ENCLOSURE 2

JMD-EXN-HH0-08-023

Limerick LPRM Calibration Interval Extension Support

Non-Proprietary Information

INFORMATION NOTICE

This is a non-proprietary version of Enclosure 1 of JMD-EXN-HH0-08-023, which has the proprietary information removed. Portions of the document that have been removed are indicated by white space inside open and closed bracket as shown here [[ ]].

LPRM Calibration Interval Increase for Limerick Generating Station, Units 1 and 2

Summary

This report provides the basis for application of an LPRM calibration interval of up to 2000 effective full power hours (EFPH). The report identifies the extended calibration interval as being within the qualification basis of the core monitoring system (3DMONICORE™) for the Limerick Generating Station (LGS), Units 1 and 2. The qualification bases for the thermal limits calculations were reviewed for MCPR, MAPLHGR and LHGR.

The impact of an increase in the LPRM calibration interval to 2000 EFPH has been included in the qualification of the 3DMONICORE™ core monitoring system in use at the Limerick Generating Station (LGS) units. For LGS, an interval of 2000 EFPH is equivalent to ~2000 Megawatt Days per short ton (MWD/st) of core exposure. The safety and licensing analyses are consistent with the power uncertainty of the core monitoring system, and these have been reviewed and approved by the USNRC. Therefore, operation with the LPRM calibration interval up to 2000 EFPH is justified using the existing safety evaluations.

An examination of Reference 1 was performed to determine whether the analyses performed by Exelon were consistent with the methodology of the GEH/GNF qualification bases.

1. Introduction

This report describes the basis for application of the capability to operate with an LPRM calibration interval of up to 2000 effective full power hours (EFPH). This capability is within the qualification basis of the core monitoring system 3DMONICORE™ for the Limerick Generating Station (LGS), Units 1 and 2. The qualification bases for the thermal limits calculations were reviewed for MCPR, MAPLHGR and LHGR. The qualification bases for calculation of these thermal limits has included the specific uncertainties associated with an LPRM calibration interval up to 2000 EFPH. Therefore, operation with the LPRM calibration interval up to 2000 EFPH is justified using the existing safety evaluations.

2. Scope of Evaluation

GE Hitachi Nuclear Energy (GEH)/Global Nuclear Fuel (GNF) has previously justified an LPRM calibration interval up to 2000 EFPH by comparing core monitoring predictions before and after periodic LPRM calibration. These comparisons and other prediction uncertainty studies have been periodically documented for review and approval by the USNRC. This evaluation involves a review of the GEH/GNF documentation provided to and approved by the USNRC in support of core monitoring accuracy requirements. The GNF core monitoring system 3DMONICORE™, used at LGS, includes provision for an LPRM calibration interval up to 2000 EFPH, as well as equipment failure. The following Section 3.0 documents the approach taken for this review and Section 4.0 documents the details of the core monitoring qualification basis. Section 5.0 reports the review of the Exelon evaluation of the proposed change.

3. Evaluation Basis and Assumptions

The increase in the LPRM calibration interval impacts primarily the core monitoring system calculation of fuel thermal margins. The acceptability of an increase in the LPRM calibration interval is dependent upon the accuracy of the prediction of power distribution. Therefore, the case is made in Section 4 that the increased LPRM calibration interval has been accounted for in the power uncertainty applied in the safety and licensing analyses.

4. Evaluation of LPRM Calibration

This evaluation includes a review of the bundle and nodal power uncertainty of the core monitoring system and the impact of the LPRM calibration interval. The reference documents that have been used in the review of the power predictions with the USNRC are also identified.

4.1 MCPR Power Uncertainty

GEH/GNF has performed detailed analyses (References 2 to 7) of power uncertainties in the core monitoring system. These analyses include model uncertainties and instrument update uncertainties. Since the inception of 3DMONICORE™, an LPRM calibration interval up to 2000 EFPH, a single Traversing-Incore-Probe (TIP) machine Out-Of-Service (OOS) and [[
]]of the LPRMs failed or rejected have been included in these analyses.

Specifically, for the 3DMONICORE™ system currently used at LGS, the power distribution uncertainties are as follows for 2000 EFPH operation:

Table 1 (Ref. 6, Table 4.2)

[[		
		]]

It should be noted that the table above is taken in its entirety from Reference 6. For details of the analyses and sources, the reference should be examined. Since the reference was approved in 1999, additional information has been analyzed and presented to the NRC as part of the ongoing Methods benchmarking. Reference 8 provides an example of this, addressing the 10x10 tracking. The tracking data for 10x10 fuel has been analyzed and confirms the validity of the total bundle power uncertainty given in the table.

The 3DMONICORE™ methods and methods uncertainties have been reviewed and approved by the Nuclear Regulatory Commission (Ref. 6). "Uncertainty due to LPRM Updates and Instrument Failure" addresses both the LPRM Calibration Interval and failure of one TIP machine (up to [[ ]]). The maximum RMS difference in bundle power due to missing TIP data with 2000 EFPH calibration interval is [[ ]]as is found in Table 1 and is used as the uncertainty allowance for missing TIP data. It should be noted that this determination of 3DMONICORE™ bundle power uncertainties is not dependent on the evaluation of the SLMCPR, although the approved methodology for cycle-specific SLMCPR utilizes these uncertainties.

From the analyses performed in Reference 6 above, the qualification basis for monitoring MCPR includes the 2000 EFPH calibration interval. The Reference 7 document shows that the qualification for the latest core physics methods remains the same as for the previous evaluations.

Additionally, although Reference 6 shows that the 2000 EFPH is part of the design basis for the uncertainties found in Table 1, Reference 9 provides an analysis showing that even if the uncertainty for the update interval is doubled then the total bundle power uncertainty is only increased from [[ ]] to [[ ]]. Reference 9 also shows that this has an [[ ]] on the calculated SLMCPR value.

Therefore, it is concluded that LGS can be operated within the Power Distribution Uncertainties for Safety Limit MCPR (Ref. 6) with 3DMONICORE™ for 2000 EFPH without running a full TIP set and calibrating LPRMs, with one TIP machine OOS and [[ ]] of the LPRMs failed or rejected indefinitely.

4.2 LHGR and MAPLHGR Power Uncertainty

The NRC requested additional information and the GEH responses that were provided are included as appendices in the NRC acceptance of the Licensing Topical Report (Ref. 6). In these appendices, the NRC requested an uncertainty analysis for the 3DMONICORE™ prediction of peak kW/ft and MAPLHGR. In response, an analysis was performed then documented in Appendix A and later updated in Appendix B. The analysis continued to use the [[ ]]uncertainty allowance for missing TIP data. This [[ ]]is included in the [[ ]]. In this appendix, the LPRM update uncertainty on LHGR is shown to be [[ ]]. The nodal uncertainty derived was [[ ]]and the total LHGR uncertainty, which included the additional peaking uncertainty [[ ]].

The power distribution uncertainty allowance for thermal-mechanical analysis is [[ ]]for LHGR. The [[ ]]uncertainty includes the LPRM update uncertainty derived in the approved licensing report and is well within this allowance. The variability in MAPLHGR would be less than for LHGR because of the exclusion of the local peaking uncertainty. With this in mind, it is confirmed that the uncertainties for LPRM updates of 2000 EFPH intervals or less are acceptable within the qualification basis.

4.3 Calibration Of LPRMs

Reference 6, Section 4, analyzed the effects on operation of TIP and LPRM failures. The analyses performed included the effects on LPRM calibration with a single TIP OOS. Again, the approved NRC topical used the missing TIP data uncertainty in the stack-up for the LPRM update uncertainty.

The calibration with missing TIP information will be performed differently for those LPRMs that do not have TIP-supplied data. Basically, the planar average adaption correction term (which is applied to the [[ ]]) will be applied based on the TIP strings that are present. However, this update of the LPRM calibration has been taken into account in the references and the currently approved uncertainties already have the TIP OOS included.

4.4 LPRM Gain Adjustment Factor

The recommended acceptance range for LPRM Gain Adjustment Factors (GAFs) following amplifier calibration is 1.00 +/- 0.15. The LPRM system also provides neutron flux signal inputs to the Average Power Range Monitor (APRM) system, Oscillation Power Range Monitor (OPRM) system, and the Rod Block Monitor (RBM) system, in addition to the 3D MONICORE core monitoring system. The APRM system provides indication of core average thermal power and input to the Reactor Protection System (RPS). The OPRM system is capable of detecting thermal-hydraulic instability by monitoring the local neutron flux within the reactor core. It also provides input to the RPS. The RBM system prevents the withdrawal of selected control rods when local power is above a preset limit. LPRM inputs to the 3D MONICORE system are used to calculate core power distribution and ensure operation within established fuel thermal operating limits.

The APRM readings are maintained within +/- 2% of core thermal power by calibration against weekly heat balance calculations. The core monitoring system corrects the value of LPRM reading used in the thermal limits calculation for burnup induced sensitivities. Because the LPRM chamber responses are very linear over the interval involved, the LPRM interval extension and the GAF range have an insignificant effect on the APRM accuracy during the power maneuvers or transients between LPRM calibrations. When a rod is selected, the RBM channel readings are automatically calibrated against an APRM reading and the rod block trips are set to a percentage, corresponding to the safety analysis, of the calibrated reading. Again, because LPRM chamber responses are very linear over the interval involved, the RBM system response during rod withdrawal is not significantly affected.

5. Review of the Exelon Evaluation of Proposed Changes

Reference 1 is the evaluation provided by Exelon in support of the proposed change in LPRM calibration interval to 2000 EFPH. A review of the document was performed by GNF.

Although 2500 EFPH is not explicitly addressed by References 2 through 7, Exelon's argument is reasonable given the conditions that they cite, including the improved core monitoring system and the better methods comparison (e.g. PANAC11 methods having a [[
]]) which is found in Reference 7.

Reference 1 evaluated application of the change in interval within the GETAB uncertainties. However, this is also applicable for the LGS in that the plant uses the approved improved SLMCPR methodology documented in Reference 6, commonly referred to as Reduced Uncertainties. The evaluation that Exelon performed is consistent with the methodology of GNF and the applicability of the bounding interval in Reference 6 and the conditions detailed in Reference 9. It is also consistent with the evaluation in support of a similar calibration interval increase for Peach Bottom Atomic Power Station, Reference 10.

6. Conclusion

The impact of an increase in the LPRM calibration to 2000 EFPH has been included in the qualification of the core monitoring system 3DMONICORE™ for LGS. The safety and licensing analyses are consistent with the power uncertainty of the core monitoring system, and these have been reviewed and approved by the USNRC. Therefore, operation with the LPRM calibration interval up to 2000 EFPH at LGS, is justified using the existing safety evaluations as stated by the USNRC in the SER of Reference 6.

7. References

1. Letter from P. B. Cowan, Exelon Generation Company, LLC, to U.S. Nuclear Regulatory Commission, "License Amendment Request - Revise Local Power Range Monitor Calibration Frequency," dated October 19, 2007.
2. NEDE-20340-3, "Process Computer Performance Evaluation Accuracy", November 1985.
3. NEDE-20340-3, Rev 1, "Process Computer Performance Evaluation Accuracy", April 1986.
4. NEDE-20340-3, Rev 2, "Process Computer Performance Evaluation Accuracy", August 1991.
5. NEDE-34321, "3DMONICORE (RL3D) Performance Evaluation Accuracy", January 1994.
6. NEDC-32694P-A, "Power Distribution Uncertainties for Safety Limit MCPR Evaluations", August 1999.
7. NEDC-32773P Rev. 1 "Advanced Methods Power Distribution Uncertainties for Core Monitoring" January 1999.
8. Letter, G. A. Watford (GNF) to R. Pulsifer (NRC), "Request for Additional Information – GE14 Review – Power Distribution Uncertainties and GEXL Correlation Development Procedure," March 27, 2001 (FLN-2001-004).
9. GNF S-0000-0082-2744 Rev 0, "Limerick LPRM Calibration Interval Extension Support", Bill Cline, March 4, 2008.
10. GNF S-0000-0080-3313 Rev 1, "Peach Bottom LPRM Calibration Interval Extension Support", Bill Cline, February 12, 2008.

ENCLOSURE 3

Limerick Generating Station
Units 1 and 2
Docket Nos. 50-352 and 50-353

License Amendment Request
Revise LPRM Calibration Interval

Global Nuclear Fuel Report
Limerick LPRM Calibration Interval Extension Support

Affidavit

ENCLOSURE 3

JMD-EXN-HH0-08-023

Limerick LPRM Calibration Interval Extension Support

Affidavit

Global Nuclear Fuel – Americas

AFFIDAVIT

I, Andrew A. Lingenfelter, state as follows:

(1) I am Vice President, Fuel Engineering, Global Nuclear Fuel–Americas, LLC ("GNF-A"), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosure 1 of GNF's letter, JMD-EXN-HH0-08-023, J. Michael Downs to Dave Helker (Exelon Nuclear), entitled Limerick LPRM Calibration Interval Extension Support, March 13, 2008. GNF proprietary information in Enclosure 1, which is entitled "Limerick LPRM Calibration Interval Extension Support," 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, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (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 the methods used in these analyses, along with the testing, development and approval of the supporting methodology was achieved at a significant cost, on the order of several million dollars, to GNF-A or its licensor.

(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 13th day of March 2008.

Andrew A. Lingenfelter

Andrew A. Lingenfelter
Vice President, Fuel Engineering
Global Nuclear Fuel – Americas, LLC