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Exelon Nuclear

Attachment 1 contains Proprietary Information. Withhold from public disclosure under 10 CFR 2.390. When separated from Attachment 1, this document is decontrolled.

RS-12-020

10 CFR 50.90

January 30, 2012

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

LaSalle County Station, Unit 1
Facility Operating License No. NPF-11
NRC Docket No. 50-373

Subject: Supplemental Information Supporting the Request for Technical Specification Change for Minimum Critical Power Ratio Safety Limit (TAC No. ME7331)

References:

1. Letter from Mr. David M. Gullott (Exelon Generation Company, LLC (EGC)) to U. S. NRC, "Request for Technical Specification Change for Minimum Critical Power Ratio Safety Limit," dated October 12, 2011
2. Letter from U. S. NRC to Mr. Michael J. Pacilio (EGC), "LaSalle County Station, Unit 1 -Request for Additional Information Regarding Proposed Technical Specification Safety Limit Minimum Critical Power Ratio Changes (TAC No. ME7331)," dated January 19, 2012

In Reference 1, Exelon Generation Company, LLC (EGC) requested an amendment to Appendix A, Technical Specifications (TS), of Facility Operating License No. NPF-11 for LaSalle County Station (LSCS), Unit 1. The proposed change revises the value of the safety limit minimum critical power ratios (SLMCPRs) in TS Section 2.1.1, "Reactor Core SLs." These changes are needed to support the upcoming cycle of operation (i.e., Cycle 15) for LSCS, Unit 1. In Reference 2, the NRC requested that EGC provide additional information in support of their review of Reference 1. The EGC responses to the NRC requests are provided in the attachments to this letter. Specifically, the responses to NRC RAI-1 through 6 are provided in Attachment 1, the response to NRC RAI-2 is contained in Attachments 1 and 4, and the response to NRC RAI-07 is provided in Attachment 4.

Attachment 1 contains Proprietary Information. Withhold from public disclosure under 10 CFR 2.390. When separated from Attachment 1, this document is decontrolled.

Attachment 1 contains information that is proprietary to Global Nuclear Fuel (GNF) and should be withheld from public disclosure in accordance with paragraph (b)(4) of 10 CFR 2.390, "Public inspections, exemptions, requests for withholding." An affidavit from GNF attesting to the proprietary nature of this information is provided in Attachment 2. Attachment 3 is a non-proprietary version of Attachment 1.

The information provided in this letter does not affect the No Significant Hazards Consideration or the Environmental Consideration provided in Attachment 1 of the original license amendment request as described in the Reference 1 submittal.

In accordance with 10 CFR 50.91(b), "State consultation," EGC is providing the State of Illinois with a copy of this letter and its attachment to the designated State Official.

This letter contains no new regulatory commitments. If you have any questions concerning this letter, please contact Mr. Mitchel A. Mathews at (630) 657-2819.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 30th day of January, 2012.

Respectfully,

David M. Gullott
Manager – Licensing
Exelon Generation Company, LLC

Attachments:

1. Additional Information Supporting the Request for Technical Specification Change for Minimum Critical Power Ratio Safety Limit – Proprietary Version
2. Global Nuclear Fuel Affidavit Supporting Proprietary Nature of Information in Attachment 1
3. Additional Information Supporting the Request for Technical Specification Change for Minimum Critical Power Ratio Safety Limit – Non-Proprietary Version
4. Exelon Generation Company, LLC Supplemental Response to NRC RAI-2 and Response to NRC RAI-7
5. LaSalle County Station, Unit 1, Cycle 15 Cycle Design Inputs and Requirements (CDIR)

Attachment 2

Global Nuclear Fuel Affidavit Supporting Proprietary Nature of Information in Attachment 1

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 Enclosures 1 of GNF's letter, CFL-EXN-HA1-12-008, C. Lamb (GNF-A) to J. Fisher (Exelon), entitled "GNF Response to NRC RAIs for LaSalle Unit 1 Cycle 15 SLMCPR Submittal," dated January 27, 2012. GNF-A proprietary information in Enclosure 1, which is entitled "Response to NRC RAIs for LaSalle Unit 1 Cycle 15 SLMCPR Submittal," is identified by a dotted underline inside double square brackets. [[This sentence is an example.{3}]] A "[[" marking at the beginning of a table, figure, or paragraph closed with a "]]" marking at the end of the table, figure or paragraph is used to indicate that the entire content between the double brackets is proprietary. In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GNF-A relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975 F2d 871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F2d 1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GNF-A's competitors without license from GNF-A constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals aspects of past, present, or future GNF-A customer-funded development plans and programs, resulting in potential products to GNF-A;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. above.

(5) To address 10 CFR 2.390 (b) (4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GNF-A, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GNF-A, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or subject to the terms under which it was licensed to GNF-A. Access to such documents within GNF-A is limited on a "need to know" basis.

(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 affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 27th day of January 2012.

Lukas Trosman
Engineering Manager, Reload Design and Analysis
Global Nuclear Fuel – Americas, LLC

Attachment 3

Additional Information Supporting the Request for Technical Specification Change for Minimum Critical Power Ratio Safety Limit – Non-Proprietary Version

ENCLOSURE 2

CFL-EXN-HA1-12-008

Response to NRC RAIs for LaSalle Unit 1 Cycle 15 SLMCPR Submittal

Non-Proprietary Information – Class I (Public)

INFORMATION NOTICE

This is a non-proprietary version of CFL-EXN-HA1-12-008 Enclosure 1, which has the proprietary information removed. Portions of the document that have been removed are indicated by white space inside an open and closed bracket as shown here [[ ]].

REQUEST FOR ADDITIONAL INFORMATION

LASALLE COUNTY STATION, UNIT 1

LICENSE AMENDMENT REQUEST REGARDING

PROPOSED SAFETY LIMIT MINIMUM CRITICAL POWER RATION CHANGE

DOCKET NO. 50-373

By letter dated October 12, 2011 (Agencywide Documents Access and Management System Accession (ADAMS) Accession No. ML112860067), Exelon Generation Company LLC (Exelon, the licensee) submitted a license amendment request (LAR) proposing to modify technical specification (TS) Section 2.1, "Safety Limits," for LaSalle County Station (LSCS), Unit 1. The requested change involved revised safety limit minimum critical power ratios (SLMCPRs) calculated as a result of the cycle-specific analysis performed by Global Nuclear Fuel (GNF) to support operation in the upcoming LSCS, Unit 1, Cycle 15. The U.S. Nuclear Regulatory Commission (NRC) staff has been reviewing the submittal and has determined that additional information is needed to complete its review.

RAI-01:

In the LAR, Attachment 6, Tables RAI-06-1 and RAI-06-2, provide core map to show those bundles experienced 0.1 boiling transition criterion of limiting cases for single-loop operation (SLO) and two-loop operation (TLO). Please provide identification of bundle group and number of bundles in the Figure 1, Attachment 5, corresponding to their burnup status (once-burned, twice-burned, or fresh fuel) for Cycle 15.

Response to RAI-01:

Table RAI-01-1 shown below contains the bundle group, number of bundles, bundle type, burnup status and fuel type (IAT) associated with the Cycle 15 core loading map presented in Figure 1 of Attachment 5 of the LAR. All of the data presented in Table RAI-01-1 is equivalent for both TLO and SLO.

Table RAI-01-1

Bundle Group, Number of Bundles, Bundle Type, Burnup Status and Fuel Type for Both TLO and SLO

[[

]]

RAI-02:

Core design is an iterative process designed to develop an optimal configuration that meets operational requirements. In the LAR, Attachment 7, for the slides titled "Pre-Estimation – Linear Reactivity," please provide the most current updated parameters applicable to LSCS, Unit 1, Cycle 15. Also, provide the details of a plant-specific final core loading pattern as shown in Figure 1 including core design procedures, guidelines, criteria, and approved methodologies used for this Cycle 15 analysis with respect to a mixed core application.

Response to RAI-02:

Pre-estimating reload batch size and enrichment, either using the method on the slide entitled "Pre-Estimation - Linear Reactivity" or any other method, is not applicable to the final, analyzed core design.

Methods used to analyze the core-loading pattern, shown in Figure 1, are in accordance with GESTAR II. GESTAR II is the umbrella for all procedures, guidelines, criteria, and methodologies used for this analysis. There is no change in approved methodologies. This is a SLMCPR Technical Specifications change within approved methodologies. SLMCPR is not the primary driver in developing the fuel cycle core design. The energy plan, reactivity, and thermal margins are the primary drivers.

In the development of a mixed core, as in the development of a core containing all GNF fuel, the loading pattern is developed collaboratively by GNF and Exelon based on Exelon input. Among the inputs are:

- Cycle Energy Requirements – fuel bundle design (nuclear) and loading patterns
- Thermal Limit Margins
- Reactivity Margins – minimum shutdown margin, minimum and maximum hot excess reactivity
- Discharge Exposure Limitations and Other Limits as established by safety analysis
- Desired Control Rod Patterns – sequences and durations
- Channel Distortion Minimization

RAI-03:

GNF2 fuel deviates from traditional 10x10 design through the introduction of a partial length rod configuration, the use of higher linear power, and the use of mixing vanes. The NRC staff considers this a new fuel design with regards to the four restrictions identified in the safety evaluation of General Electric (GE) Licensing Topical Reports NEDC-32601P, NEDC-32694, and Amendment 25 to NEDE-24011-P-A. Given that LSCS, Unit 1, Cycle 15, uses a core loading pattern which includes GNF2 fuel, provide the following: (1) an evaluation of the four restrictions in NEDC-32601P, NEDC-32694 and Amendment 25 to NEDE-24011-P-A and the applicability to mixed core with ATRIUM 10 fuel; (2) a description that explains under what conditions the methodologies listed in Section 1.0 of Attachment 5 are sufficient and applied to the LSCS, Unit 1, Cycle 15, application; and (3) a clarification for the statement "no new GNF2 fuel designs are being introduced in LSCS, Unit 1, Cycle 15," in Section 2.5 of Attachment 5.

Response to RAI-03-1:

The four restrictions for GNF2 were determined acceptable by the NRC review of the "GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II)," NEDC-33270P, Revision 0, FLN-2007-011, March 14, 2007. Specifically, in the NRC audit report ML081630579 for the said document, Section 3.4.1 page 59 states:

> "The NRC staff's SE of NEDC-32694P-A (Reference 69 of NEDE 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."

Additionally, the NRC audit report, ML081630579, Section 3.4.2.2.1 page 59 states:

> "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."

The four restrictions applied specifically to the mixed core were addressed during the transition from ATRIUM-10 to GNF2 fuel. These limitations were addressed for ATRIUM-10 as follows:

(1) The TGBLA fuel rod power calculational uncertainty for ATRIUM-10 was determined and verified.

(2) The rod power calculation uncertainties were used to reevaluate and confirm the R-factor uncertainty for ATRIUM-10.

(3) The applicability of the Minimum Critical Power Ratio (MCPR) Importance Parameter (MIP) criterion was previously reevaluated through the inclusion of plants containing ATRIUM-10 fuel in the data contained in Figure 5 of Attachment 5.

(4) The bundle power uncertainty associated with the core monitoring system was verified by Exelon as applied to ATRIUM-10.

Response to RAI-03-2:

There are three references listed in Section 1.0 of Attachment 5. The applicability of each of the three references is discussed. The three references are:

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

B. NEDC-32694P-A, "Power Distribution Uncertainties for Safety Limit MCPR Evaluations," August 1999.

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

Attachment 5 Table 2 identifies the actual methodologies used for the Cycle 15 SLMCPR calculations. References A and B are directly applicable to the analysis. This process is fuel product independent as long as the R-Factors were appropriately generated.

Reference C is the generic R-Factor methodology report that describes the changed methodology that was adopted after part length rods were introduced. The NRC staff's Safety Evaluation (SE) for NEDC-32505P-A has a requirement that the applicability of the R-Factor methodology is confirmed when a new fuel type is introduced. The confirmation for GNF2 was determined to be acceptable by the NRC staff review of the "GEXL17 Correlation for GNF2 Fuel," NEDC-33292P, Revision 0, FLN-2007-011, March 14, 2007 in the NRC audit report ML081630579, Section 3.5.5 page 62. The confirmation for the ATRIUM-10 GEXL97 correlation applicable to LSCS Unit 1 Cycle 15 was determined to be acceptable by the NRC staff review of the "GEXL97 Correlation for ATRIUM-10 Fuel," NEDC-33106P-A, Revision 2, June 2004.

Response to RAI-03-3:

GNF2 is an evolutionary fuel product based on GE14 that maintains the previously established 10x10 array and two water rod makeup.

RAI-04:

The LSCS, Unit 1, Cycle 15, is a mixed core with once and twice burned ATRIUM 10 fuel. Please provide: (1) a detailed description of the methodologies used and procedures applied to the LSCS, Unit 1, Cycle 15, calculation for the proposed SLMCPR values based on Figure 3, Attachment 5; and (2) justification that the methodologies related to ATRIUM 10 fuel may not be needed in this application because none is listed in Section 1.0, Attachment 5.

Response to RAI-04-1:

While LSCS Unit 1 Cycle 15 contains ATRIUM-10 fuel that was not manufactured by GNF, the methodologies contained within NEDC-32601P-A incorporate fuel-type dependency using fuel-specific inputs. A specific critical power correlation for ATRIUM-10 fuel, GEXL97, referenced in the response to RAI-03-2, was used in this calculation. Additionally, the following items in Figure 3, Attachment 5 were calculated specifically for the ATRIUM-10 fuel in the core:

- σ CPD (GEXL) – This information comes from the previously-approved GEXL-97 correlation referenced in the response to RAI-03-2.
- σ RPEAK – This value was established in accordance with NEDC-32601P-A and is based on the modeling uncertainties for ATRIUM-10 fuel in GNF methods established in Cycle 11, as well as current manufacturing and channel bow uncertainties relevant to this fuel.

Response to RAI-04-2:

The methodologies listed in Section 1.0, Attachment 5 are applicable to GNF2 and ATRIUM-10 designs, and are therefore applicable to LSCS Unit 1 Cycle 15.

RAI-05:

Please identify the breakdown of the 10x10 data shown in Attachment 5, Figure 5, by fuel type (i.e., GE14, GNF2), because Figure 5 only shows combined data points for the two fuel types. Also provide: (1) details of the application of Figure 5 data to a mixed core with ATRIUM 10 fuel; and (2) justification that the estimation formula for SLMCPR value is still valid for LSCS, Unit 1, Cycle 15, application.

Response to RAI-05:

The 10x10 (GE14, GNF2) points shown in Figure 5 of Attachment 5 reflect transition cores with a mix of 10x10 fuel products. Thus, there are not specific GNF2 data points in Figure 5. The table shown below provides the GE14 and GNF2 batch sizes, and the corresponding [[ ]] for the 10x10 (GE14, GNF2) points in the figure. Each row in the table below corresponds to one of the "10x10 (GE14, GNF2)" data points in Figure 5. The table is in ascending order of the abscissa of Figure 5 for ease of correlation to the figure. Sums of batch sizes and [[ ]] may not add to 100% due to rounding and/or the presence of other fuel products in the core.

[[		Batch Fraction (%)		[[	
		GE14	GNF2		
		31.0	38.5		
		28.6	71.4		
		64.4	35.6		
		31.0	38.5		
		31.0	38.5		
		64.4	35.6		
		28.6	71.4		
		28.6	71.4		
		67.4	32.6		
		64.4	35.6		
		67.4	32.6		
	]]	67.4	32.6		]]

Response to RAI-05-1:

Figure 5 is an updated version of Figure III.5-2 from NEDC-32601P-A (referenced in Section 1.0 of Attachment 5). Per the response to RAI III.5 on NEDC-32601P-A, "The reduction in CPR margin...required to place a nominal rod pattern nearer the operating limit is correlated to the natural logarithm of the ratio of the nominal MIP to the limiting MIP value. This correlation is shown in Figure III.5-2 for all fuel types. The fact that all the data for different fuel types is interspersed about the same curve suggests that it is appropriate to establish a single threshold value for MIP that is independent of fuel type." Figure 5 was previously updated with points representing plants containing ATRIUM-10 fuel. The continued interspersion of the data about the correlation provides continued support for the conservatism of the current MIP criteria used in the SLMCPR process, and the independence of this criterion from fuel type.

Response to RAI-05-2:

While still used as a secondary reasonability check, the estimation formula is not part of the SLMCPR development process. It has no effect on the final SLMCPR.

RAI-06:

Please clarify that there is no effect of GNF2 bent spacer wing to LSCS, Unit 1, Cycle 15, operation. If there is an adverse impact, please provide an assessment of the impacts on operations and fuel thermal performance.

Response to RAI-06:

GNF2 bent spacer wing related Part 21 issues are not applicable to LSCS Unit 1 Cycle 15 because the GNF2 fuel in this cycle is not impacted by the Part 21 issue, as indicated in Section 2.13 of Attachment 5 of the LAR.

RAI-07:

Please provide an updated version of power/flow map for Cycle 15 operation including stability Option III features of scram region and controlled entry region for backup stability protection based on the Boiling-Water Reactor Owners Group position stated in NEDO-31960A for SLO and TLO.

Response to RAI-07:

Exelon will provide a response to this RAI.

Attachment 4

Exelon Generation Company, LLC Supplemental Response to
NRC RAI-2 and Response to NRC RAI-7

NRC RAI-2. Core design is an iterative process designed to develop an optimal configuration that meets operational requirements. In the LAR, Attachment 7, for the slides titled "Pre-Estimation - Linear Reactivity," please provide the most current updated parameters applicable to LSCS, Unit 1, Cycle 15. Also, provide the details of a plant-specific final core loading pattern as shown in Figure 1 including core design procedures, guidelines, criteria, and approved methodologies used for this Cycle 15 analysis with respect to a mixed core application.

Exelon Generation Company, LLC (EGC) Supplemental Response to NRC RAI-2

The response provided by Global Nuclear Fuel (GNF) for RAI-2 in Attachment 1 describes the use of approved GNF methodologies and procedures in accordance with General Electric Standard Application for Reactor Fuel (GESTAR-II). Exelon procedures and guidelines were also used for LaSalle County Station (LSCS), Unit 1, Cycle 15 to direct the bundle design and core reload process. Exelon procedures NF-AA-100, "Reload Control Procedure," and NF-AB-110, "Bundle and Core Design (BWR)," were previously provided to the NRC in the responses to an NRC request for additional information (RAI) related the Quad Cities Nuclear Power Station, Unit 1, Cycle 22 Minimum Critical Power Ratio Safety Limit (SLMCPR) license amendment request (i.e., NRC Accession Number ML112650386), dated September 21, 2011, as Attachments 5 and 6, respectively.

Design criteria for LSCS, Unit 1 Cycle 15 are defined in the Cycle Design Inputs and Requirements (CDIR) document, which sets the cycle energy, thermal margins, and other design constraints. This document is included as Attachment 5.

NRC RAI-7. Please provide an updated version of power/flow map for Cycle 15 operation including stability Option III features of scram region and controlled entry region for backup stability protection based on the Boiling-Water Reactor Owners Group position stated in NEDO-31960A for SLO and TLO.

EGC Response to NRC RAI-7

The power/flow map for Cycle 15 will remain unchanged from LSCS, Unit 1, Cycle 14, which is the "LaSalle County Station, Unit 1, Cycle 14 and Expected Cycle 15, Power-to-Flow Map," provided in Attachment 10 of the October 12, 2011, license amendment request. The power/flow map for backup stability protection (BSP) at LSCS, Unit 1 conservatively treats the controlled entry region as an immediate exit region (i.e., Region 2). Region 1 on the power/flow map is the scram region. The BSP region boundaries are calculated based on a specified core decay ratio per the approved stability methodology described in NEDE-24011-P-A, Revision 18, "General Electric Standard Application for Reactor Fuel (GESTAR II, U.S. Supplement)," Section S.4.2.2, "Backup Stability Protection (BSP) for Option III," dated April 2011. The core decay ratio is a function of principal reactor core parameters (e.g., power and power distribution, flow, subcooling, fuel design, etc.). The core decay ratio is independent of the core flow mode (i.e., the same for two loop operation (TLO) and single loop operation (SLO)). Therefore, the calculated BSP regions are bounding and applicable for both TLO and SLO.

The power/flow map generally depicts a "natural circulation" flow line and a "maximum rod line." The BSP region boundaries are calculated based on points on the natural circulation line and the maximum rod line. The BSP regions are depicted as areas between the maximum rod line, the natural circulation line, and the BSP region boundaries in the high-power, low-flow region of the map. However, the natural circulation line is approximate and the core flow measurement uncertainty is larger at low flow conditions. In the past, this has resulted in operating conditions in which the indicated power/flow condition was below (i.e., to the left of) the natural circulation line on the power/flow map. Also, industry operational experience has identified conditions in which operation above the maximum rod line has occurred. To address these situations, an operational decision was made to conservatively extend operating boundaries (e.g., rod lines, stability regions, etc.) back to "zero flow" and extend the BSP boundaries above the maximum rod line. These operational enhancements to the power/flow map have been made to provide additional guidance to address the unlikely, but possible circumstance of operating at those conditions.

Attachment 5

LaSalle County Station, Unit 1, Cycle 15 Cycle Design Inputs and Requirements (CDIR)

NUCLEAR FUELS
TRANSMITTAL OF DESIGN INFORMATION

☒ SAFETY RELATED ☐ NON-SAFETY RELATED ☐ REGULATORY RELATED	**Originating Organization** ☒ Nuclear Fuels ☐ Other (specify) N/A	NF ID# NF1100177 Revision# 1 SRRS # 3A.130 Page 1 of 20

Station: LaSalle **Unit:** 1 **Cycle:** 15 **Generic:** N/A

Subject: LaSalle Unit 1 Cycle 15 Cycle Design Inputs & Requirements

To: Phil Hansett (LaSalle - RX Eng. Manager) and Charlie Lamb (GNF – Customer Project Manager) **EC/ECR#: 382897**

John L. McHale Prepared by	John L. McHale Signature	9/13/11 Date
David A. Phegley Reviewed by	 Signature	9/13/2011 Date
John K. Wheeler Approved by	 Signature	9/14/11 Date

Status of Information:
☒ Verified
☐ Unverified
☐ Engineering Judgment

Action Tracking # for Method and Schedule of Verification for Unverified DESIGN INFORMATION: N/A

Description of Information:

Rev. 1: This transmittal updates the CDIR to Revision 1 as indicated by revision bars.

Rev. 0: This information includes a listing of assumptions, design margin limitations, design methodology limitations, and expected station modifications which will impact the L1C15 reload design.

Purpose of Information: This data is to be used to create the L1C15 fuel and core design.

Source of Information: References found within the document.

Supplemental Distribution:

E – Mail:
Gary Benes (LaSalle)
Josh Shea (LaSalle)
Karl Hachmuth (LaSalle) + HAKSOO KIM (NF-CANTERA) 9/13/11
9/14/11

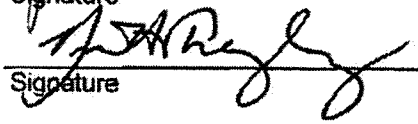
Hard Copy:
Cantera Records Management

LaSalle Unit 1
Cycle 15

Cycle Design Inputs & Requirements

Revision 1

CDIR LaSalle Unit 1 Cycle 15, Revision 1

John L. McHale Prepared by	John L. McHale Signature	9/13/11 Date
David A. Phegley Reviewed by	 Signature	9/13/2011 Date
John K. Wheeler Approve by	Signature	Date
N/A for Rev. 1 RDOT Approval Obtained	Signature	Date
N/A for Rev. 1 RRB Approval Obtained	Signature	Date

Section A – Core Design Data Related Items			
Item	**Criteria**	**Value**	**References/Comments**
A.1.a	End of Cycle 14 Shutdown Date	2/13/12	Exelon Nuclear Group's Planned Outage Schedule, Revision 28 L1C15 EUP
A.1.b	Refueling Outage Duration	25 days	Exelon Nuclear Group's Planned Outage Schedule, Revision 28 L1C15 EUP
A.2	Beginning of Cycle 15 Startup Date	3/9/12	Exelon Nuclear Group's Planned Outage Schedule, Revision 28 L1C15 EUP
A.3.a	End of Cycle 15 Shutdown Date	2/10/14	Exelon Nuclear Group's Planned Outage Schedule, Revision 28 L1C15 EUP
A.3.b	Cycle 14 Thermal Power Level	3546 MWth	L1C15 EUP This value is post-MUR, which occurred on 9/17/2010. Prior to this date the Thermal Power Level was 3489 MWth.
A.4.a	End of Cycle 14 Nominal Exposure	17,968.6 MWd/MT	16,300.8 MWd/ST L1C15 EUP
A.4.b	End of Cycle 14 Energy	2,440,869 MWd	L1C15 EUP
A.5	End of Cycle 14 Minimum Exposure	17,527.7 MWd/MT	15,900.8 MWd/ST (EOC Cycle 14 Nominal Exposure – 440.9 MWd/MT (400 MWd/ST)) L1C15 EUP
A.6.a	Cycle 15 EUP Required EOR Energy	2,332,840 MWd	L1C15 EUP

Section A – Core Design Data Related Items			
Item	**Criteria**	**Value**	**References/Comments**
A.6.b	Cycle 15 EOR Exposure Acceptance Band	EOR Calculated k-eff within following tolerance of target: +0.0005 Δk / -0.0 Δk	Exelon Design Requirement
A.6.c	Cycle 15 Thermal Power Level	3546 MWth	L1C15 EUP
A.6.d	Cycle 15 Operating Capacity Factor	98.375%	L1C15 EUP (BOC to EOR)
A.7	Cycle 15 EUP Total Cycle Energy	2,445,824 MWd	L1C15 EUP
A.8	Design MFLPD Limit	MFLPD ≤ 0.88	No MFLPD points may exceed 0.885 in the design cycle. Required for both MB-2 and PANAC11.
A.9	Design MFLCPR Limit	MFLCPR ≤ 0.90	No MFLCPR points may exceed 0.905 in the design cycle. Required for both MB-2 and PANAC11.
A.10	Design MAPRAT Limit	MAPRAT ≤ 0.88	No MAPRAT points may exceed 0.885 in the design cycle. Required for both MB-2 and PANAC11.
A.11	Design Cold Shutdown Margin (SDM) Limit	Exelon Methodology (MB2) ≥ 1.0% Δk/k GNF Methodology: ≥ 1.0% Δk	Based upon EOC 14 Minimum Cycle Exposure Limits using GNF Methodology are based on using GRETA and a 0.003 Δk local vs. distributed adjustment. SDM must be met at multiple temperatures between 68°F and 320°F based on short energy window for EOC14.
A.12	Total SDM adjustments and penalties	Exelon Methodology (MB2): 0.00% Δk/k GNF Methodology: Local vs. distributed 0.003 Δk (within GRETA)	Exelon Methodoly (MB2): No Adjustments or Penalties Required GNF DBD DB-0004.01, Rev. 6 GRETA is used with GNF design methodology only. Local vs. distributed adjustment is needed for SDM and MSBWP calculations.
A.13	Hot excess reactivity limit	≥ 1.0% Δk near BOC ≤ 1.5% Δk at peak hot excess ≤ 0.4% Δk min to max	NF-AB-110-2060, Revision 8 guidance.

Section A – Core Design Data Related Items			
Item	**Criteria**	**Value**	**References/Comments**
A.14	Design Cycle Hot Operating K-effective Target	MB2: Cycle Exp (GWd/MT) / k-critical (hot) 0.0 1.0060 5.0 1.0010 10.0 0.9990 13.0 0.9990 17.0 1.0045 18.0 1.0045 PANAC11: Cycle Exp (GWd/ST) / k-critical (hot) 0.0 1.0060 4.0 1.0060 14.0 1.0000 20.0 1.0000	MB2: Developed based upon historical eigenvalue data from LaSalle 1 and LaSalle 2 Cycles 11 through 14. PANAC11: GNF document "Critical Eigenvalue and Thermal Margin Review, LaSalle 1 Cycle 15." Approved 5/17/11.
A.15	Current Cycle Cold Critical K-effective Target	MB2: Cycle Exp (GWd/MT) / k-critical (cold) 0.0 0.9950 4.0 0.9920 20.0 0.9920 PANAC11: Cycle Exp (GWd/MT) / k-critical (cold) 0.0 1.0000 4.0 0.9960 20.0 0.9960	MB2: Developed based upon historical eigenvalue data from LaSalle 1 and LaSalle 2 Cycles 11 through 14. PANAC11: GNF document "Critical Eigenvalue and Thermal Margin Review, LaSalle 1 Cycle 15." Approved 5/17/11.
A.16	Cold Critical K-effective Adjustments	None	No additional adjustments other than those listed in A.11 and A.12 above.
A.17	Standby Liquid Control (SLC) System Shutdown Capability Requirement – (SDM)	SLCS SDM > 1.0%	Assumes natural Boron enriched to 45 weight % in the B-10 isotope (1571 ppm natural boron equivalent) at 68 °F.
A.18	Fuel Exposure Limits	ATRIUM-10(MWd/kgU): ≤ 58.7 rod average exposure ≤ 54.0 bundle average exposure GNF2: Peak Pellet – MWD/MT	Peak pellet exposure must remain within all pellet exposure based limits provided in the COLR. ATRIUM-10 limits from L-003372, Revision 2. GNF2: NEDC-33270P Rev. 3 GNF2 Advantage Generic Compliance With NEDE-24011-P-A (GESTAR II) NEDE-24011-P-A-17-US, General Electric Standard Application for Reactor Fuel (GESTAR II)

Section A – Core Design Data Related Items			
Item	**Criteria**	**Value**	**References/Comments**
A.19	Fuel Exposure Limits	End of Design Cycle NEXRAT <0.97 Perform multi-cycle check of NEXRAT	Exelon Design Target Multi-cycle analysis should include four cycles past the design cycle.
A.20	Residence Time Limits	None for ATRIUM-10 fuel	GNF DB-0004.01 Rev. 6
A.21	Full Core Offload Capability constraints	None at this time	LaSalle currently does not have full core offload capability. Based upon the 2011 schedule for Dry Cask Storage and rack inserts, full core offload capability will be regained by the end of 2011.
A.22.a	Core Symmetry	Attempt to maintain octant symmetry as much as possible. Maintain symmetry by bundle type and exposure.	Report non-symmetric pairs to reactor engineering prior to startup if it leads to non-symmetric thermal limits.
A.22.b	Quarter Core Shuffle Restrictions	Maintain bundles in same quadrant during shuffle as practical. No face-adjacent shuffles within a cell.	Exceptions shall be documented.
A.23	Target Sequences Exchange Plans	See Attachment B	Assumes SU date of 3/9/2012. These sequence exchange dates take into account the calendar, Unit 2 exchanges, Unit 2 R14 Outage, and quarterly large load drops for surveillance tests.
A.23.b	Core Loading Strategy	Improved Low Leakage Core Design (ILLCD) Implement Exelon SCORE Principles as Possible Evaluate core loading plan changes using the GEH MCO software to achieve ≤ 0.024% MCO	Exelon Target
A.24.a	Control Rod Pattern Limitations	Maintain constant rod patterns between Sequence Exchanges when possible. Avoid use of Group 8 rods alone in the core. Group 7A rods may only be placed at positions 00-08 or 48.	Exelon Target
A.24.b	Rod Sequence	A-2 / A-1	
A.24.c	"Clean" Rod Sequence Exchanges	Maximum Continuous Controlled Interval = 3.1 GWD/MT Core Average Exposure	NF-AB-440-1002, Rev. 2
A.24.d	Prohibited Design Control Rod Positions	02, 04, 42, 44, 46	Exelon Design Requirement

Section A – Core Design Data Related Items			
Item	**Criteria**	**Value**	**References/Comments**
A.24.e	Minimize Use of Shallow Rod Positions	No shallow rods (> position 24)	Exelon Design Requirement
A.24.f	Minimize Rod Pattern Changes	No rod pattern changes in summer 2012 No rod pattern changes in summer 2013	Summer is defined as 06/01/YY – 08/31/YY
A.24.g	Maximum Deviation from Target Eigenvalue	± 0.0005 Δk BOC – EOR + 0.0005 Δk for EOR	Exelon Target
A.25.a	Core Flow Window	96.57-105.25 Mlb_m/hr 89%-97% of rated flow	Flow is limited by unit rod-line restrictions (see A.25.b).
A.25.b	Unit rod-line restrictions (low and high) for operation to be used in the reload design.	High: 108% Low: 101%	Rodline = [%CTP*100 / (C_1 + (C_2*%FLOW) + (C_3*%FLOW^2))] C_1=22.191, C_2=0.89714, C_3=-0.0011905 Reference: NF-LA-712-2501, Rev. 10
A.26	Cycle 14 SLMCPR	1.11 DLO 1.12 SLO	SLMCPR change due to GNF2 TBD. Perform preliminary check of SLMCPR prior to bundles being finalized.
A.27.a	L1C15 SLMCPR design assumption	1.11 DLO 1.12 SLO	Actual values are determined after Reference Loading Pattern is finalized.
A.27.b	Estimated OLMCPR	Option B limits: 1.55 BOC to EOC	Based upon stability analysis setting the limit for entire cycle.
A.27.c	Range of Acceptable OPRM Amplitude Setpoint Values	OPRM setpoint ≥ 1.11	
A.28	APLHGR Limits	ATRIUM-10: Same as Cycle 14 GNF2: Use GNF2-B36-P3 curves	Values to be used for bundle and core design work. If licensing activities change these values, then the updated values from the COLR shall be used for cycle operation. Exelon Target (PRIME03 is NRC approved for GNF2)
A.29	LHGR Steady State Limits	ATRIUM-10: Same as Cycle 14 GNF2: Use GNF2-B36-P3 curves	Values to be used for bundle and core design work. If licensing activities change these values, then the updated values from the COLR shall be used for cycle operation. Exelon Target (PRIME03 is NRC approved for GNF2)
A.30	Transient LHGR Limits	N/A	Engineering input – no reference needed. MEOD limits are used and thus there are no separate transient LHGR limits. Not applicable to GNF Fuel

Section A – Core Design Data Related Items			
Item	**Criteria**	**Value**	**References/Comments**
A.31	Off-Rated thermal limits to be used in the bundle and core design phase prior to the completion of the cycle Reload Report	MCPR(P), MCPR(F), LHGRFAC(P), LHGRFAC(F)	Off-rated thermal limits are calculated during the Reload Licensing stage. During the Bundle and Core Design stage rated limits are used. At the power and flow conditions used during the core design phase, off-rated limits would have little effect.
A.32	Fuel channel distortion management limitations and mitigation strategy for design	Exelon Channel Distortion Design / Monitoring Criteria See Attachment C	NF-AB-105 (Rev. 13), Attachment 4, Criterion 2 and 3 as well as the general considerations contained in the attachment.
A.33.a	Minimum allowed calculated reactor period and maximum allowed single notch worth for in-sequence notch worth determinations	Individual notch worth between 04-36 and total worth between 36-48 must be less than the Δk that would result in a 50 second period	NF-AB-130-2620, Rev. 8 Notch worth must consider sequence steps beyond Groups 1-4 (Groups 7,8,9, and/or 10) as necessary to satisfy requirements up to +3.5% keff around critical.
A.33.b	Range around the expected cold critical eigenvalue when the notch worth and step worth limits are to be enforced	-1.2% to +3.5% keff around the expected cold critical eigenvalue evaluated at 120 °F and 320 °F.	NF-AB-130-2620, Rev. 8 Bounding range based on uncertainties for non-BOC critical
A.33.c	Maximum rod step worth allowed in the defined range around cold criticality for the startup sequence	Step worth (sum of all notch worth between movement limits) must be less than the minimum of: 0.005 Δk or (7/64) * [$k_0 - k_{ARI} - 0.0112$] (Δk) where k_0 = the cold critical target keff at each exposure point of interest k_{ARI} = the cold all rods inserted keff at each exposure point of interest	NF-AB-130-2620, Rev. 8 Step worth must consider sequence steps beyond Groups 1-4 (Groups 7,8,9, and/or 10) as necessary to satisfy requirements up to +3.5% keff around critical.
A.34	Code package(s) to be used to determine the cold notch worths	Exelon: CASMO-4/MICRO-B2 MICROBURN-B2 GNF: TGBLA06 PANAC11	
A.35	Core loading restrictions to minimize risk of high notch worths during insequence criticals	Avoid triple loading fresh fuel toward the center portion of the core	Notch worths will be verified in the early stages of design to ensure a success path exists or the core design will be altered as needed.

Section A – Core Design Data Related Items			
Item	**Criteria**	**Value**	**References/Comments**
A.36.a	EOP/EPG Calculation Assumptions and Limitations: Core and Bundle Peaking Factors	Must meet one of these three (uncontrolled 40% voids) 1) LPF ≤ 1.4 2) Any combination of LPF and APF such that LPF * APF ≤ 1.4 * 2.0 3) LPF ≤ 1.59 for all bundle axial power shapes peaked at or below the midplane for a maximum APF of 2.0	Letter, GEH-HA0WX227-006, "LCS GNF2 Fuel Transition: F0906 Generic EPG Data," dated April 1, 2011. LPF = Local Peaking Factor APF = Axial Peaking Factor
A.36.b	EOP/EPG Calculation Assumptions and Limitations: EOC Core Average Exposure	≤ 38 GWD/ST	Letter, GEH-HA0WX227-006, "LCS GNF2 Fuel Transition: F0906 Generic EPG Data," dated April 1, 2011.
A.36.c	EOP/EPG Calculation Assumptions and Limitations: EOC Core Average Effective Full Power Period	≤ 5 years	Letter, GEH-HA0WX227-006, "LCS GNF2 Fuel Transition: F0906 Generic EPG Data," dated April 1, 2011.
A.36.d	EOP/EPG Calculation Assumptions and Limitations: Reload Average Enrichment	≥ 3.779 $^{w}/_{o}$ U^{235}	Letter, GEH-HA0WX227-006, "LCS GNF2 Fuel Transition: F0906 Generic EPG Data," dated April 1, 2011.
A.36.e	EOP/EPG Calculation Assumptions and Limitations: MSBWP	All rods at position 02 or deeper and the strongest rod out yields ≥ 1.00% Δk/k SDM	Engineering input – no reference needed. L1C14 MSBWP was 02. If the 02 position is not met, must contact station EPG/SAG coordinator. SDM must be met at multiple temperatures between 68°F and 320°F based on short energy window for EOC14.
A.36.f	EOP/EPG Calculation Assumptions and Limitations: SLC System Requirements	Cold: SDM ≥ 1.00 %Δk/k Hot: SDM ≥ 0.00 %Δk/k	The 45% enriched B-10 shall be factored into these calculations (see item A.17). SDM must be met at multiple temperatures between 68°F and 320°F based on short energy window for EOC14.
A.37	Moisture Carryover	Evaluate core loading plan using GEH MCO software to achieve ≤ 0.024% MCO.	Engineering input – no reference needed. This value is an administrative limit used at LaSalle.

Section A – Core Design Data Related Items			
Item	**Criteria**	**Value**	**References/Comments**
A.38	Decay Heat Load	EOC13 CAVEX < 36,000 MWd/MTU & initial core average enrichment for new fuel > 3.5 w/o (treat all fuel as fresh)	TODI NFM9900058 Rev. 0. AREVA Letter CMP:05:057, "Transmittal of FANP Letter Report on Disposition of Several Safety Scope of Work Items", C.M. Powers to R.J. Chin, dated 10/12/2005. The values listed may be updated as part of NFI to GNF2.
A.39	Fluence Analysis Assumptions	See DA L-002869, current revision	Fluence analysis owned by station design engineering if further information needed.
A.40	CPR correlation type(s) and limitations	GNF2 - GEXL17 0.94 < R-Factor < 1.30 (@ all bows, controlled/ uncontrolled, all exposures) ATRIUM-10 GEXL97(03) 1.02 < R-Factor < 1.20 (@ all bows, controlled/ uncontrolled, all exposures)	GNF DB-0003.26 R8 GNF AG-0024.01 R3 GEXL17 for GNF2 NEDC-33292 R3, June 2009 GEXL97(03) for A10 NEDC-33106 R1, June 2003
A.41	Spent fuel pool gamma heating constraints on bundle and core design	1. Bundle enrichment range from 3.38 to 4.50 w/o U235. 2. Bundle uranium loading (nominal) < 197.0 kgU. 3. Rod exposure < 58,700 MWD/MTU. 4. Average bundle power (reactor rated thermal power / # bundles) < 5.566 MWt. 5. Radial Peaking Factor < 2.00. 6. Axial Peaking Factor < 1.80.	AmerGen Calculation No. C-1101-202-E620-443, Revision 1, "PWR & BWR Isotopic Inventories for Spent Fuel Pool Gamma Heating Study." These criteria are bounding values and are the basis for spent fuel pool heating calculations as shown in the above document.
A.42	Fuel promotion from exterior location to interior location limitations for design	No fuel on the outer two rows in L1C14 may be shuffled inward toward the center of the core.	NF-AB-110-2210, Rev. 13
A.43	Reactor dome pressure and feedwater temperature	1020 psia 428.5 deg. F	These values are representative values as they change constantly as the steam flow, etc. change in the plant. The reactor heat balance in the 3d simulator codes is used to calculate these values as needed if they are not directly input.
A.44	Reinsert fuel bundles for this cycle's design	0 – 1	One bundle will be considered for reinsertion into L1C15. This bundle (43C135) has one cycle of operation from L2C13 and was identified as a failed assembly during L2R13.

Section B – Fuel Bundle Design Data Related Items			
Item	**Criteria**	**Value**	**References/Comments**
B.1.a	Unit 1 Spent fuel pool criticality limits for GNF2 fuel	See Attachment D	"LaSalle Unit 1 and Unit 2 Nuclear Power Station Spent Fuel Pool Criticality Safety Analysis with GNF2 Fuel," AREVA ANP-3003(P), Revision 1, June 2011
B.1.b	Unit 2 Spent fuel pool criticality for GNF2 fuel *Include Boraflex Assumption	See Attachment D	"LaSalle Unit 1 and Unit 2 Nuclear Power Station Spent Fuel Pool Criticality Safety Analysis with GNF2 Fuel," AREVA ANP-3003(P), Revision 1, June 2011
B.1.c	Unit 2 Spent fuel pool criticality compliance with NETCO Inserts	See Attachment D	"LaSalle Unit 1 and Unit 2 Nuclear Power Station Spent Fuel Pool Criticality Safety Analysis with GNF2 Fuel," AREVA ANP-3003(P), Revision 1, June 2011
B.2	New fuel vault criticality criteria for reload fuel	For GNF2 Fuel at all axial levles: 1) Fuel may be stored with or without channels 2) Maximum Lattice Average Enrichment, wt% U-235: 4.70 3) Minimum Number of Rods containing Gd_2O_3: 6* 4) Minimum wt% Gd_2O_3 in these Gd rod: 3.0	"LaSalle Unit 1 and Unit 2 Nuclear Power Station New Fuel Storage Vault Criticality Safety Analysis for GNF2 Fuel," AREVA ANP-3008(P), Revision 0, June 2011 * Face adjacent gadolinia rods are treated as a single gadolinia rod.
B.3	Criticality criteria for fuel shipping containers	RAJ-II shipping cask will be used. Criticality criteria are provided in the GNF2 Design Basis Document.	GNF DB-0003.26 Rev. 8
B.4	10 CFR 70.24 criticality monitoring exemptions	LS Exempt from 10 CFR 70.24 for criticality monitoring	LS must meet 10 CFR 50.68(b) in lieu of 10 CFR 70.24 as is documented in UFSAR Section 9.1
B.5.a	Fuel type to be manufactured (fresh fuel)	GNF2	New fuel type is being introduced for LaSalle 1.
B.5.b	Fuel Type for Multi-cycle Analysis	Cycle 16: GNF2 Cycle 17: GNF2 (EPU) Cycle 18: GNF2 (EPU) Cycle 19: GNF2 (EPU)	Extended Power Uprate (EPU) information for Cycles 17, 18, and19 is documented in Attachment A.
B.5.c	Fuel Manufacturing Constraints	GNF Fuel Contract GNF Design Basis Document	GNF DB-0003.26 Rev. 8
B.6	Source for fuel product line dimensions	Nuclear Design Bases – Fuel Bundles (GNF2)	GNF DB-0003.26 Rev. 8
B.7	Assumptions made for this cycle's channel bow	35 mils	Value determined by GNF

Section B – Fuel Bundle Design Data Related Items			
Item	**Criteria**	**Value**	**References/Comments**
B.8	CPR correlation limitations (R-Factor)	GNF2 - GEXL17 0.94 < R-Factor < 1.30 (@ all bows, controlled/ uncontrolled, all exposures) ATRIUM-10 GEXL97(03) 1.02 < R-Factor < 1.20 (@ all bows, controlled/ uncontrolled, all exposures)	GNF DB-0003.26 R8 GNF AG-0024.01 R3 GEXL17 for GNF2 NEDC-33292 R3, June 2009 GEXL97(03) for A10 NEDC-33106 R1, June 2003
B.9	Local Peaking Factor Constraints	<1.4 for 40 VH at 0.0 GWD/ST (HOTUNC) <1.2 for 40VH at 20 GWD/ST (HOTUNC) <1.85 for 40VH at 0.0 GWD/ST (HOTCON) <1.090 for 70 VH at 20 GWD/ST, VAN zone for fuel on first row (HOTUNC)	Exelon targets. May be exceeded with Exelon approval. Based upon experience with TGBLA06, this is applied to TGBLA06 and compared to CASMO-4. NF-AB-110-2000, Rev. 4.
B.10.a	Core loading restrictions	Minimize movement of fuel bundles to a face adjacent position in the same fuel cell.	This takes up an inordinate amount of time on the refuel floor and in most cases is not necessary in achieving a good core design.
B.10.b	Core loading restrictions	Number of cycles on same water face < 2	GE SIL 320, NF-AB-110-2210 (Rev. 13)
B.11	Limitations on placement/enrichment of gadolinia rods	No gad rods face adjacent to water rods and minimize placement of gad rods in location D-4 and G-7 (face adjacent to 2 short PLRs) No gad rods face adjacent to one another	Exelon Requirement GNF DB-0003.26 Rev. 8
B.12	Limitations on the amount of gadolinia allowed in fuel pellets	Per GNF2 design basis document.	GNF DB-0003.26 Rev. 8
B.13.a	Target bundle average Enrichment	3.8 – 4.2%	Past GNF2 Bundle Design used by Exelon.
B.13.b	Allowed Enrichments	Per GNF2 Design Basis Document	GNF DB-0003.26 Rev. 8
B.13.c	Max. Number of Fuel Rod Enrichments	Per GNF2 Design Basis Document	GNF DB-0003.26 Rev. 8
B.13.d	Fuel Rod Enrichment Axial Variation	Per GNF2 Design Basis Document	GNF DB-0003.26 Rev. 8
B.14	Target minimum length for bottom fuel zone	6 inches	GNF DB-0003.26 Rev. 8
B.15	Natural Uranium Top and Bottom	6 inches	GNF DB-0003.26 Rev. 8, top zone was 11 inches in previous cycle.

Section B – Fuel Bundle Design Data Related Items			
Item	**Criteria**	**Value**	**References/Comments**
B.16	Maximum allowable control blade history delta MFLCPR penalty	MICROBURN-B2: Derived from PANAC11 and thus the limit below applies. PANACEA: IRFGEN = 2 Maximum delta MFLCPR < 0.005 between IRFGEN =1 and IRFGEN =2	MICROBURN-B2 methodology will utilize R-Factor penalties as provided by GNF to account for CBH CPR impacts in the fresh fuel using the GEXL17 CPR correlation. NF-AB-110-2010, Rev. 9
B.17	Rotated bundle delta CPR	< 0.31	Rotated Bundle shall not set OLMCPR, GNF DB-0003.26 Rev. 8 Exelon Target
B.18	Fuel manufacturing constraints which may be challenged in this reload design	None	
B.19	Exposure peaking limits on the lattice designs	Integrated Exposure Peak (REX) < 1.15 at 45 GWD/ST, 40% VH, BASE lattice	Exelon target. Confirm acceptable NEXRAT in multi-cycle.
B.20	Maximum number of unique rod types	23	GNF DB-0015 Rev. 0
B.21	Target gadolinium suppression penalty	Gad suppression > -1.5% Maximum gadolina suppression = -5.0%	Exelon target value. This is an engineering value being set by the CDIR. Goal is to minimize Gd suppression penalty on LHGR. Desire is to meet target for all lattices at all exposures. For limited cases, it may exceed target but must stay below maximum unless approved by the BWR Design Manager.
B.22	Target R-Factors	< 1.08 @ 0 GWD/ST (hot, uncontrolled) for fresh fuel in core interior	Exelon Target. This is an engineering value being set by the CDIR.
B.23	Target local peaking factors	See B.9	
B.24	Gad Rod Concentrations	Per GNF2 Design Basis Document	GNF DB-0003.26 Rev. 8
B.25	Maximum Gad Concentration	8%	GNF DB-0003.26 Rev. 8
B.26	Gad Rod concentration Axial Variation	Per GNF2 Design Basis Document	GNF DB-0003.26 Rev. 8
B.27	Gad Rod / Tie Rod Locations	Per GNF2 Design Basis Document	GNF DB-0003.26 Rev. 8
B.28	Max. Number of Fresh Bundle Types	8	GNF DB-0015 Rev. 0
B.29	Minimum number of bundles per batch	16	GNF DB-0015 Rev. 0
B.30	Maximum number of unique Gad Rod types	9	GNF DB-0015 Rev. 0
B.31	Maximum number of unique Gad Pellet types	7	GNF DB-0015 Rev. 0

Section C – Miscellaneous Design Data Related Items			
Item	**Criteria**	**Value**	**References/Comments**
C.1	Fuel conditioning guidelines to be used in this design	NF-AB-440 and NF-AB-440-1002	Will only be needed at POWERPLEX-III stage but the general approach is used in design stage to set limits for fuel shuffles (power changes) and rod pattern creation (fuel conditioning "friendly").
C.2	Computer code(s) to be used for lattice and core design along with any special version requirements	Exelon: CASMO-4 (2.05.14) MICRO-B2 (UMAR04R1) MICROBURN-B2 (UAPR05R1) GNF: TGBLA06/PANAC11	
C.3	Power-flow map – may be referenced if in procedure or other controlled document which is made available to the reload vendor	LaSalle Station Procedure LOA-RR-101 Current Revision	
C.4	Listing of required Technical Specification changes for the reload (i.e. changed SLMCPR, methodology, computer code, etc.)	SLMCPR (TBD) due to the introduction of GNF2	It has not been determined if a SLMCPR change will be required.
C.5	Listing of core component changes planned (control blade types, TIP/LPRM types, etc.)	High Duty Blades: Westinghouse CR99 # - 7 Low Duty Blades GE Marathon Ultra MD # - 59 LPRM replacements	NA300 LPRM instruments are currently used for replacements in LS units.
C.6	Any studies or projects which are in progress which could impact the reload design or reload licensing	GNF2 NFI ATWS Analysis for GNF2 Source Term Analysis with GNF2, including any follow-on design basis accident recalculations Fluence effects due to reduced size of top natural lattice in GNF2	If ATWS analysis does not pass with currently SLC capability, may need to use GE14 bundle design.

Section C – Miscellaneous Design Data Related Items			
Item	**Criteria**	**Value**	**References/Comments**
C.7	Limits related to the radiological alternate source term analysis (rod burnups, kW/ft limitations, peaking factor limits, etc.)	Peak rod average exposure < 54 GWD/MT or, <u>if</u> peak rod average exposure ≥ 54 GWD/MT, <u>then</u> peak rod average LHGR must not exceed 6.3 kW/ft Radial Peaking Factor maintained ≤ 1.7.	Reg. Guide 1.183 "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors" L-003067, Rev. 2 – Fuel Handling Accident
C.8	Items which are determined to be Critical to Quality.	None specified at this time	
C.9	Fuel type to be used in downstream multicycle analyses	GNF2	

Section D			
Item	**Criteria**	**Value**	**References/Comments**
D.1	Planned Station Modifications of Impact	GNF2 Introduction	
D.2	Planned Setpoint Changes of Impact	None	RDOT/RRB/SMDI
D.3	Planned Station Minor Modifications of Impact	None	RDOT/RRB/SMDI
D.4	Planned Component Changes of Impact	See items C.5 and C.6	RDOT/RRB/SMDI

Attachment A
LaSalle 1 Cycle 15 EUP

LaSalle 1		Cycle 14	Cycle 15	Cycle 16	Cycle 17	Cycle 18	Cycle 19
Rated Reactor Thermal Power, MWth		3,546 (Post-MUR)	3,546	3,546	3,988	3,988	3,988
Beginning-of-Cycle (BOC) Date		03/05/10	03/09/12	03/01/14	03/11/16	03/22/18	04/01/20
End-of-Cycle (EOC) Date		02/13/12	02/10/14	02/22/16	03/04/18	03/14/20	03/25/22
Outage Length, Days:	Post-Cycle	25	19	18	18	18	18
	Mid-Cycle	0	0	0	0	0	0
Operating Cycle Length, Days		710	703	723	723	723	723
(BOC to EOC)							
Total Cycle Length, Days (S/U to S/U)		735	722	741	741	741	741
(Includes Planned Outages)							
Full Power Capability (End of Rated):	Days	710.0	668.7	684.4	682.8	682.4	680.9
	MWd	2,440,869	2,332,840	2,383,773	2,674,766	2,673,101	2,667,295
	MWd/MT	17,968.6	16,940.2	17,012.4	18,924.3	18,912.6	18,871.5
	EFPD	688.3	657.9	672.2	670.7	670.3	668.8
Full Power Cycle Extension Capability:	Days	0.0	0.0	0.0	0.0	0.0	0.0
BWRs: ICF/FFWTR	MWd	0	0	0	0	0	0
PWRs: ACTR/APSR Pull	MWd/MT	0.0	0.0	0.0	0.0	0.0	0.0
	EFPD	0.0	0.0	0.0	0.0	0.0	0.0
Total Full Power Capability:	Days	710.0	668.7	684.4	682.8	682.4	680.9
	MWd	2,440,869	2,332,840	2,383,773	2,674,766	2,673,101	2,667,295
	MWd/MT	17,968.6	16,940.2	17,012.4	18,924.3	18,912.6	18,871.5
	EFPD	688.3	657.9	672.2	670.7	670.3	668.8
Coastdown Cycle Extension:	Days	0.0	34.3	38.6	40.2	40.6	42.1
	MWd	0	112,983	126,227	147,351	148,808	153,874
	MWd/MT	0.0	820.4	900.8	1,042.5	1,052.8	1,088.7
	EFPD	0.0	31.9	35.6	36.9	37.3	38.6
Cycle Operating Capacity Factor, %		96.95	98.11	97.90	97.88	97.87	97.84
(Excludes refueling outage)							
Cycle Capacity Factor, %		93.65	95.53	95.52	95.50	95.49	95.47
(Includes refueling outage & MCO)							
Total Cycle Energy:	MWd	2,440,869	2,445,824	2,510,000	2,822,117	2,821,910	2,821,169
	MWd/MT	17,968.6	17,760.7	17,913.2	19,966.9	19,965.4	19,960.2
	EFPD	688.3	689.7	707.8	707.7	707.6	707.4

Attachment B
Target Sequence Exchange Plans

Rod Group	Sequence Start Date	Sequence End Date	Sequence Interval MWd/ST	Cumulative Exposure MWd/ST
A2	3/9/12	5/20/12	1678	1678
A1	5/21/12	9/2/12	2413	4090
A2	9/3/12	12/16/12	2413	6503
A1	12/17/12	3/24/13	2252	8755
A2	3/25/13	5/26/13	1448	10203
A1	5/27/13	9/8/13	2413	12616
A2	9/9/13	12/15/13	2252	14868
ARO	12/16/13	1/5/14	483	15351
Coast	1/6/14	2/10/14	804	16155

Attachment C
Channel Distortion Design / Monitoring Criteria

Shadow-Corrosion Based Threshold

1. No cell may contain one or more channels with >= 64 EFID for Zirc-2 channels or >= 120 EFID for Zirc-4 channels **AND** >=36 GWd/MT channel exposure – all fuel violating this criteria must be rechanneled, discharged, or moved within the loading.

2. Cells that will contain one or more channels with >= 64 EFID (Zirc-2 or Zirc-4 channels) at end-of-cycle must be monitored.

    a. Monitoring to begin prior to any channel in the cell exceeding 33 GWd/MT channel exposure.
    b. Rechannel at site discretion to minimize/eliminate required monitoring.[1]

Fast Fluence Gradient Based Threshold

1. **ATRIUM-10 Fuel Only** – No cell configuration may violate the Control Rod Friction Surveillance Recommendations (Interim Supplemental Surveillance for AREVA Fuel Channels in Core Periphery Locations) – rechannel, discharge, or move fuel within the loading to ensure no cells violate this criteria.

2. No cell configuration may violate the GE Nuclear Energy SIL No. 320, Supplements 1, 2, and 3 (Mitigation of the Effects of Peripheral Core Location on Fuel Channel Bowing C-Lattice Criteria) – rechannel, discharge, or move fuel within the loading to ensure no cells violate this criteria.

3. No peripheral cell may contain two or more channels with >= 43 GWd/MT channel exposure at end-of-cycle – rechannel, discharge, or move fuel within the loading to ensure no cells violate this criteria.

4. Peripheral cells that will contain one channel with >= 43 GWd/MT channel exposure at end-of-cycle must be monitored.

    a. Monitoring to begin prior to the leading channel exceeding 37 GWd/MT channel exposure.
    b. Rechannel at site discretion to minimize / eliminate required monitoring.[1]

[1] Note that ATRIUM-10 fuel bundles may only be re-channeled at the end of their first operating cycle and not later.

Attachment D
Spent Fuel Pool Criticality Limits

The fuel may be stored in the Spent Fuel Pool provided the lattice average enrichment is less than 5.0 wt% U-235, and the k_∞ of each enriched lattice does not exceed the following in-rack k_∞ values at any point during its lifetime.

Zone	Distance from BAF	Max. in-rack k_∞
TS3	> 126" to TAF	0.9185
TS2	> 96" to 126"	0.8869
TS1	0" to 96"	0.8843

Fuel lattices that meet the U-235 enrichment and gadolinia requirements described below have been shown to meet these requirements.

Distance from BAF	≥ 10 Gad Rods / Lattice	≥ 13 Gad Rods / Lattice	≥ 10 Gad Rods / Lattice
> 126" to TAF	≤ 4.84 wt% U-235 ≥ 4.00 wt% Gd2O3	≤ 4.95 wt% U-235 ≥ 4.00 wt% Gd2O3	≤ 4.95 wt% U-235 ≥ 5.00 wt% Gd2O3
> Y" to 126"	≤ 4.68 wt% U-235 ≥ 6.00 wt% Gd2O3	≤ 4.85 wt% U-235 ≥ 6.00 wt% Gd2O3	≤ 4.95 wt% U-235 ≥ 7.00 wt% Gd2O3
> X" to Y"	≤ 4.13 wt% U-235 ≥ 6.00 wt% Gd2O3	≤ 4.40 wt% U-235 ≥ 6.00 wt% Gd2O3	≤ 4.40 wt% U-235 ≥ 7.00 wt% Gd2O3
0" to X"	≤ 4.27 wt% U-235 ≥ 6.00 wt% Gd2O3	≤ 4.48 wt% U-235 ≥ 6.00 wt% Gd2O3	≤ 4.63 wt% U-235 ≥ 7.00 wt% Gd2O3

Note: Elevations X" and Y" are proprietary to GNF, GEH, or GE. If needed, Nuclear Fuels can be contacted to discuss these values.

Note: Enriched lattices within each bundle must meet one of the three possibilities for the respective "Distance from BAF" range. Not all lattices within the bundle have to meet the requirements from the same column.