SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 181 TO FACILITY OPERATING LICENSE NO. NPF-62

AMERGEN ENERGY COMPANY, LLC

CLINTON POWER STATION, UNIT NO. 1

DOCKET NO. 50-461

1.0 INTRODUCTION

By letter dated December 12, 2006 (Agencywide Documents Management System (ADAMS) Accession No. ML063470222), AmerGen Energy Company, LLC, the licensee for Clinton Power Station, Unit 1, requested to amend the Technical Specifications (TSs), Appendix A, of Renewed Facility Operating License No. NPF-62 for Clinton Power Station, Unit 1 (CPS) (Reference 1). The requested amendment would increase the interval between local power range monitor (LPRM) calibrations from 1000 megawatt-days/ton (MWD/T) to 2000 MWD/T that are required by CPS TS surveillance requirement (SR) 3.3.1.1.8 and 3.3.1.3.2.

During its review, the Nuclear Regulatory Commission (NRC) staff determined that additional information was necessary. The NRC staff issued requests for additional information (RAIs) to the licensee by letters dated September 20, 2007 (Reference 2), and February 28, 2008 (Reference 3), to which the licensee responded by letters dated November 16, 2007 (Reference 4), and May 16, 2008 (Reference 5), respectively. The November 16, 2007, and May 16 and June 27, 2008, supplements, contained clarifying information and did not change the NRC staff's initial proposed finding of no significant hazards consideration.

The NRC staff has completed its review and finds that that the requested modification is acceptable, as discussed in this safety evaluation. The NRC staff's finding is based on a commitment provided by the licensee by letter dated June 27, 2008 (Reference 6). The licensee committed to double an uncertainty parameter used in the determination of the cycle-specific safety limit minimum critical power ratio. This commitment is discussed in further detail in Sections 3.3.6, 3.4, and 4.0 of this Safety Evaluation. This commitment will be controlled by CPS's commitment management program and the staff has determined that the commitment does not warrant creation of a regulatory requirement.

2.0 REGULATORY EVALUATION

Title 10 of the *Code of Federal Regulations*, Part 50, (10 CFR Part 50) Section 50.36(c)(2)(ii)(B), specifies that a TS limiting condition for operation (LCO) must be established for, among other things, each operating restriction that is an initial condition of a design-basis accident or transient analysis that either assumes failure of or presents a challenge to the integrity of a fission product barrier (Reference 7).

Enclosure

Section 50.36(c)(3) of 10 CFR Part 50 specifies that "Surveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained..."

Together, these two provisions of 10 CFR Section 50.36 require that the surveillance practice contained in SR 3.3.1.1.8 and the associated LCO 3.3.1.1 result in adequate assurance that the LPRM calibration interval will support LPRM accuracy requirements for input to the Reactor Protection System (RPS). Also, the provisions of 10 CFR 50.36 require that the surveillance practice contained in SR 3.3.1.3.2 results in adequate assurance that the LPRM calibration interval will support Oscillation Power Range Monitor (OPRM) accuracy requirements for input to the RPS.

The safety limit minimum critical power ratio (SLMCPR) is a parameter applied to boiling-water reactors to assure compliance with specified acceptable fuel design limits (SAFDL). It is calculated using a statistical process that takes into account all operating parameters and associated uncertainties. The SLMCPR is the core-wide critical power ratio (CPR) at which 99.9 percent of the rods in the core would not be expected to undergo boiling transition during normal operation. The SLMCPR is contained in TS 2.1.1.2.

The minimum critical power ratio (MCPR) fuel cladding integrity safety limit ensures that during normal operation and during anticipated operational occurrences, at least 99.9 percent of the fuel rods in the core do not experience transition boiling. This is accomplished by the determination of a CPR margin for transients, which is added to the SLMCPR to determine the operating limit MCPR (OLMCPR). At the OLMCPR, at least 99.9 percent of the fuel rods would be expected not to experience transition boiling during normal operations and transients caused by single operator error or equipment malfunction. The OLMCPR is contained in the Core Operating Limits Report, and its adherence is required by TS LCO 3.2.2.

The average planar linear heat generation rate and linear heat generation rate (LHGR) limits are established, also in accordance with the requirements of 10 CFR 50.36, to protect the fuel from excessive heat generation, which would cause gross mechanical failure of the fuel system. These limits are established on a cycle-specific basis using an approved methodology, and their observance is required by TS LCOs 3.2.1 and 3.2.3. These are the SAFDLs that protect the fuel from mechanical failure.

The online core monitoring system is used to establish that the core is operating within the OLMCPR, and within the peak LHGR limits. As the LPRM reading is a parameter that feeds into the core monitoring system and is used to determine the core-wide MCPR, and peak LHGR, its uncertainty must be accounted for in the statistical determination of the SLMCPR, which forms the basis for the OLMCPR, and in the thermal-mechanical analysis used to determine the LHGR limits. Therefore, the NRC staff evaluated the effects that increased calibration intervals would have on the power distribution uncertainties at CPS to ensure that the plant would remain in compliance with TS 2.1.1.2 and TS LCOs 3.2.1 through 3.2.3, and hence, 10 CFR Section 50.36.

The stability solution in place at CPS employs the use of an OPRM system, which relies on input from the LPRM detectors. Therefore, the staff evaluated the requested change in LPRM calibration interval to ensure that the plant would remain in compliance with TS 2.1.1.2, with respect to the LPRM input function to the OPRM system. The staff's evaluation considered whether increased core monitoring uncertainty would negatively impact the ability of the OPRM system to detect and suppress unstable power oscillations prior to challenging the fuel cladding integrity safety limit.

The NRC staff also evaluated the effects of the requested LPRM calibration interval extension to ensure that the average power range monitor (APRM) and rod control and information (RCIS) systems would not be unacceptably affected by the requested extension.

3.0 TECHNICAL EVALUATION

The LPRM system is composed of fission chamber detectors, signal conditioning equipment, display and alarm equipment, associated power supplies, cabling, and trip functions. The LPRM system provides neutron flux signal inputs to the APRM system, OPRM system, RCIS, and the 3D MONICORE core monitoring system.

The APRM system provides indication of core average thermal power and input to the RPS. The OPRM system is capable of detecting thermal-hydraulic instability by monitoring oscillations in the local neutron flux within the reactor core. It also provides input to the RPS. The RCIS displays the LPRM readings to the operator on a digital display. LPRM inputs to the 3D MONICORE system are used to calculate core power distribution and ensure operation within established fuel thermal operating limits.

At CPS, the LPRM system is composed of 33 LPRM detector strings, radially-distributed throughout the core. Each detector string contains four fission chambers located at fixed axial elevations. Each fission chamber produces an output current that is processed by the LPRM signal-conditioning equipment to provide the desired scale indications. Adjacent to each LPRM string is a calibration tube through which traversing in-core probe (TIP) movable neutron detectors are periodically traversed to provide a continuous axial gamma flux profile at each LPRM string location. These data are used in the calibration of the 132 fixed LPRM fission detectors.

The LPRM system is designed to provide a sufficient number of LPRM signals to satisfy the safety design-basis of the APRM, OPRM, and 3D MONICORE systems. This safety design-basis is to detect conditions in the core that threaten the overall integrity of the fuel barrier due to excessive power generation and provide signals to the RPS so that the release of radioactive material from the fuel barrier is limited. The LPRM system also incorporates features designed to diagnose and display various system trip and inoperative conditions.

3.1 LPRM Calibration Uncertainty

Neutron TIP data are used to perform periodic LPRM channel calibrations. These calibrations compensate for small changes in detector sensitivity resulting from the depletion of fissile material lining the individual LPRM fission chambers. LPRM calibrations are performed while the reactor is operating at power due to the limited sensitivity of the LPRM detectors. Adjacent to each LPRM string is a calibration tube, through which TIP movable neutron detectors are traversed to provide a continuous axial flux profile at each LPRM string location. From these flux profiles, thermal neutron flux profiles are calculated. Appropriate gain adjustment factors are determined for each LPRM detector based on this information. These gain adjustment values are then applied to LPRM signals during the LPRM calibration process.

The changes in LPRM detector sensitivity discussed above contribute to the LPRM update uncertainty, which is a quantification of the uncertainty that results from the sensitivity changes during the interval over which the LPRM detector is calibrated. The LPRM update uncertainty is one component that is combined with others to obtain a radial power distribution uncertainty, which ultimately is convoluted with still other uncertainties to assess the required margin in the fuel cladding integrity safety limit. The statistical margin included in the fuel cladding integrity safety limit assures compliance, in part, with the SAFDL.

3.2 APRM, OPRM, and RCIS Systems

The licensee stated that the APRM, the OPRM, and the RCIS systems are the only nuclear instrumentation systems that use LPRM readings. According to the licensee's justification, the APRM readings are maintained within TS-required accuracy limits via weekly comparison to heat balance calculations. Because the APRM system is calibrated using a means other than the TIP system comparison for which the interval extension has been requested, the NRC staff finds that the APRM system will not be adversely affected by the requested extension. The staff finds, therefore, that the requested calibration interval extension is acceptable with respect to the LPRM input to the APRM system.

The licensee stated that the OPRM system is insensitive to the absolute value of individual LPRM readings when the reactor is at equilibrium. The OPRM system is designed to monitor the core for thermal-hydraulic instabilities, which are indicated by cyclic fluctuations in neutronic power. Certain biases affecting the LPRM detectors could result in the propagation of the bias to the OPRM system. Such propagation could inhibit the function of the OPRM to detect a thermal-hydraulic instability in a reactor core. The licensee stated that the requested calibration interval extension would not affect the functionality of the OPRM system.

The cyclic fluctuations indicative of an instability are monitored by averaging signals from a small number, typically 2-4, of LPRMs to determine the magnitude of power oscillations in the 0.3-0.7 Hz range. The magnitude is defined as the ratio of the peak LPRM signal to its average. The OPRM system in use at CPS is described more comprehensively in the NRC staff's safety evaluation (SE) for Amendment No. 171 to the facility operating license for CPS (Reference 8), and in BWR Owners Group Licensing Topical Report NEDO-32465-A, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications," dated August, 1996 (Reference 9).

In Reference 4, the licensee provided data about the LPRM signal uncertainty to show how the signal uncertainty changes as a function of exposure. The data illustrated that, in the range of the requested calibration interval extension, there is very little change in LPRM signal uncertainty. In comparison, the 0.3-0.7 Hz oscillation cycles expected in an instability are short. Therefore, a bias in an LPRM detector associated with the increased calibration interval could reasonably be construed as constant over the duration of a postulated instability.

Because the bias associated with the LPRM detector sensitivity decay is effectively constant, the averaging function used by the OPRM system would eliminate the bias.
Based on these considerations:

(1) The averaging function of the OPRM would eliminate any bias due to LPRM sensitivity decay, and

(2) The LPRM sensitivity decay is minimal through the duration of the requested calibration interval extension.

The NRC staff agrees with the licensee that the requested calibration interval extension will not affect the functionality of the OPRM system. Therefore, the proposed calibration interval extension is acceptable with regard to the functionality of the OPRM system.

The licensee stated that the LPRM detectors provide an input to the RCIS, but that this input is used only to display the LPRM reading to the operator. Therefore, the requested calibration interval affects no safety function performed by the RCIS, and the extension is acceptable with regard to the LPRM input to the RCIS.

3.3 3D MONICORE Uncertainties

The 3D MONICORE system does not compensate for the LPRM uncertainty. Thus, the LPRM uncertainty becomes a component of the overall power distribution uncertainty associated with the core monitoring system. Because the power distribution data are used to determine the on-line margin to fuel cladding integrity, an acceptably quantified power distribution uncertainty is required to assure compliance with SAFDL.

The licensee provided a technical basis for requesting the LPRM calibration interval increase that included several reasons why the LPRM update uncertainty would not significantly affect the power distribution uncertainty. These bases are presented and evaluated in the following subsections.

3.3.1 LPRM Response Uncertainty Bounded by GETAB

The licensee stated that the calibration frequency has a small effect on the overall power distribution uncertainty associated with LPRM based on operation between successive LPRM calibrations. The licensee also stated that the small additional uncertainty would not increase the total power distribution uncertainty to a value in excess of the value allowed by the GE Thermal Analysis Basis (GETAB) safety limit analysis (Reference 10).

In Reference 5, the licensee acknowledged that **[[**
]]. Therefore, the GETAB uncertainty limits are not applicable, and instead, the power distribution uncertainty limits contained in NEDC-32694P-A, "Power Distribution Uncertainties for Safety Limit Minimum Critical Power Ratio Evaluations," are applicable (Reference 11). The power distribution uncertainty at CPS is less than the value referenced in GETAB that forms the basis for this argument.

The NRC staff finds, therefore, that the GETAB uncertainty argument presented in the license amendment request is not reflective of the safety analyses in use at CPS, and is, therefore, inapplicable.

A statement in Reference 5 concluded that "the evaluation Exelon (the licensee) performed [in the license amendment request] is consistent with the methodology of GNF (the fuel vendor) and the applicability of the bounding interval" of the power distribution uncertainties contained in Reference 11. This conclusion is evaluated further in Section 3.3.3 of this Safety Evaluation.

3.3.2 Hardware and Software Improvements

The licensee stated that the original surveillance frequency was based on using the older GE P1, Periodic Core Evaluation, software in the evaluation of core power distribution and fuel operating limits. This original software has subsequently been replaced with the current 3D MONICORE system, which contains sophisticated neutron diffusion and adaptive learning models. The licensee also stated that the original surveillance frequency was based on a different type of LPRM detector. This older type of detector has been replaced at CPS with a detector that introduces less uncertainty into the power distribution calculations.
While the NRC staff agrees that the use of more sophisticated software and more reliable hardware will reduce the LPRM signal uncertainty, the data that supported reduced power

distribution uncertainty allowables were also based on these improvements. The data presented in Reference 11, for instance, were based on calculations performed using 3D MONICORE. Therefore, the NRC staff concludes that it is inappropriate to justify increasing the LPRM calibration interval to 2000 MWD/T based on the referenced hardware and software improvements, because the overall power distribution uncertainty allowables in use at CPS have been reduced for the same reason.

The licensee stated in Reference 4 that the PANAC11 version of 3D MONICORE is substantially more accurate and contains less uncertainty than do previous versions of PANACEA. Reference 11 is based on the older, less accurate versions of PANACEA. The NRC staff agrees that the bundle power uncertainty used in the SLMCPR analysis at CPS is conservatively higher than the bundle power uncertainty associated with PANAC11. However, the conservatively higher bundle power uncertainty forms the technical basis for the NRC approval of the method described in Reference 11 and the licensee's SLMCPR is determined in accordance with this approved method. The NRC staff finds, therefore, that it is not possible to credit the conservatively higher uncertainty allowable value, used in the SLMCPR analysis, to support the licensee's amendment request.

3.3.3 Detailed Statistical Evaluations

The licensee stated, "the technical bases for extending the interval between LPRM calibrations to 2000 MWD/T have been previously reviewed and approved by the NRC staff." In this statement, the licensee refers to the NRC SE that approved Reference 11. However, the statistical evaluations contained in Section 3.2 of Reference 11 were presented to support an adequately conservative method to calculate and convolute the uncertainties that are input to the SLMCPR. The NRC staff did not approve Reference 11 as a means to justify extending the LPRM calibration interval, and the SE does not provide for this extension. It is the NRC staff's position that the evaluation in Section 3.2 of Reference 11 is provided as an example to explain why the selected uncertainties were appropriate.

Supplemental information provided by the licensee in Reference 5 contained an evaluation performed by Global Nuclear Fuels (GNF) regarding the technical applicability of Section 3.2 of Reference 11 as a technical basis for the requested LPRM calibration interval extension. The evaluation contains a detailed summary of relevant uncertainties used in the CPS safety limit minimum critical power ratio calculation, and a recapitulation of the information contained in Section 3.2 of Reference 11. The supplement also contains a GNF-authored evaluation of the original submittal provided to the NRC by the licensee, and a technical position by GNF, concluding, "operation with the LPRM calibration interval up to 2000 EFPH at CPS, is justified using safety evaluations as stated by the USNRC in the SER of [Reference 11]."

In light of the fact that GNF is the entity responsible for Reference 11, the NRC staff reviewed the Reference 11 licensing topical report (LTR) and its attached documentation, including the NRC staff's RAI submitted during the review. The NRC staff re-evaluated Section 3.2 of the

LTR, and the associated review documentation, to determine whether the NRC staff had previously evaluated the statistical evaluation presented in Section 3.2 for its generic applicability at a 2000 MWD/T LPRM calibration interval for any BWR.

In its re-evaluation, to confirm GNF's statement regarding the NRC's approval, and the applicability of Reference 11 for the requested purpose, the staff sought to determine whether:

(1) Sufficient review activity, as evidenced by RAI, was shown in the LTR's supporting documentation to show that the staff evaluated the generic

applicability of the 2000 EFPH extent of the statistical evaluation.

(2) The evaluation presented in Section 3.2 of Reference 11 was based on a broad enough sample of data to warrant its generic applicability at a 2000 MWD/T LPRM calibration interval.

(3) In the nine year history of the LTR's approval, whether there was a precedent showing a plant-specific application of the LTR in this fashion.

It should be noted that the NRC staff discusses the statistical evaluation performed in Reference 11 in terms of effective full-power hour (EFPH), because the studies presented are based on these exposure intervals. The NRC staff discusses the LPRM surveillance interval in MWD/T, because the calibration interval in the TS is based on burnup. In the case of CPS, the licensee has demonstrated, based on the mass of fuel in each core, that the unit conversion is conservative. At CPS, a 2500 MWD/T burnup corresponds to 2118 EFPH of operation (Reference 4). This conversion is a direct proportionality-based on core loading, and it is clear that evaluations corresponding to calibration interval of 2000 EFPH apply for an interval that is greater than 2000 MWD/T.

The NRC staff found that there were no RAIs or responses docketed during the review of Reference 11 concerning the nature of the statistical evaluation discussed in Section 3.2 of Reference 11. Furthermore, the evaluation summarizes data collected by studying an operating BWR/4 with 8x8 fuel stating:

> …the uncertainty in bundle power due to the LPRM update **[[**
>
> **]]**

From this information, the staff concludes that the uncertainty parameter in use is permissible for plants operating with a 1000 MWD/T LPRM calibration interval based on the limiting nature of LPRM update uncertainty evaluated while operating **[[ ]].** This conclusion is supported by the fact that GNF's confirmatory study with different fuel, while showing a high degree of consistency with the reference case, illustrates that the use of a different fuel system has resulted in standard deviations in excess of the parameter used in the SLMCPR evaluation.

Furthermore, the NRC staff finds that the extent of the data presented in the evaluation, which spans **[[ ]]** and **[[ ]]**, is not comprehensive enough to warrant its generic justification of an LPRM calibration interval extension to 2000 MWD/T.

The NRC staff finds that, based on the referenced uncertainty evaluation, there is reasonable assurance that the LPRM update uncertainty associated with a 1000 MWD/T LPRM calibration interval is less than the value presented in Reference 11. However, the staff does not find that the evaluation contained in Reference 11 was reviewed with sufficient rigor to confirm that the case presented in Reference 11 is generically applicable for any plant seeking an LPRM calibration interval increase to 2000 MWD/T. In consideration of the staff's view in this regard, there is not reasonable assurance that the LPRM update uncertainty evaluated in Reference 11 would be applicable in light of the operating strategy, core design, and hardware system in use at CPS for an LPRM calibration interval of 2000 MWD/T.

3.3.4 Operating Practice at CPS

In Reference 4, the licensee identified several operational practices at CPS that are different from the assumptions set forth in the statistical evaluation presented in Reference 11. These differences include:

1. CPS routinely completes LPRM calibrations with zero missing TIP strings, in contrast to the amount assumed missing in Reference 11.

2. The evaluation in Reference 11 assumed a certain number of failed LPRMs, and an associated uncertainty component. This component would be less at CPS, because the plant routinely operates with significantly fewer failed LPRMs.

3. TIP signal nodal uncertainty is experimentally evaluated at CPS once per cycle and demonstrated to be significantly less than the uncertainty limit.

4. Typical operating practice at CPS is conservative relative to core loading and control rod pattern asymmetries assumed in the total nodal power distribution uncertainty.

5. Operating practice at CPS provides for avoiding the use of the 25 percent extension on surveillance intervals allowed by the TSs.

6. The LPRM update uncertainty increase assumes decreasing detector sensitivity with increasing core neutron exposure, which could be conservative based on the actual operational behavior of the detector.

The NRC staff evaluated each of these differences between the assumptions in Reference 11 and actual operation at CPS. Items 1-5 are operating practices that the licensee could change at any time without NRC regulatory involvement. These operating practices could change, for instance, upon the introduction of lead test assemblies into the core at CPS. Furthermore, sufficient information was not provided in the RAI response for the NRC staff to verify these practices and statements. Therefore, the NRC staff cannot base safety conclusions on these arguments. Regarding Item 6, it is not clear to the NRC staff what effect these differences would have on the total nodal power uncertainty at CPS. To evaluate these differences, specific data and quantifiable uncertainty differences would be required.

The NRC staff has considered the statistical analysis in Reference 11, which was referenced by the licensee, and the differences between operating practice at CPS and the assumptions in Reference 11. The NRC staff finds that the analysis demonstrates an appropriately conservative method considering the existing operational practices and flexibilities. Therefore, the NRC staff finds that the statistical evaluations do not form an adequate basis to increase the LPRM calibration interval as requested.

3.3.5 Precedential Approvals

The licensee stated that the NRC has previously approved similar amendment requests at James A. Fitzpatrick Nuclear Power Plant (Reference 12), Vermont Yankee Nuclear Power Station (Reference 13), and River Bend Station Unit 1 (Reference 14). These amendments were approved in 1999, 2000, and 2003. The NRC staff noted that the James A. Fitzpatrick Nuclear Power Plant approval was based on a plant-specific evaluation performed by General Electric. The River Bend Station and Vermont-Yankee Nuclear Power Station provided detailed and robust statistical analyses in support of their amendment requests as opposed to the largely qualitative justification provided in this request. The NRC staff, therefore, finds that the referenced precedents are dissimilar to, and do not support, the approach used in this license amendment request.

3.3.6 Increased Bundle Power Distribution Uncertainty

In light of the inapplicability of the uncertainty evaluation presented in Reference 11 as a technical basis for the requested calibration interval extension, the licensee provided supplemental information by letter dated May 16, 2008 (Reference 5). The letter contains, as an attachment, an evaluation of the effects that doubling the LPRM update uncertainty **[[** **]]** has on the SLMCPR. The evaluation concludes that the effect results in an SLMCPR increase less than 0.001. This is below the NRC staff's threshold of significance for the SLMCPR, and hence, it is unlikely that the SLMCPR would change.

The NRC technical staff finds that an implementation condition should require the use of the doubled LPRM update uncertainty for CPS SLMCPR calculations. This condition will provide reasonable assurance that the LPRM update uncertainty bounds the extended calibration interval.

The supplement also contained an evaluation by GNF, concluding that the **[[** **]]** uncertainty used in the SLMCPR analysis described by NEDC-32694P-A. This behavior is demonstrated by a plot of **[[** **]]** This behavior confirms that doubling the LPRM update uncertainty over the value used for a 1000 MWD/T calibration interval is a conservative approach, even in consideration of the 25-percent allowable increase on TS surveillance intervals.

The NRC staff reviewed the original LPRM update uncertainty evaluation presented in Section 3.2 of Reference 11. The uncertainty parameter was determined by comparing power distribution predictions running in the "LPRM Adaptive" monitoring mode for 2000 EFPH, and comparing to TIP system readings. The NRC staff agrees that this study demonstrates, albeit in a bounding sense, the power distribution uncertainty associated specifically with LPRM detector sensitivity decay.

Although the NRC staff views the study presented in Section 3.2 of Reference 11 as a bounding study, the NRC staff agrees, as discussed above, that doubling the observed LPRM update

uncertainty limit is a conservative approach to establish the effects of using a bounding LPRM update uncertainty for the SLMCPR analysis for a 2000 MWD/T calibration interval at CPS. The licensee commits to use this doubled uncertainty parameter for SLMCPR evaluations during those operating cycles that employ a 2000 MWD/T LPRM calibration interval, which provides reasonable assurance that the power distribution uncertainty accounts for the increased calibration interval.

This conclusion is also supported by the demonstrated LPRM detector sensitivity decay behavior shown in Reference 5.

3.3.7 Acceptable LHGR and MAPLHGR Uncertainties

As addressed in Section 2 of this SE, the requested LPRM calibration interval increase can also adversely affect the 3D-MONICORE system's surveillance of linear heat generation rate limits. In Reference 5, GNF stated that the licensee was well within its allowance for power distribution uncertainties for the LPRM calibration interval requested. The staff agrees with GNF's, and the licensee's position in this regard; the technical basis is contained in Appendices A and B of Reference 11.

Specifically, Appendix B to Reference 11 presents the results of **[[**

]] GNF stated in Reference 5 that the power distribution uncertainty allowance for thermal-mechanical analysis is **[[**
]] for LHGR.

The staff independently evaluated the effect the selection of a bounding LPRM update uncertainty would have on the uncertainty, and concluded that increasing the LPRM update uncertainty in a fashion similar to that employed by GNF in the SLMCPR evaluation would not violate the **[[** **]]** allowance used in the thermal-mechanical analyses.

With regard to the LHGR uncertainties, therefore, the NRC staff finds that the requested calibration interval will provide for acceptable core monitoring performance. The NRC staff's finding is based on the fact that the power distribution uncertainty allowance for the LHGR is greater than the actual value, which, as GNF stated, includes the LPRM update uncertainty. Because a greater margin exists on the LHGR bundle power distribution uncertainty than on the SLMCPR power distribution uncertainty, the NRC staff does not require such explicit confirmation of the applicability of the LHGR bundle power distribution uncertainty.

3.4 Technical Evaluation Conclusion

On the basis of the above evaluation, the NRC staff finds that the licensee's request to amend the TSs at CPS to extend the LPRM calibration interval from 1000 MWD/T to 2000 MWD/T is acceptable.

The NRC staff is reasonably assured that the increase in power distribution uncertainty resulting from the calibration interval extension would be bounded by the doubled value assumed in the licensee's SLMCPR calculation, and by the allowance for power distribution uncertainty in the LHGR thermal-mechanical evaluations. As such, the NRC staff finds reasonable assurance that the requested modification to TS Surveillance Requirement 3.3.1.1.8 would meet the requirements of 10 CFR 50.36. The NRC staff concludes further that the proposed calibration interval extension will not adversely affect the performance of the APRM, OPRM or rod-block monitor systems, for which the LPRMs provide input. Therefore, the NRC staff finds that there is reasonable assurance that there will be adequate protection of public health and safety and the environment if the requested amendment is implemented.

The NRC technical staff's conclusions are based on the licensee's commitment to use a doubled LPRM update uncertainty in its SLMCPR calculations using current NRC-approved, GNF methods (Reference 6). The extended calibration interval will require further justification when using different core monitoring hardware and software, and analytical methods.

4.0 REGULATORY COMMITMENT

The licensee provided the following regulatory commitments to its application in the June 27, 2008, letter to the NRC, supporting the request for a license amendment:

AmerGen Energy Company (the licensee) will double the LPRM update uncertainty that is specified in NEDC-32694P-A, "Power Limit MCPR Evaluations," when calculating the Safety Limit Minimum Critical Power Ratio (SLMCPR) for future operating cycles using an LPRM calibration interval of 2000 MWD/T beginning with Cycle 13. This commitment type is not a one-time action.

The original LPRM update uncertainty value can continue to be utilized for future cycles during which the LPRM calibration surveillance interval is maintained at 1000 MWD/T.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Illinois State official was notified of the proposed issuance of the amendment. The State official had no comments.

6.0 ENVIRONMENTAL CONSIDERATION

The amendment changes requirements with respect to installation or use of a facility's components located within the restricted area as defined in 10 CFR Part 20 changes a surveillance requirement. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (72 FR 28718; May 22, 2007). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

8.0 REFERENCES

1. AmerGen Energy Company, letter to US Nuclear Regulatory Commission, "Request for a License Amendment to Revise Local Power Range Monitor Calibration Frequency," December 12, 2006. ADAMS Accession No. ML063470222.

2. Sands, S., US Nuclear Regulatory Commission, letter to Crane, C., AmerGen Energy Company, "Clinton Power Station, Unit No. 1 – Request for Additional Information Related to Revision of Local Power Range Monitor Calibration Frequency," September 20, 2007. ADAMS Accession No. ML072360435.

3. Sands, S., US Nuclear Regulatory Commission, letter to Pardee, C., Exelon Generation Company, "Clinton Power Station, Unit No. 1 – Request for Additional Information Related to License Amendment Request to Revise Local Power Range Monitor Calibration Frequency," February 28, 2008. ADAMS Accession No. ML080520391.

4. Benyak, D., AmerGen Energy Company, letter to US Nuclear Regulatory Commission, "Additional Information Supporting the Request for a License Amendment to Revise Local Power Range Monitor Calibration Frequency," November 16, 2007. ADAMS Accession No. ML073200979.

5. Benyak, D., AmerGen Energy Company, letter to US Nuclear Regulatory Commission, "Additional Information Supporting the Request for a License Amendment to Revise Local Power Range Monitor Calibration Frequency," May 16, 2008. ADAMS Accession No. ML081400237.

6. Benyak, D., AmerGen Energy Company, letter to US Nuclear Regulatory Commission, "Additional Information Supporting the Request for a License Amendment to Revise Local Power Range Monitor Calibration Frequency," June 27, 2008. ADAMS Accession No. ML081820432.

7. U.S. Code of Federal Regulations, "Domestic Licensing of Production and Utilization Facilities," Part 50, Chapter I, Title 10, "Energy."

8. Jabbour, K., US Nuclear Regulatory Commission, letter to Crane, C., AmerGen Energy Company, "Clinton Power Station, Unit 1 – Issuance of Amendment for Addition of Oscillation Power Range Monitor," January 26, 2006. ADAMS Accession No. ML060120224.

9. Boiling-Water Reactor Owners Group, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications," NEDO-32465-A, August, 1996.

10. General Electric Company, "General Electric BWR Thermal Analysis Basis (GETAB) Data, Correlation, and Design Application," NEDO-10958-P-A, January 1977.

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