ATTACHMENT 4

to

Entergy Letter 2.14.076

Global Nuclear Fuels Report, GNF-001N8659-R1-NP, "GNF Additional Information Regarding the Requested Changes to the Technical Specification SLMCPR, Pilgrim Cycle 21"

(26 Pages)

Global Nuclear Fuel
A Joint Venture of GE, Toshiba, & Hitachi

Global Nuclear Fuel

GNF-001N8659-R1-NP
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Non-Proprietary Information – Class I (Public)

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

Pilgrim Cycle 21

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1.0 Methodology

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

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

Table 2 identifies the actual methodologies used for the Pilgrim Cycle 20 and the Cycle 21 SLMCPR calculations.

2.0 Discussion

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

2.1. Major Contributors to SLMCPR Change

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

Table 3 presents the MIP and RIP parameters for the previous cycle and the current cycle along with the TLO SLMCPR estimate using the MIPRIP correlation. If the minimum core flow case is applicable, the TLO SLMCPR estimate is also provided for that case although the MIPRIP correlation is only applicable to the rated core flow case. This is done only to provide some reasonable assessment basis of the minimum core flow case trend. In addition, Table 3 presents estimated effects on the TLO SLMCPR due to methodology deviations, penalties, and/or uncertainty deviations from approved values. Based on the MIPRIP correlation and any effects due to deviations from approved values, a final estimated TLO SLMCPR is determined. Table 3 also provides the actual calculated Monte Carlo SLMCPRs. Given the bias and uncertainty in the MIPRIP correlation [[ ]] and the inherent variation in the Monte Carlo results [[ ]], the change in the Pilgrim Cycle 21 calculated Monte Carlo TLO SLMCPR using rated core power and rated core flow conditions is consistent with the corresponding estimated TLO SLMCPR value.

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

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

2.2. Deviations in NRC-Approved Uncertainties

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

2.2.1. R-Factor

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

Pilgrim has experienced control blade shadow corrosion-induced channel bow to the extent that an increase in the NRC-approved R-Factor uncertainty of [[ ]] is deemed prudent to address its effect. Accounting for the control blade shadow corrosion-induced channel bow, the Pilgrim Cycle 21 analysis shows an expected channel bow uncertainty of [[ ]], which is bounded by a GEXL R-Factor uncertainty of [[ ]]. Thus, the use of a GEXL R-Factor uncertainty of [[ ]] adequately accounts for the expected control blade shadow corrosion-induced channel bow for Pilgrim Cycle 21.

2.2.2. Core Flow Rate and Random Effective TIP Reading

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

For the TLO calculations performed at 76.7% core flow, the approved uncertainty values for the core flow rate (2.5%) and the random effective Traversing In-Core Prove (TIP) reading (1.2%) are conservatively adjusted by dividing them by 76.7/100. The steps "σ CORE FLOW" and "σ TIP (INSTRUMENT)" in Figure 4.1 from NEDC-32601P-A (Reference 2), which has been provided for convenience in Figure 3 of this document, are affected by this deviation, respectively.

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

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

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

2.3. Departure from NRC-Approved Methodology

No departures from NRC-approved methodologies were used in the Pilgrim Cycle 21 SLMCPR calculations.

2.4. Fuel Axial Power Shape Penalty

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

[[				
				]]

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

[[	

]]

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

For the limiting bundles, the fuel axial power shapes in the SLMCPR analysis were examined to determine the presence of axial power shapes identified in the above table. These power shapes were found; therefore, power shape penalties were applied to the calculated Pilgrim Cycle 21 SLMCPR values, and their effect is listed in Table 3.

2.5. Methodology Restrictions

The four restrictions identified on page 3 of NRC's Safety Evaluation (SE) relating to the General Electric licensing topical reports NEDC-32601P (Reference 2), NEDC-32694P

(Reference 3), and Amendment 25 to NEDE-24011-P-A (Reference 1) are addressed in References 11, 12, 7, and 13.

The four restrictions for GNF2 were determined to be acceptable by the NRC review of "GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II), NEDC-33270P, March 2007, and GEXL17 Correlation for GNF2 Fuel, NEDC-33292P, March 2007," (Reference 14). Specifically, in the NRC audit report (Reference 15) for the said document, Section 3.4.1 page 59 states:

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

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

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

As such, no new GNF fuel designs are being introduced in Pilgrim Cycle 21; therefore, the NEDC-32505P-A (Reference 4) statement "...if new fuel is introduced, GENE must confirm that the revised R-Factor method is still valid based on new test data" is not applicable.

2.6. Minimum Core Flow Condition

For Pilgrim Cycle 21, the minimum core flow SLMCPR calculation performed at 76.7% core flow and rated core power condition was limiting as compared to the rated core flow and rated core power condition. For convenience, Figures III.5-1 and III.5-2 from NEDC-32601P-A (Reference 2) have been provided in Figures 4 and 5, respectively, in order to show this minimum core flow condition relative relationship to the data on these figures. For this condition the MIP [[

]] Therefore, this demonstrates that the MIP criterion for determining what constitutes a reasonably bounding limiting rod pattern is still valid for this minimum core flow condition. Hence, the rod pattern used to calculate the SLMCPR at 100% rated power/76.7% rated flow reasonably assures that at least 99.9% of the fuel rods in the core would not be expected to experience boiling transition during normal operation or anticipated operational occurrences (AOOs) during the operation of Pilgrim Cycle 21. Consequently, the SLMCPR value calculated from the 76.7% core flow and rated core power condition limiting MCPR distribution reasonably bounds this mode of operation for Pilgrim Cycle 21.

2.7. Limiting Control Rod Patterns

The limiting control rod patterns used to calculate the SLMCPR reasonably assures that at least 99.9% of the fuel rods in the core would not be expected to experience boiling transition during normal operation or AOOs during the operation of Pilgrim Cycle 21.

2.8. Core Monitoring System

For Pilgrim Cycle 21, the 3D Monicore system will be used as the core monitoring system.

2.9. Power/Flow Map

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

2.10. Core Loading Diagram

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

2.11. Figure References

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

2.12. Additional SLMCPR Licensing Conditions

For Pilgrim Cycle 21, no additional SLMCPR licensing conditions are included in the analysis.

2.13. 10 CFR Part 21 Evaluation

2.13.1. GNF2 Bent Flow Wing

A manufacturing defect was discovered in the spacer flow wings of the fresh GNF2 fuel loaded in Pilgrim Cycle 18. The condition is characterized as the spacer flow wing associated with a corner location being bent downward. This condition is described further in Attachment 2 of GNF Enclosure 3 of Reference 16, Attachment 1. The manufacturing process leading to this condition has been corrected such that the Pilgrim Cycle 19, 20, and 21 GNF2 bundles are not affected by this defect. However, as the Cycle 18 GNF2 fuel continues to reside in Cycle 21, the effect of this defect on the SLMCPR has been assessed.

For Cycle 21, the GNF2 bundles loaded in Cycle 18 are the lowest reactivity bundles in the core, and they are all placed on the periphery (outermost rows). The periphery of the core does not contribute to the SLMCPR results as the bundles are not contributing rods for the 0.1% boiling transition. Due to their placement in the lowest power region of the core, there is no effect of the GNF2 bent flow wing on the final SLMCPR calculation for Pilgrim Cycle 21.

2.14. Summary

The requested changes to the Technical Specification SLMCPR values are 1.10 for TLO and 1.12 for SLO for Pilgrim Cycle 21.

3.0 References

1. Global Nuclear Fuel, "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A, Revision 20, December 2013.

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, John F. Schardt (GNF-A) to US 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.

6. Letter, Jason S. Post (GENE) to US 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.

7. Letter, Glen A. Watford (GNF-A) to US 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.

8. Letter, Glen A. Watford (GNF-A) to US 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.

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

10. Letter, Andrew A. Lingenfelter (GNF-A) to US NRC Document Control Desk with cc to MC Honcharik (NRC), "Removal of Penalty Being Applied to GE14 Critical Power Correlation for Outlet Peaked Axial Power Shapes," FLN-2007-031, September 18, 2007.

11. Letter, Glen A. Watford (GNF-A) to US NRC 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.

12. Letter, Glen A. Watford (GNF-A) to US NRC Document Control Desk with attention to

Joseph E. 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.

13. Letter, Andrew A. Lingenfelter (GNF-A) to US NRC Document Control Desk with cc to SS Philpott (NRC), "Amendment 33 to NEDE-24011-P, General Electric Standard Application for Reactor Fuel (GESTAR II) and GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II), NEDC-33270P, Revision 3, March 2010," MFN 10-045, March 5, 2010.

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

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

16. Letter, Pete Deitrich (JAF) to US NRC Document Control Desk, "Response to Follow-up Request for Additional Information Re: James A. FitzPatrick Nuclear Power Plant Proposed Change to the James A. FitzPatrick Nuclear Power Plant's Technical Specification Concerning the Safety Limit Minimum Critical Power Ratio (TAC No. ME3786)," JAFP-10-0122, September 2, 2010.

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

Fuel Type					
5	GNF2-P10DG2B388-6G6.0/7G5.0-100T2-145-T6-3143	(Cycle 18)	22	GNF2-P10DG2B398-5G6.0/8G5.0-100T2-145-T6-4172	(Cycle 20)
6	GNF2-P10DG2B388-6G6.0/7G5.0-100T2-145-T6-3143	(Cycle 18)	23	GNF2-P10DG2B389-15G5.0-100T2-145-T6-4173	(Cycle 20)
7	GNF2-P10DG2B395-6G6.0/9G5.0-100T2-145-T6-3422	(Cycle 19)	24	GNF2-P10DG2B375-7G6.0/6G5.0-100T2-145-T6-4174	(Cycle 20)
8	GNF2-P10DG2B401-6G6.0/8G5.0/1G4.0-100T2-145-T6-3421	(Cycle 19)	25	GNF2-P10DG2B387-15G6.0-100T2-145-T6-4308	(Cycle 21)
11	GNF2-P10DG2B389-6G6.0/8G5.0-100T2-145-T6-3141	(Cycle 18)	26	GNF2-P10DG2B387-12G6.0/4G5.0-100T2-145-T6-4309	(Cycle 21)
12	GNF2-P10DG2B407-6G6.0/2G5.0/6G4.0-100T2-145-T6-3642	(Cycle 19)	27	GNF2-P10DG2B398-14G5.0-100T2-145-T6-4310	(Cycle 21)
13	GNF2-P10DG2B401-6G6.0/2G5.0/6G4.0-100T2-145-T6-3640	(Cycle 19)	28	GNF2-P10DG2B387-13G6.0-100T2-145-T6-4311	(Cycle 21)
15	GNF2-P10DG2B406-6G6.0/6G5.0/2G4.0-100T2-145-T6-3641	(Cycle 19)	29	GNF2-P10DG2B387-15G6.0-100T2-145-T6-4308	(Cycle 21)
16	GNF2-P10DG2B401-6G6.0/2G5.0/6G4.0-100T2-145-T6-3640	(Cycle 19)	30	GNF2-P10DG2B387-12G6.0/4G5.0-100T2-145-T6-4309	(Cycle 21)
19	GNF2-P10DG2B389-6G6.0/2G5.0/6G4.0-100T2-145-T6-3142	(Cycle 18)	31	GNF2-P10DG2B398-14G5.0-100T2-145-T6-4310	(Cycle 21)
20	GNF2-P10DG2B375-6G6.0/7G5.0-100T2-145-T6-3434	(Cycle 19)	32	GNF2-P10DG2B387-13G6.0-100T2-145-T6-4311	(Cycle 21)
21	GNF2-P10DG2B406-6G6.0/2G5.0/6G4.0-100T2-145-T6-4171	(Cycle 20)			

Figure 1. Current Cycle Core Loading Diagram

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

Fuel Type					
1	GE14-P10DNAB404-5G6.0/10G5.0-100T-145-T6-2960	(Cycle 17)	15	GNF2-P10DG2B406-6G6.0/6G5.0/2G4.0-100T2-145-T6-3641	(Cycle 19)
2	GE14-P10DNAB398-5G6.0/10G5.0-100T-145-T6-2958	(Cycle 17)	16	GNF2-P10DG2B401-6G6.0/2G5.0/6G4.0-100T2-145-T6-3640	(Cycle 19)
5	GNF2-P10DG2B388-6G6.0/7G5.0-100T2-145-T6-3143	(Cycle 18)	17	GNF2-P10DG2B389-6G6.0/2G5.0/6G4.0-100T2-145-T6-3142	(Cycle 18)
6	GNF2-P10DG2B388-6G6.0/7G5.0-100T2-145-T6-3143	(Cycle 18)	18	GE14-P10DNAB400-12G6.0/3G5.0-100T-145-T6-2961	(Cycle 17)
7	GNF2-P10DG2B395-6G6.0/9G5.0-100T2-145-T6-3422	(Cycle 19)	19	GNF2-P10DG2B389-6G6.0/2G5.0/6G4.0-100T2-145-T6-3142	(Cycle 18)
8	GNF2-P10DG2B401-6G6.0/8G5.0/1G4.0-100T2-145-T6-3421	(Cycle 19)	20	GNF2-P10DG2B375-6G6.0/7G5.0-100T2-145-T6-3434	(Cycle 19)
9	GE14-P10DNAB400-13GZ-100T-145-T6-2959	(Cycle 17)	21	GNF2-P10DG2B406-6G6.0/2G5.0/6G4.0-100T2-145-T6-4171	(Cycle 20)
10	GE14-P10DNAB399-15GZ-100T-145-T6-2957	(Cycle 17)	22	GNF2-P10DG2B398-5G6.0/8G5.0-100T2-145-T6-4172	(Cycle 20)
11	GNF2-P10DG2B389-6G6.0/8G5.0-100T2-145-T6-3141	(Cycle 18)	23	GNF2-P10DG2B389-15G5.0-100T2-145-T6-4173	(Cycle 20)
12	GNF2-P10DG2B407-6G6.0/2G5.0/6G4.0-100T2-145-T6-3642	(Cycle 19)	24	GNF2-P10DG2B375-7G6.0/6G5.0-100T2-145-T6-4174	(Cycle 20)
13	GNF2-P10DG2B401-6G6.0/2G5.0/6G4.0-100T2-145-T6-3640	(Cycle 19)			

Figure 2. Previous Cycle Core Loading Diagram

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

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

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Figure 5. Relationship Between MIP and CPR Margin

Table 1. Description of Core

Description	Previous Cycle Minimum Core Flow Limiting Case	Previous Cycle Rated Core Flow Limiting Case	Current Cycle Minimum Core Flow Limiting Case	Current Cycle Rated Core Flow Limiting Case
Number of Bundles in the Core	580		580	
Limiting Cycle Exposure Point (i.e., Beginning of Cycle (BOC)/Middle of Cycle (MOC)/End of Cycle (EOC))	EOC	EOC	EOC	EOC
Cycle Exposure at Limiting Point (MWd/STU)	10,250	10,250	9,500	9,500
% Rated Core Flow	76.7%	76.7%	76.7%	76.7%
Reload Fuel Type	GNF2		GNF2	
Latest Reload Batch Fraction, %	26.2%		24.8%	
Latest Reload Average Batch Weight % Enrichment	3.94%		3.91%	
Core Fuel Fraction: GE14 GNF2	 0.207 0.793		 0.000 1.000	
Core Average Weight % Enrichment	3.95%		3.93%	

Table 2. SLMCPR Calculation Methodologies

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

Table 3. Monte Carlo Calculated SLMCPR vs. Estimate

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

Table 3. Monte Carlo Calculated SLMCPR vs. Estimate

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

Table 4. Non-Power Distribution Uncertainties

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

Table 4. Non-Power Distribution Uncertainties

	Nominal (NRC-Approved) Value ± σ (%)	Previous Cycle Minimum Core Flow Limiting Case	Previous Cycle Rated Core Flow Limiting Case	Current Cycle Minimum Core Flow Limiting Case	Current Cycle Rated Core Flow Limiting Case
NEDC-32601P-A					
Feedwater Flow Measurement	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Feedwater Temperature Measurement	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Reactor Pressure Measurement	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Core Inlet Temperature Measurement	0.2	0.2	0.2	0.2	0.2
Total Core Flow Measurement	6.0 SLO/2.5 TLO	6.0 SLO/3.3 TLO	6.0 SLO/2.5 TLO	6.0 SLO/3.3 TLO	6.0 SLO/2.5 TLO
Channel Flow Area Variation	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Friction Factor Multiplier	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Channel Friction Factor Multiplier	5.0	5.0	5.0	5.0	5.0

Table 5. Power Distribution Uncertainties

Description	Nominal (NRC-Approved) Value ± σ (%)	Previous Cycle Minimum Core Flow Limiting Case	Previous Cycle Rated Core Flow Limiting Case	Current Cycle Minimum Core Flow Limiting Case	Current Cycle Rated Core Flow Limiting Case
GETAB/NEDC-32601P-A					
GEXL R-Factor	[[ ]]	N/A	N/A	N/A	N/A
Random Effective TIP Reading	2.85 SLO/1.2 TLO	N/A	N/A	N/A	N/A
Systematic Effective TIP Reading	8.6	N/A	N/A	N/A	N/A
NEDC-32694P-A, 3DMONICORE					
GEXL R-Factor	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Random Effective TIP Reading	2.85 SLO/1.2 TLO	2.85 SLO/1.6 TLO	2.85 SLO/1.2 TLO	2.85 SLO/1.6 TLO	2.85 SLO/1.2 TLO
TIP Integral	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Four Bundle Power Distribution Surrounding TIP Location	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]
Contribution to Bundle Power Uncertainty Due to Local Power Range Monitor (LPRM) Update	[[ ]]	[[ ]]	[[ ]]	[[ ]]	[[ ]]

Table 5. Power Distribution Uncertainties

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

Table 6. Critical Power Uncertainties

Description	Nominal Value ± σ (%)	Previous Cycle Minimum Core Flow Limiting Case	Previous Cycle Rated Core Flow Limiting Case	Current Cycle Minimum Core Flow Limiting Case	Current Cycle Rated Core Flow Limiting Case
[[					
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Global Nuclear Fuel – Americas

AFFIDAVIT

I, Lukas Trosman, state as follows:

(1) I am Engineering Manager, Reload Design and Analysis, 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 GNF-A proprietary report GNF-001N8659-R1-P, *GNF Additional Information Regarding the Requested Changes to the Technical Specification SLMCPR, Pilgrim Cycle 21*, September 2014. GNF-A proprietary information in GNF-001N8659-R1-P, *GNF Additional Information Regarding the Requested Changes to the Technical Specification SLMCPR, Pilgrim Cycle 21*, September 2014, is identified by a dotted underline inside double square brackets. [[This sentence is an example.{3}]]. Figures and large objects containing GNF-A proprietary information are identified with double square brackets before and after the object. 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 qualifies 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 F.2d 871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F.2d 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 September 2014.

Lukas Trosman
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