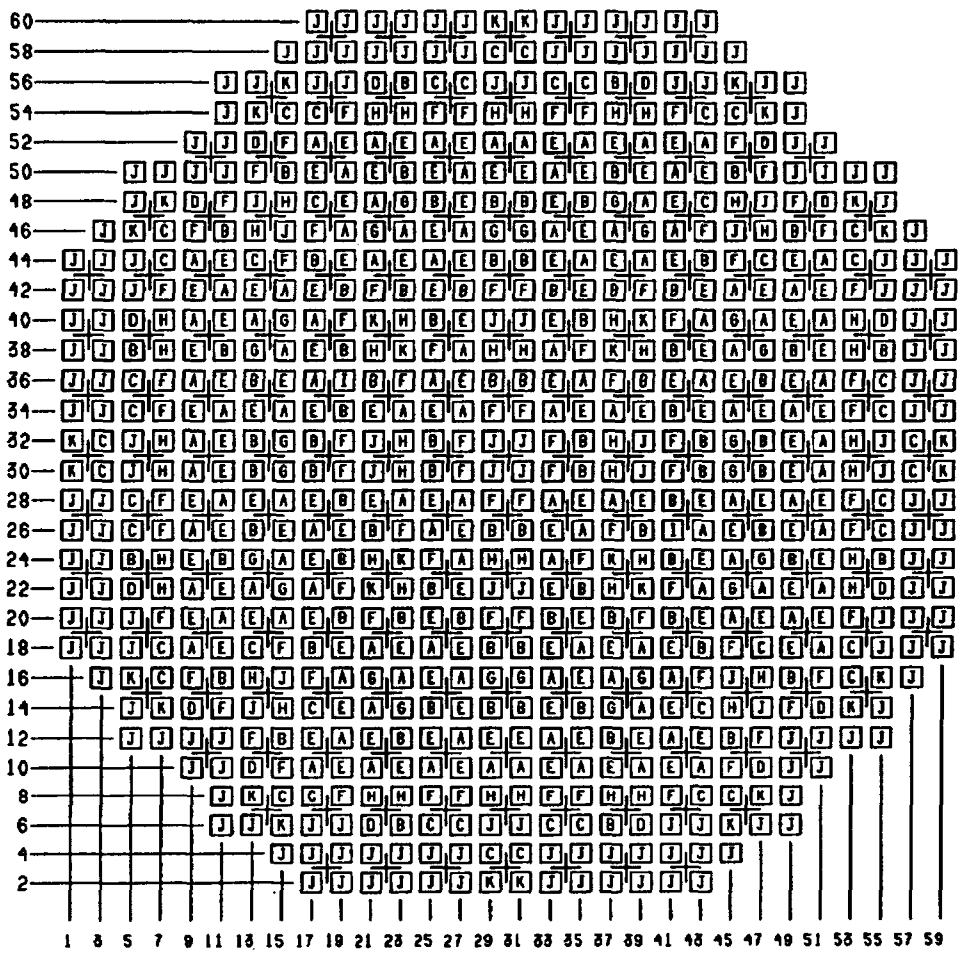
Comparison of the Limerick 1 Cycle 11 and Cycle 10 SLMCPR

QUANTITY, DESCRIPTION	Limerick 1 Cycle 10	Limerick 1 Cycle 11	
Number of Bundles in Core	764	764	764
Limiting Cycle Exposure Point	EOR-1.0K	EOR-1.1K	EOR-1.1K
Cycle Exposure at Limiting Point [MWd/STU]	14600	13600	13600
Reload Fuel Type	GE14	GE14	GE14
Latest Reload Batch Fraction [%]	36.6	34.6	34.6
Latest Reload Average Batch Weight % Enrichment	4.17	4.16	4.16
Batch Fraction for GE14[%]	36.6	71.2	71.2
Batch Fraction for GE13[%]	63.4	28.3	28.8
Core Average Weight % Enrichment	4.16	4.17	4.17
Core MCPR (for limiting rod pattern)	1.42	1.39	1.39
[[			]]
[[			]]
Power distribution methodology	GETAB NEDO-10958-A	GETAB NEDO-10958-A	Revised NEDC-32601P-A
Power distribution uncertainty	GETAB NEDO-10958-A	GETAB NEDO-10958-A	Reduced NEDC-32694P-A
Non-power distribution uncertainty	Revised NEDC-32601P-A	Revised NEDC-32601P-A	Revised NEDC-32601P-A
Calculated Safety Limit MCPR	**1.10**	**1.09**	**1.07**

Table 2
Limerick 1 Cycles 10 and 11 SLMCPR Results Assessment

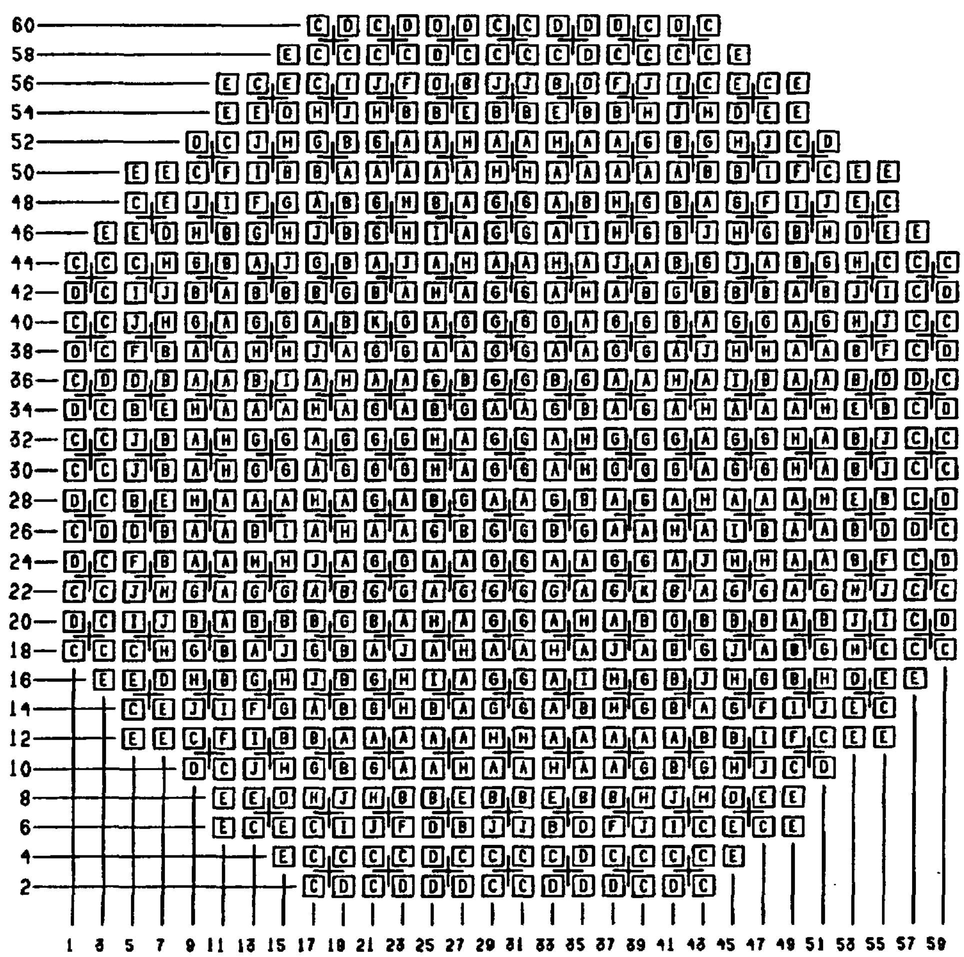
1	2	3a	3b	4
Quantity	Cycle 10 GETAB Value	Cycle 11 GETAB Bases	Cycle 11 Revised Bases	Impact on SLMCPR for Cycle 11 (col. 3b-3a)
Tech Specs	Current	Used for comparison only	Proposed	[[-]]
1. Impact of Revised Uncertainties Not Related to Power Distribution				
Reference Document	NEDC-32601P-A August 1999	NEDC-32601P-A August 1999	NEDC-32601P-A August 1999	Approved by NRC
Feedwater flow uncertainty	[[		]]	None
Reactor pressure uncertainty	[[			None
Channel flow area uncertainty	[[			None
Friction multiplier uncertainty	[[		]]	None
				[[
2. Impact of Reduced Power Distribution Uncertainties and Revised Modeling				
Reference Document	NEDO-10958-A January 1977	NEDO-10958-A January 1977	NEDC-32694P-A August 1999	Both approved by NRC
R-factor uncertainty	[[		]]	[[ ]]
Critical power uncertainty	[[		]]	None
TIP random uncertainty component	[[[[			None
Adaptive mode for Safety Limit analysis	Absolute		Shape	Both approved by NRC
Effective total bundle power uncertainty	[[		]]	Part of overall TIPSYS
Effective non-random TIPSYS	[[		]]	Part of overall TIPSYS
Effective <u>overall TIPSYS</u> uncertainty as modeled	[[		]]	[[ ]]
3. Secondary Impact on SLMCPR because Reduced SLMCPR causes a Lower OLMCPR				
Target OLMCPR	1.38	1.38	1.38	See below
[[			]]	[[ ]]
[[			]]	[[ ]]
[[ ]]				[[ ]]
Total Impact on SLMCPR				
Calculated SLMCPR - DLO	[[			-]]
Calculated SLMCPR - SLO	[[			]]
TS SLMCPR - DLO	1.10	[[ ]]	1.07	[[ ]]
TS SLMCPR - SLO	1.11	[[ ]]	1.08	[[ ]]

Figure 1 - Cycle 10 Reference Core Loading Pattern



FUEL TYPE	
A = GE13-P9CTB417-13GZ-100T-146-T	G = GE14-P10CNAB417-7G8.0/8G7.0-100T-150-T-2527
B = GE13-P9CTB417-11GZ-100T-146-T	H = GE14-P10CNAB417-13GZ-100T-150-T-2528
C = GE13-P9CTB417-13GZ-100T-146-T	I = GE14-P10CNAB417-7G8.0/8G7.0-80U45R-150-T-2531
D = GE13-P9CTB417-11GZ-100T-146-T	J = GE13-P9CTB412-13GZ-100T-146-T
E = GE14-P10CNAB417-7G8.0/8G7.0-100T-150-T-2527	K = GE13-P9CTB413-14GZ-100T-146-T
F = GE14-P10CNAB417-13GZ-100T-150-T-2528	

Figure 2 - Cycle 11 Reference Core Loading Pattern



FUEL TYPE	
A = GE14-P10CNAB417-15GZ-100T-150-T6-2594	G = GE14-P10CNAB417-7G8.0/8G7.0-100T-150-T6-2529
B = GE14-P10CNAB414-14GZ-100T-150-T6-2690	H = GE14-P10CNAB417-13GZ-100T-150-T6-2530
C = GE13-P9CTB417-13GZ-100T-146-T6-3833	I = GE14-P10CNAB417-7G8.0/8G7.0-100T-150-T6-2529
D = GE13-P9CTB417-11GZ-100T-146-T6-3834	J = GE14-P10CNAB417-13GZ-100T-150-T6-2530
E = GE13-P9CTB417-13GZ-100T-146-T6-3833	K = GE14-P10CNAB417-7G8.0/8G7.0-80U45R-150-T6-~~2532~~ 2532
F = GE13-P9CTB417-11GZ-100T-146-T6-3834	

A.E 11/19/2003