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10 CFR 50.90

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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket No. 50-461

Subject: Request for Amendment to Appendix A, Technical Specifications for the Oscillation Power Range Monitor Instrumentation

References:

(1) Letter from Keith R. Jury (AmerGen Energy Company, LLC) to U. S. NRC, "Request for License Amendment for Core Flow Operating Range Expansion and Oscillation Power Range Monitor (OPRM) Instrumentation," dated May 1, 2003

(2) Letter from U. S. NRC to J. V. Parrish (Energy Northwest), "Columbia Generating Station – Issuance of Amendment RE: Oscillation Power Range Monitoring Technical Specifications," dated April 5, 2001

(3) Letter from U. S. NRC to J. K. Wood (FirstEnergy Nuclear Operating Company), "Perry Nuclear Power Plant, Unit 1 – Issuance of Amendment RE: Activation of Thermal-Hydraulic Stability Monitoring Instrumentation," dated April 5, 2001

(4) Letter from Keith R. Jury (Exelon Generation Company, LLC) to U. S. NRC, "Schedule for Completing Actions to Implement Long-Term Stability Solution," dated December 19, 2003

(5) Letter from Patrick R. Simpson (Exelon Generation Company, LLC) to U. S. NRC, "Withdrawal of Request for License Amendment for Core Flow Operating Range Expansion and Oscillation Power Range Monitor (OPRM) Instrumentation," dated January 20, 2005

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," AmerGen Energy Company, LLC (AmerGen), requests a change to the Technical Specifications (TS), Appendix A, of Facility Operating License No. NPF-62 for Clinton Power Station (CPS), Unit 1.

The proposed changes incorporate into the TS the Oscillation Power Range Monitor (OPRM) instrumentation that will be declared operable within 30 days after completion of the February 2006 refueling outage. The proposed changes add Section 3.3.1.3, "Oscillation Power Range Monitor (OPRM) Instrumentation," and revise Sections 3.4.1, "Recirculation Loops Operating," and 5.6.5, "Core Operating Limits Report (COLR)," to insert a new TS section for the OPRM instrumentation, delete the current thermal hydraulic instability administrative requirements, and add the appropriate references for the OPRM trip setpoints and methodology. CPS will activate the automatic reactor protection system (i.e., scram) outputs of the OPRM instrumentation upon implementation of these proposed TS changes.

In Reference 1, AmerGen submitted an amendment request to adopt a maximum extended load line limit analysis "plus" (MELLLA+) and a "Detect and Suppress Solution – Confirmation Density (DSS-CD)" approach to automatically detect and suppress neutronic and thermal-hydraulic instabilities (THI). Since the analysis supporting the MELLLA+ amendment request requires the use of the DSS-CD approach, CPS had committed to implementing the DSS-CD solution as part of the implementation of the MELLLA+ amendment request. In the interim, CPS continued to operate with the OPRM instrumentation installed and providing alarms but with the trip function disabled. This allowed for evaluation of the performance of the OPRM algorithms without risk of spurious scrams.

Reference 4 provided the Exelon Generation Company, LLC and AmerGen schedules for completing the actions to implement a long-term stability solution. No separate schedule for the implementation of the OPRM system was provided for CPS in Reference 4 since the MELLLA+ amendment request identified the requested approval date for MELLLA+ and DSS-CD. However, resolution of generic issues associated with NRC review of the MELLLA+ Licensing Topical Reports resulted in a significant delay in the review and approval of the CPS MELLLA+ amendment request. Since review and approval of the CPS MELLLA+ and OPRM TS changes would not be completed in time to support the next refueling outage scheduled for February 2006, AmerGen revised the schedule for implementation of the MELLLA+. AmerGen formally withdrew the MELLLA+ amendment request in Reference 5 and revised the CPS plans to implement the DSS-CD approach when activating and arming the OPRM system. As a result, AmerGen is proposing these changes to support activating and arming the OPRM system using the Option III algorithm during startup from the February 2006 refueling outage. Once the NRC review of the MELLLA+ and DSS-CD Licensing Topical Reports is complete, AmerGen will resubmit the amendment request to adopt MELLLA+ and DSS-CD in support of implementation during the January 2008 refueling outage.

The proposed changes are similar to those approved by the NRC for the Columbia Generating Station and the Perry Nuclear Power Plant, Unit 1, in References 2 and 3, respectively.

The attached information supporting the proposed changes is subdivided as follows.

1 Attachment 1 gives a description and safety analysis of the proposed changes.
2. Attachment 2 includes the marked-up TS pages with the proposed changes indicated.
3. Attachment 3 provides re-typed versions of the TS pages with the proposed changes included.
4. Attachment 4 includes the marked-up TS Bases pages. The TS Bases pages are provided for information only.
5. Attachment 5 summarizes formal licensee commitments pending NRC approval of the proposed amendment

AmerGen has concluded that the proposed changes present no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), "Issuance of amendment," paragraph (c).

AmerGen requests approval of the proposed changes by January 31, 2006 in order to support preparation for the next refueling outage scheduled for February 2006. Once approved, the changes will be implemented within 30 days following startup from the February 2006 refueling outage.

The proposed changes have been reviewed by the CPS Plant Operations Review Committee and approved by the Nuclear Safety Review Board in accordance with the requirements of the Quality Assurance Program.

AmerGen is notifying the State of Illinois of this application for amendment by transmitting a copy of this letter and its attachments to the designated State Official.

Should you have any questions related to this information, please contact Mr. Timothy A. Byam at (630) 657-2804.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 1st day of April 2005.

Respectfully,

Keith R. Jury

Keith R. Jury
Director - Licensing and Regulatory Affairs
AmerGen Energy Company, LLC

Attachments:
1. Evaluation of Proposed Changes
2. Marked-up Technical Specifications Pages for Proposed Changes
3. Revised Technical Specifications Pages for Proposed Changes
4. Marked-up Technical Specifications Bases Pages for Proposed Changes
5. Commitments

ATTACHMENT 1
Evaluation of Proposed Changes

Subject: Request for Amendment to Appendix A, Technical Specifications for the Oscillation Power Range Monitor Instrumentation

1.0 DESCRIPTION

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," AmerGen Energy Company, LLC (AmerGen), requests a change to the Technical Specifications (TS), Appendix A, of Facility Operating License No. NPF-62 for Clinton Power Station (CPS), Unit 1.

The proposed changes incorporate into the TS the Oscillation Power Range Monitor (OPRM) instrumentation that will be declared operable (i.e., activate the automatic reactor protection system scram outputs of the OPRM instrumentation) within 30 days after completion of the February 2006 refueling outage. Operation for this period without the OPRM instrumentation being operable will permit sufficient time to verify the OPRM instrumentation operates properly, confirm OPRM system setpoints are correct and ensure there are no spurious trips associated with the instrumentation. The proposed changes add Section 3.3.1.3, "Oscillation Power Range Monitor (OPRM) Instrumentation," and revise Sections 3.4.1, "Recirculation Loops Operating," and 5.6.5, "Core Operating Limits Report (COLR)," to insert a new TS section for the OPRM instrumentation, delete the current thermal hydraulic instability administrative requirements, and add the appropriate references for the OPRM trip setpoints and methodology.

AmerGen requests approval of the proposed changes by January 31, 2006 in order to support preparation for the next refueling outage scheduled for February 2006. Once approved, the changes will be implemented within 30 days following startup from the February 2006 refueling outage.

2.0 PROPOSED CHANGES

As described in Section 1.0, following NRC approval of the proposed TS changes, CPS will activate the reactor scram outputs of the OPRM instrumentation. The proposed changes incorporate the following TS changes.

2.1. TS Section 3.3.1.3, "Oscillation Power Range Monitor (OPRM) Instrumentation"

This change adds a TS section that requires the OPRM instrumentation to be operable.

- The required minimum number of operable OPRM channels will be four channels. The OPRM instrumentation will be required to be operable when reactor power is greater than or equal to 21.6% Rated Thermal Power (RTP).
- A note is placed in the Actions section that states, "Separate Condition entry is allowed for each channel."
- Limiting Condition for Operation (LCO) Condition A and associated Required Actions and Completion Times require that, with one or more required channels inoperable, the inoperable channels or the associated trip system

be placed in trip or that an alternate method to detect and suppress thermal hydraulic instability oscillations be implemented within 30 days.

- LCO Condition B and associated Required Actions and Completion Times require that, with OPRM trip capability not maintained, initiate an alternate method of detecting and suppressing thermal hydraulic instability oscillations within 12 hours and restore OPRM trip capability within 120 days.

- LCO Condition C applies if the Required Action and associated Completion Time are not met. The Required Action allows 4 hours to reduce reactor power to less than 21.6% RTP.

The proposed Surveillance Requirements (SRs) are as follows.

- SR 3.3.1.3.1 The OPRM instrumentation will have a channel functional test performed with a frequency of every 184 days.

- SR 3.3.1.3.2 The OPRM instrumentation will have a channel calibration performed every 24 months. A clarifying statement is added to note that the setpoints for the trip function shall be as specified in the COLR. Neutron detectors are excluded from the channel calibration via a note.

- SR 3.3.1.3.3 The OPRM instrumentation will have a logic system functional test performed every 24 months.

- SR 3.3.1.3.4 This SR verifies that the OPRM system is not bypassed when thermal power greater than or equal to 25% RTP and recirculation drive flow less than or equal to the value corresponding to 60% of rated core flow. The required frequency is every 24 months.

- SR 3.3.1.3.5 The reactor protection system response time will be verified within limits every 24 months on a staggered test basis. Neutron detectors are excluded from the response time testing via a note.

A note is placed before the SRs that states, "When a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed for up to 6 hours provided the OPRM maintains trip capability."

The proposed addition of TS Section 3.3.1.3 is consistent with the NRC-approved proposed changes for the Asea Brown Boveri (ABB) Combustion Engineering OPRM system installation as described in Reference 1, with the following exceptions. The basis for these exceptions is discussed in Section 4.0 below.

- The TS changes approved in Reference 1 include an SR that requires calibration of the local power range monitors (LPRMs) every 1000 megawatt days per ton (MWD/T). The proposed changes in this amendment request do not include this requirement, since it is similar to another SR (i.e., SR 3.3.1.1.8) currently in CPS TS.

- A clarifying statement has been added to SR 3.3.1.3.2 to state that the setpoints for the trip function shall be as specified in the COLR.
- The description of the enabled region in SR 3.3.1.3.4 is clarified to more accurately describe this region for CPS.

2.2 TS Section 3.4.1, "Recirculation Loops Operating"

Due to the automatic functions provided by the OPRM instrumentation, the manual operator actions specified in TS Section 3.4.1 (and its associated Conditions, Required Actions, and SRs), which were required to be taken upon entry into a specified thermal power/core flow region of the power-to-flow map, will be removed. The removal of these references include elimination of LCO items 3.4.1.A.2, and B.2, removal of Conditions and associated Required Actions B, C, D, G.1 and G.2, as well as deletion of SR 3.4.1.2 and Figure 3.4.1-1. In addition, the note preceding the LCO applicability will be deleted.

A new proposed Condition C will address the condition where the requirements for single loop operation are not met. The associated Required Action will require satisfying the requirements of the LCO within 24 hours. The new proposed Condition D addresses the condition where the Required Actions and associated completion times for Conditions A, B, or C are not met or where no recirculation loops are in operation. The Required Action associated with this condition is to be in Mode 3 in 12 hours.

2.3 Section 5.6.5, "Core Operating Limits Report (COLR)"

Section 5.6.5.a will have a requirement added to include the setpoints for the OPRM trip function in the COLR.

Section 5.6.5.b will have a reference added to describe the NRC-approved methodology for determining the setpoints for the OPRM trip function. This reference is NEDO-32465-A, "BWR Owners' Group Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology and Reload Applications," August 1996 (Reference 2).

New TS Bases pages have been added in support of the new proposed TS section 3.3.1.3. In addition, the TS Bases will be revised to reflect the proposed changes to the CPS TS 3.4.1.

3.0 BACKGROUND

The NRC issued Generic Letter (GL) 94-02, "Long-Term Solutions and Upgrade of Interim Operating Recommendations for Thermal Hydraulic Instabilities in Boiling Water Reactors," which required licensees to develop and submit to the NRC a plan for long-term stability corrective actions. In response to GL 94-02, in Reference 3, Illinois Power Company (CPS licensee at the time) committed to implement the long-term solution designated as Option III in NEDO-31960-A (including Supplement 1), "BWR Owners' Group Long-Term Stability Solutions Licensing Methodology," (Reference 4) by installing the ABB Combustion Engineering Option III OPRM system. GL 94-02 also discussed the use of interim corrective actions (ICAs) to provide operator controlled actions to avoid regions of potential instability and insert a manual reactor scram if oscillations are detected.

The ABB system utilizes the OPRM detect-and-suppress function to implement Option III. The system monitors LPRM signals for indications of neutron flux oscillations. The OPRM also monitors indicated power and indicated recirculation flow to automatically enable the OPRM trip when in a predefined region of the power-to-flow map. The OPRM initiates a trip whenever it detects an instability condition when in the predefined region of the power-to-flow map.

Following restart from the refueling outage in which the OPRM instrumentation was installed (i.e., Spring 1999), the OPRM trip functions were not activated in order to allow evaluation of the performance of the OPRM algorithms without the risk of spurious scrams. During this evaluation period, ABB Combustion Engineering notified the NRC of a design defect in the OPRM system in accordance with 10 CFR 21, "Reporting of defects and noncompliances," as documented in Reference 5. As a result, the scheduled date for placing the reactor scram capability associated with the system into service was deferred in order to make the necessary modifications to the CPS OPRM system. Once these modifications were made, functional testing resumed. During this second evaluation period, in 2001, General Electric (GE) Company initiated a report in accordance with 10 CFR 21 (Reference 13) concerning stability reload licensing calculations that support the development of setpoints for the OPRM trip function. The OPRM trip functions were not armed pending resolution of this reported condition. The reported condition has now been resolved as described in Reference 6. While awaiting resolution of the 10 CFR 21 issues, AmerGen has continued to operate CPS with the OPRM instrumentation monitoring the reactor core for thermal hydraulic instability oscillations using the Option III methodology. During this time, the OPRM trip functions have not been activated, however, AmerGen has continued to implement the ICAs to detect and suppress power oscillations.

4.0 TECHNICAL ANALYSIS

4.1 Technical Basis for Proposed Addition of TS Section 3.3.1.3

The OPRM instrumentation system consists of four OPRM instrumentation trip channels, one per Reactor Protection System (RPS) channel. Each trip channel consists of two OPRM instrumentation modules, either of which can initiate the trip signal for that channel. Each OPRM instrumentation module receives input from 16 or 17 LPRMs. Each OPRM instrumentation module also receives input from the other OPRM instrumentation module in the trip channel, as well as from RPS average power range monitor (APRM) power and flow signals to automatically enable the trip function of the OPRM instrumentation module.

The OPRM system uses three separate algorithms for detecting thermal hydraulic instability related oscillations: the period based detection algorithm (PBDA), the amplitude based algorithm, and the growth rate algorithm. The OPRM system hardware implements these algorithms in microprocessor-based modules. These modules execute the algorithms based on LPRM inputs and generate alarms and trips based on these calculations. These trips result in tripping the RPS when the appropriate trip logic is satisfied. As discussed in Reference 2, only the PBDA is used in the safety analysis. The remaining algorithms provide defense in depth and additional protection against unanticipated oscillations.

The Boiling Water Reactor Owners' Group (BWROG) Stability Long-Term Solution Option III methodology for establishing the OPRM PBDA trip setpoints is described in the NRC approved topical report NEDO-32465-A (Reference 2). For plant/cycle-specific application, the methodology described in Reference 2 remains unchanged, with the exception that a plant/cycle-specific delta critical power ratio/initial critical power ratio vs. oscillation magnitude (DIVOM) curve slope is used in place of the generic DIVOM curve slope. The acceptability of utilizing a plant/cycle-specific DIVOM curve is documented in Reference 6.

The methodology for developing the DIVOM curve is described in Section 4.4 of Reference 2. For plant/cycle-specific application, the methodology for developing the DIVOM curve is described in Section 4.4 of Reference 2 except that plant and cycle-specific parameters (e.g., core power and flow, core loading, cycle energy, fuel types, etc.) are utilized in place of the generic fleet parameters. The values of other OPRM system parameters, such as the PBDA period confirmation setpoints in Table 3-1 of Reference 2, remain within their original acceptable range. The current values of these setpoints have been established based on recent industry operational experience of the Option III OPRM system. The PBDA setpoints in Table 3-2 of Reference 2 remain unchanged. As described in Section 4.4.4 of Reference 2, TRACG analyses will be performed to determine the relationship between the hot bundle oscillation magnitude and the change in critical power ratio (CPR), i.e., the DIVOM correlation. These analyses will utilize plant and cycle-specific inputs/parameters as described above.

The OPRM PBDA trip setpoints will be determined by applying the plant/cycle-specific DIVOM to the process for initial applications described in Section 5 of Reference 2. In this process, the final minimum critical power ratio (FMCPR) is calculated from the initial minimum critical power ratio (IMCPR) based on the following equation:

$$FMCPR = IMCPR - IMCPR * \left\{ \frac{\Delta CPR}{IMCPR} \right\}$$

The FMCPR is then compared to the safety limit MCPR (SLMCPR). If the FMCPR is greater than the SLMCPR, the OPRM PBDA trip setpoints are acceptable.

For future cycles, a reload review process consistent with that described in Section 6 of NEDO-32465-A will be utilized. An evaluation of the applicability of the previous cycle DIVOM curve to the upcoming cycle will be performed. If required, a new DIVOM curve will be calculated. Once the appropriate DIVOM curve is established, the same process for determining the OPRM PBDA trip setpoints, as described above, is applied.

The PBDA detects an instability related oscillation based on the occurrence of a fixed number of consecutive LPRM signal period confirmations concurrent with the LPRM signal amplitude exceeding a specified peak to average setpoint. Upon detection of an instability related oscillation, a trip is generated in the module associated with that OPRM instrumentation channel.

Each OPRM instrumentation module is continuously tested by a self-test function. On detection of an OPRM instrumentation module self-test failure, either a "Trouble" or "INOP" alarm is activated. The "Trouble" alarm indicates that a condition is present that reduces the robustness of the system but does not cause the OPRM channel to fail to meet its functional requirements. The OPRM instrumentation module provides an "INOP" alarm when the self-test feature indicates that the OPRM instrumentation module may not be capable of meeting its functional requirements. No trip is generated as a result of a self-test failure. When one OPRM instrumentation module is inoperable, the remaining redundant OPRM instrumentation module in the associated OPRM trip channel maintains the operability of the trip channel; thus, there is no loss of trip function and no TS actions are required. If both OPRM instrumentation modules in an OPRM channel are inoperable, the associated OPRM instrumentation channel is inoperable, and the proposed TS actions are entered, consistent with the approved TS in Reference 1.

Proposed TS LCO 3.3.1.3, Action A.3 allows for the option of initiating an alternate method to detect and suppress thermal hydraulic instability oscillations in the event one or more required channels are inoperable. TS LCO 3.3.1.3, Action B.1 requires that an alternate method for detecting and suppressing thermal hydraulic instability oscillations be initiated in the event the OPRM trip capability is not maintained. The alternate method to detect and suppress thermal hydraulic instability (THI) will be based on the same actions currently in effect at CPS relative to THI monitoring and avoidance. These actions are based on the ICAs for instability prevention recommended by the BWROG and committed to in the Illinois Power Company (now AmerGen) response to NRC Generic Letter 94-02 (Reference 3).

The alternate method maintains the same guidance on how and when to monitor for THI, and contains detailed power-to-flow operating maps that depict regions of high power and low flow to enable manual operator actions for preventing plant operation in areas where the potential for THI is increased. As described in CPS Procedure 3005.01, "Unit Power Changes," there are three regions (i.e., Restricted Zone, Exit Region, and Controlled Entry Region) identified on the power-to-flow map to address the potential for THI by requiring specific actions be taken by the operator if operation should result in the plant being in one of these regions. Operation in the Restricted Zone requires the operator to immediately scram the reactor regardless if core oscillations due to THI are present or not. The Operator is directed to not enter this zone and that time spent near the Restricted Zone should be minimized. Deliberate entry into the Exit Region is not permitted. If entry into this region does occur, the operator will promptly exit the region by core flow, rods or use of a Cram Array. Entry into the Controlled Entry Region is only permitted as part of a planned power change. Inadvertent or forced entry into this region requires prompt exit by core flow or reverse rod sequence. These actions are currently proceduralized; they have been and will continue to be included as part of training for licensed operators. This alternate methodology will be entered in response to inoperability of one or more OPRM channels or inoperability of the OPRM trip system. This methodology will remain in use until the OPRM trip function can be returned to an operable status.

The detailed TS requirements for the OPRM system, including the LCO, Applicability, Conditions, Required Actions, and Completion Times, are consistent with the proposed TS provided in Reference 10 and approved by the NRC in Reference 1, with the exceptions described in Section 2.0. The basis for these exceptions follows.

- The TS changes approved in Reference 1 include an SR that requires calibration of the LPRMs every 1000 MWD/T. This value is bracketed in the proposed TS in Reference 10, indicating that plant-specific information should be substituted. CPS TS, in SR 3.3.1.1.8, currently require this calibration and specify a frequency of 1000 MWD/T average core exposure. The TS Bases state that the 1000 MWD/T frequency is based on operating experience with LPRM sensitivity changes. Thus, current SR 3.3.1.1.8 meets the intent of the SR for LPRM calibration approved in Reference 1, and is not required to be duplicated in proposed TS Section 3.3.1.3. The TS Bases for TS Sections 3.3.1.3 and 3.3.1.1 will be revised to reflect that the LPRM calibration is required to demonstrate OPRM operability.

- Proposed SR 3.3.1.3.2 states that the OPRM instrumentation will have a channel calibration every 24 months. This frequency is consistent with the fuel cycle length. A statement is added to note that the setpoints for the trip function shall be as specified in the COLR. This statement clarifies that the setpoints for the trip function are to be stated in the COLR and provides consistency with the statement added to TS Section 5.6.5.a, which requires that the COLR contain the setpoints for SR 3.3.1.3.2.

- SR 3.3.1.3.4 verifies that the OPRM system is not bypassed with reactor power greater than or equal to 25% RTP and recirculation drive flow less than or equal to the value corresponding to 60% of rated core flow. These values define the region in which the OPRM system is enabled, and are not protective limits. The 60% of rated core flow value is consistent with the information available to the operator and the value discussed in Reference 2, Section 2.2, "Licensing Compliance." The 25% RTP value is the plant-specific value for the 30% RTP value, which is bracketed in the proposed TS in Reference 10. In Reference 7, AmerGen requested changes to CPS TS to implement a 20% power uprate. Reference 7, Attachment E, Section 2.4, "Stability," addressed the power uprate changes to both the reactor stability ICAs and OPRM Option III. In order to preserve the same level of protection against the occurrence of a thermal-hydraulic instability, the instability exclusion region boundaries were unchanged with respect to absolute power level. Reactor core flow did not change with power uprate, so the flow portion of the enabled region remains 60% of rated core flow. In order to maintain the same level of protection, the 30% RTP value was reduced by the ratio of 2894 MWt/3473 MWt, which reduces the power portion of the enabled region to 25% RTP. The CPS power uprate amendments were approved and issued in Reference 8.

There are no allowable values in the proposed TS associated with the OPRM trip function. The OPRM PBDA upscale trip setpoints (i.e., the number of confirmation counts and the peak to average signal amplitude required to actuate a trip signal) are determined based on the Option III licensing methodology developed by the BWROG and described in Reference 2, which is approved by the NRC. These are treated as nominal setpoints and do not require additional allowances for uncertainty. A note has been added to SR 3.3.1.3.2 to state that the setpoints for the trip function shall be as specified in the COLR.

There are also TS related setpoints for the auto-enable (not-bypassed) region, which are established as described in the TS Bases markup, and defined in SR 3.3.1.3.4. These are also treated as nominal setpoints, based on the conservatism in the establishment of the enable region, as discussed in Reference 9.

The PBDA algorithm includes several adjustable internal parameters that are not setpoints. These were initially established as part of the modification process and have been adjusted based upon both plant and industry operating experience. Since these various parameters are not considered to be setpoints, they are not specifically listed within the TS.

Finally, there are also setpoints for the "defense-in-depth" algorithms. These are also treated as nominal setpoints based on qualitative studies performed by the

BWROG and documented in Appendix A of Reference 2. These algorithms are not credited in the safety analysis.

In Reference 1, the NRC accepted the use of the ABB OPRM system for licensees to the extent specified and under the limitations delineated in the associated NRC safety evaluation. In Reference 1, the NRC requested licensees to address the following plant-specific questions when referencing the report (Reference 10) in license applications.

<u>Question 1</u>
"Confirm the applicability of CENPD-400-P, including clarifications and reconciled differences between the specific plant design and the topical report design descriptions."

<u>Response</u>
The OPRM instrumentation design at CPS includes alarm, trip, and inoperable/trouble annunciators and is consistent with the approved topical report design.

<u>Question 2</u>
"Confirm the applicability of BWROG topical reports that address the OPRM and associated instability functions, setpoints and margin."

<u>Response</u>
Reports NEDO-32465-A and NEDO-31960-A were reviewed and determined to be applicable to CPS. In the safety evaluation for NEDO-31960-A and Supplement 1 (Reference 4), the NRC found that Options III and III-A were acceptable long-term solutions for implementation in any type of BWR, subject to five conditions. Each of these five conditions has been reviewed and the following confirmations of the applicability of NEDO-31960-A and Supplement 1 to the proposed implementation of the Option III solution at CPS are provided.

2.a "All three algorithms described in NEDO-31960 and Supplement 1 should be used in Option III or III-A. These three algorithms are high LPRM oscillation amplitude, high-low detection algorithm, and period-based algorithm. "

<u>Response</u>
All three algorithms are included in the ABB design. Automatic protection is actuated if any of the three algorithms meet their trip conditions. Only the PBDA, however, is used to demonstrate protection of the MCPR safety limit for anticipated reactor instabilities. The other two algorithms are included as defense-in-depth features. Only the PBDA is required for TS operability of the OPRM instrumentation.

2.b "The validity of the scram setpoints selected should be demonstrated by analyses. These analyses may be performed for a generic representative plant when applicable, but should include an uncertainty treatment that accounts for the number of failed sensors permitted by the Technical Specifications of the plant's applicant."

Response
The applicability of the scram setpoints will be demonstrated by cycle-specific analysis using the methodology described in Reference 2. The PBDA is based upon explicit analysis methodology (Reference 2) that is applied to demonstrate a basis for concluding that the algorithm can be credited in the licensing basis for meeting the requirements of 10 CFR 50, Appendix A, General Design Criterion (GDC) 10, "Reactor design," and GDC 12, "Suppression of reactor power oscillations." The setpoints are selected to assure that a trip will occur for a reactor instability event.

Analysis of sensor failure in the OPRM system is addressed in Reference 2. The analysis of Reference 2 demonstrated that, for establishing the setpoint, it was more conservative to assume all LPRMs were operable because the sensitivity of the OPRM system increases as the number of LPRM failures increase. Due to the large number of LPRMs and OPRM cells, OPRM system operability is expected to be maintained under all conditions that satisfy operability of a sufficient number of LPRM channels to maintain APRM system operability.

2.c "Implementation of Option III or III-A will require that the selected bypass region outside of which the detect and suppress action is deactivated be defined in the Technical Specifications. "

Response
This region is included in proposed SR 3.3.1.3.4. The bases for the values defining this region are provided above in the discussion related to SR 3.3.1.3.4.

2.d "If the algorithms detect oscillations, an automatic protective action should be initiated. This action may be a full scram or an SRI. If an SRI is implemented with Option III or III-A, a backup full scram must take effect if the oscillations do not disappear in a reasonable period of time or if they reappear before control rod positions and operating conditions have been adjusted in accordance with appropriate procedural requirements to permit reset of the SRI protective action. "

Response
The automatic protective action of the OPRM systems at CPS will be a full reactor scram. An automatic select rod insert (SRI) is not available at CPS.

2.e "The LPRM groupings defined in NEDO-31960 to provide input to the Option III or III-A algorithms are acceptable for the intended oscillation detection function. These LPRM groupings are the oscillation power range monitor for Option III or the octant-based arrangements for Option III-A. The requirements for a minimum operable number of LPRM detectors set forth in NEDO-31960 are acceptable."

Response

The LPRM assignment grouping proposed to be implemented conforms with LPRM assignments shown in Appendix D to Reference 2. In their SE on Reference 2, the NRC concluded that the initial application methodology proposed in Section 5 of the topical report is acceptable. The LPRM assignments in Appendix D of Reference 2 are identified as examples of the expected LPRM assignments a licensee may choose. Therefore, it is concluded that since the LPRM assignment chosen for CPS is consistent with these examples, which were found to be acceptable by the NRC, the proposed CPS assignments are also acceptable. As described in Reference 4, current TS requirements for the operability of LPRMs (as amplified in the TS Bases) are sufficient to ensure an adequate number of operable LPRMs to provide input to the OPRM system.

Question 3

"Provide a plant-specific Technical Specification (TS) for the OPRM functions consistent with CENPD-400-P, Appendix A."

Response

The plant specific TS are provided in Attachment 2 and are consistent with Reference 10, Appendix A, except as described in this attachment.

Question 4

"Confirm that the plant-specific environmental (temperature, humidity, radiation, electromagnetic and seismic) conditions are enveloped by the OPRM equipment environmental qualification values."

Response

The OPRM system and components are mounted in main control room cabinets at CPS, which are located in a controlled environment. This environment is maintained during normal and accident plant conditions. The OPRM components installed are those subject to the ABB environmental qualification program. The OPRM components and the dual voltage regulator are qualified to perform their Class 1E safety function. For ease of reference, the plant-specific environmental conditions at the OPRM installation location for temperature, humidity, and radiation are compared to the OPRM qualification values in the following table. As shown in the table, the generic OPRM qualification values envelope the CPS temperature and radiation environmental conditions. However, the CPS main control room may experience humidity values below the OPRM qualified range. This is discussed in Section 4.b below.

Environmental Condition	**CPS Environmental Conditions**	**OPRM Generic Qualification (continuous operation)**
Temperature	65°F to 104°F	40°F to 120°F
Humidity	5% to 60% relative humidity (RH) normal	10% to 95% RH
Radiation	1000 RAD total integrated dose (TID)	< 10,000 RAD TID

The following sections discuss the plant-specific temperature, humidity, radiation, electromagnetic and seismic environmental conditions pertaining to the OPRM at CPS.

4.a Temperature/Heat Loading

The temperature qualification of the OPRM module was performed by test. The OPRM module is designed to operate continuously in a normal ambient temperature range of 40°F to 120°F. The system is designed to operate continuously in an abnormal ambient temperature environment of 140°F for 48 hours. The CPS control room temperature range is 65°F to 104°F, which is bounded by the design temperature range of the OPRM. The nominal temperature range for the CPS control room is between 71°F and 75°F.

The control room heat load has not increased significantly as a result of this modification.

4.b Humidity

The humidity qualification of the OPRM module was performed by test. The OPRM is designed to operate continuously in a humidity environment range of 10% to 95% RH, non-condensing.

The low end of the generic OPRM qualified humidity range is 10% RH. The nominal relative humidity range for the CPS control room is between 35% and 55% RH. However, depending on outside air conditions, the relative humidity may be as low as 5% RH on a temporary basis during winter months.

The concern at low humidity conditions is the chance for damage from electrostatic discharge. The OPRM equipment has been tested for electrostatic discharge, as described in Section 4.d below. Further, the potential for electrostatic discharge is minimized, since the modules are located inside panels in metal enclosures, and are not subject to incidental contact by operations or maintenance personnel. Finally, the OPRM equipment has been installed and operating satisfactorily in the main control room environments at CPS for several years. Thus, the OPRM equipment should continue to operate properly if relative humidity is temporarily below 10% RH.

4.c Radiation

The OPRM module is designed to operate and meet its performance requirements after a total integrated Co-60 gamma dose of less than 10,000 RAD. The plant specific total integrated dose condition at the OPRM installation location of less than 1000 RAD is less than the tested configuration. Therefore, the OPRM is acceptable for use at CPS.

4.d Electromagnetic Interference (EMI)

EMI testing of the OPRM equipment was performed by ABB to ensure it would not be adversely affected by the plant EMI environment (susceptibility), and to ensure the OPRM modules would not be detrimental to the existing plant EMI environment (emissions). As noted in Reference 10, the testing was conducted to MIL-STD-461C, "Guide for Instrumentation and Control Equipment Grounding in Generating Stations," and MIL-STD-462, "Measurement of Electromagnetic Interference Characteristics," for the following tests.

- CE01, 03 Conducted Emissions
- CE07 Conducted Switching Spikes
- RE02 Radiated Emissions (14 kHz to 1 GHz)
- CS01, 02 Conducted Susceptibility AC Power Leads
- CS06 Conducted Susceptibility Spike
- RS02, 03 Radiated Susceptibility

Design features for EMI considerations include a metal enclosure around the OPRM equipment, filtered input wires, and the use of ground planes on circuit boards. Post-maintenance testing of the system at CPS has energized all portions of the OPRM circuits and has not resulted in any adverse affects on other systems.

In addition, ABB designed and tested the OPRM system to meet the electrostatic discharge requirements of IEC 801-2, "Electromagnetic Compatibility for Industrial-Process Measurement and Control Equipment," Level 4 (8 kilovolt) under laboratory reference conditions in accordance with IEC 801-2 Section 8.0.

Also, ABB demonstrated fast transient (burst) withstand capability for all power input and output and all process input and output circuits, signal common and protective earth connections based on IEC 801-4, Level 4 (4 kV on power and grounds, 2 kV on process signals) as described in IEC 801-4 Sections 7.3.1 and 7.3.2.

4.e Seismic

As noted in Reference 10, the OPRM system is seismically qualified by type testing in accordance with IEEE-344-1975, "Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations." The OPRM system was subjected to a minimum of five operating basis earthquakes in each axis followed by at least one safe shutdown earthquake in each axis. Verification has been completed to document that the CPS control room response spectra are bounded by the test seismic response spectra in Reference 10.

Question 5
"Confirm that administrative controls are provided for manually bypassing OPRM channels or protective functions, and for controlling access to the OPRM functions."

Response
The OPRM has two modes of operation – operate and test. In the operate mode, the system performs normal trip and alarm functions. The test mode is used for test, calibration, setpoint adjustment, and downloading of event data. In the test mode, the OPRM's reactor trip output is bypassed and the OPRM module is considered inoperable. If both OPRM modules in a channel are in test, then the trip channel is inoperable. Entry into the test mode is controlled by a keylock switch and is annunciated in the control room. In addition, each OPRM module has an OPRM Manual Bypass input. Activating this input overrides the software trip output. A loss of power or removal of the OPRM module will still provide a channel trip signal. The input is normally open circuited and if bypass is desired, a jumper can be placed at the Digital Isolation Block.

Administrative procedures will be provided for manually bypassing OPRM instrumentation channels or protective functions, and for controlling access to the OPRM functions.

Question 6
"Confirm that any changes to the plant operator's main control room panel have received human factors reviews per plant-specific procedures."

Response
The CPS OPRM installation and implementation includes activation of the main control room annunciator if the OPRM has been manually bypassed or deliberately rendered inoperable. Keylock access is necessary to manually

bypass an OPRM module. Changes to OPRM software require both keylock access and a password. Procedural requirements will control placing an OPRM module in bypass and verifying restoration.

The CPS OPRM installation and implementation includes an operator interface via main control room annunciators that signal system status and/or problems, and the OPRM front panel LEDs. Alarms provided on the main control room annunciator panel include the OPRM ENABLED, OPRM OSCILLATION DETECTED, and OPRM TROUBLE/INOP. The OPRM trip function is included in the DIVISION 1 OR 4 NMS TRIP and the DIVISION 2 OR 3 NMS TRIP main control room annunciators. In addition, the OPRM modules are provided with local indicators that include the ALARM, TROUBLE, INOP, TRIP, TRIP ENABLED, and READY LEDs.

The changes made to the main control room panels for the OPRM system at CPS were reviewed to ensure human factors considerations were part of the design. The modification was found not to violate human factors commitments as described in the Updated Safety Analysis Report (USAR), and that it incorporates adequate human factors principles consistent with the CPS human factors standards for controls and annunciators.

In the NRC safety evaluation contained in Reference 4, the NRC stated that, "...the recirculation drive flow channel should comply with the requirements of Electrical and Electronics Engineers, Standard 279 ...." As part of the OPRM installation, the existing recirculation drive flow units (i.e., a flow converter unit and a flow arithmetic unit per channel) were verified to comply with the requirements of IEEE Standard 279.

Further, in the NRC safety evaluation contained in Reference 4, the NRC requested that the plant-specific submittal discuss the isolation devices between the OPRM system and the associated protection system. The OPRM system outputs at CPS are isolated with Class 1E qualified relays in accordance with IEEE-384.

4.2 Technical Basis for Proposed Changes to TS Section 3.4.1

Due to the automatic functions provided by the OPRM instrumentation, the manual operator actions specified in TS Section 3.4.1 (and its associated Conditions, Actions, and Surveillance Requirements), that were required to be taken upon entry into a specified thermal power/core flow region of the core map, are removed. In addition, the incorporation of the OPRM instrumentation into the TS will allow the deletion of the power versus flow TS figure and associated references.

The current LCO is modified by a Note that allows up to 12 hours before having to put in effect the required modifications to required limits and setpoints after a change in the reactor operating conditions from two loops operating to single recirculation loop operation. In lieu of this Note, AmerGen is proposing to add

Condition C with associated Action C.1 to the LCO. If the single loop requirements of LCO B.2 and B.3 are not met, the requirements of the LCO must be satisfied within 24 hours. The 24-hour Completion Time of the Condition provides time before the required modifications to required limits and setpoints have to be in effect after a change in the reactor operating conditions from two recirculation loops operating to single recirculation loop operation. This time is provided due to the need to stabilize operation with one recirculation loop, including the procedural steps necessary to limit flow and adjust the flow control mode in the operating loop, and complexity and detail required to fully implement and confirm the required limit and setpoint modifications. The 24 hour Completion Time is also based on the low probability of an accident occurring during this period, on reasonable time to complete the Required Action, and on frequent monitoring by operators allowing abrupt changes in core flow conditions to be quickly detected. Because this Condition addresses the necessary delay in establishing the required limit and setpoint modifications for single recirculation loop operation the current LCO Note is not required and is therefore being deleted.

The OPRM instrumentation will provide at least the same level of assurance that the MCPR safety limit will not be violated for anticipated oscillations as that provided by the current stability requirements in the CPS TS.

4.3 Technical Basis for Proposed Changes to TS Section 5.6.5

The addition of the requirement to include the setpoints for the OPRM trip function in the COLR follows the approach outlined in Reference 10 as approved in Reference 1 and is consistent with the industry standard TS, which provide for placement of similar cycle-specific reactor core thermal limits in the COLR.

The addition of the reference to the approved methodology for determining the trip function setpoints also follows the approach outlined in Reference 10 as approved in Reference 1 and is also consistent with the industry standard TS, which provide for placement of the NRC-approved methodologies for calculating core thermal limits in TS Section 5.6.5.

5.0 REGULATORY ANALYSIS

5.1 No Significant Hazards Consideration

AmerGen Energy Company, LLC (AmerGen), proposes changes to the Technical Specifications (TS) for Clinton Power Station (CPS), Unit 1. The proposed changes incorporate into the TS the Oscillation Power Range Monitor (OPRM) instrumentation and delete the currently required manual methods for avoiding instabilities and for detecting and suppressing potential instabilities. The OPRM system monitors neutron flux signals for signs of neutron flux oscillations and initiates a reactor scram whenever it detects an instability condition when in the predefined region of the power-to-flow map. Following NRC approval of the proposed TS changes, CPS will activate the reactor scram outputs of the OPRM instrumentation.

AmerGen has evaluated whether or not a significant hazards consideration is involved with the proposed amendments by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below.

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

The proposed changes specify limiting conditions for operation, required actions and surveillance requirements for the OPRM system, and allows operation in regions of the power to flow map currently restricted by the requirements of the Interim Corrective Actions (ICAs) and certain limiting conditions of operation of TS Section 3.4.1, "Recirculation Loops Operating." The restrictions of the ICAs and TS Section 3.4.1 were imposed to ensure adequate capability to detect and suppress conditions consistent with the onset of thermal-hydraulic oscillations that may develop into a thermal-hydraulic instability event. A thermal-hydraulic instability event has the potential to challenge the Minimum Critical Power Ratio (MCPR) safety limit. The OPRM system can automatically detect and suppress conditions necessary for thermal-hydraulic instability. With the activation of the OPRM system, the restrictions of the ICAs and TS Section 3.4.1 will no longer be required.

This proposed change has no impact on any of the existing neutron monitoring functions. When the OPRM is operable with operating limits as specified in the Core Operating Limits Report (COLR), the OPRM can automatically detect the imminent onset of local power oscillations and generate a trip signal. Actuation of a Reactor Protection System (RPS) trip (i.e., scram) will suppress conditions necessary for thermal-hydraulic instability and decrease the probability of a thermal-hydraulic instability event. In the event the trip capability of the OPRM is not maintained, the proposed changes limit the period of time before an alternate method to detect and suppress thermal-hydraulic oscillations is required. CPS intends to utilize the ICAs as the alternative method for ensuring thermal-hydraulic oscillations do not occur. Since the duration of this period of time is limited, the increase in the probability of a thermal-hydraulic instability event is not significant.

Activation of the OPRM scram function will replace the current methods that require operators to insert an immediate manual reactor scram in certain reactor operating regions where thermal hydraulic instabilities could potentially occur. While these regions will continue to be avoided during normal operation, certain transients, such as a reduction in reactor recirculation flow, could place the reactor in these regions. During these transient conditions, with the OPRM instrumentation scram function activated; an immediate manual scram will no longer be required. This may potentially cause a marginal increase in the probability of occurrence of an instability event. This potential increase in probability is acceptable because the OPRM function will automatically detect the instability condition and initiate a reactor scram before the Minimum Critical Power Ratio (MCPR) Safety Limit is reached. Consequences of the potential instability event are reduced because of the more reliable automatic detection and suppression of an instability event, and the elimination of dependence on the manual operator actions. Operators monitor for indications of thermal hydraulic instability when the reactor is operating in regions of potential instability as a backup to the OPRM instrumentation.

Therefore, the proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No.

The proposed changes replace procedural actions that were established to avoid operating conditions where reactor instabilities might occur with an NRC approved automatic detect and suppress function (i.e., OPRM).

Potential failures in the OPRM trip function could result in either failure to take the required mitigating action or an unintended reactor scram. These are the same potential effects of failure of the operator to take the correct appropriate action under the current procedural actions. The effects of failure of the OPRM equipment are limited to reduced or failed mitigation, but such failure cannot cause an instability event or other type of accident.

The OPRM system uses input signals shared with the Average Power Range Monitor (APRM) system and rod block functions to monitor core conditions and generate a Reactor Protection System (RPS) trip when required. Quality requirements for software design, testing, implementation and module self-testing of the OPRM system provide assurance that no new equipment malfunctions due to software errors are created. The design of the OPRM system also ensures that neither operation nor malfunction of the OPRM system will adversely impact the operation of the other systems and no accident or equipment malfunction of these other systems could cause the OPRM system to malfunction or cause a different kind of accident. No new failure modes of either the new OPRM equipment or of the existing APRM equipment have been introduced.

Operation in regions currently restricted by the ICAs and TS Section 3.4.1 is within the nominal operating domain and ranges of plant systems and components for which postulated equipment and accidents have been evaluated. Therefore, operation within these regions does not create the possibility of a new or different kind of accident from any previously evaluated.

These proposed changes which specify limiting conditions for operations, required actions and surveillance requirements of the OPRM system and allow operation in certain regions of the power-to-flow map do not create the possibility of a new or different kind of accident from any accident previously evaluated.

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

Response: No.

The OPRM system monitors small groups of Local Power Range Monitor (LPRM) signals for indication of local variations of core power consistent with thermal-hydraulic oscillations and generates an RPS trip when conditions consistent with the onset of oscillations are detected. An unmitigated thermal-hydraulic instability event has the potential to result in a challenge to the MCPR safety limit. The OPRM system provides the capability to automatically detect and suppress conditions that might result in a thermal-hydraulic instability event and thereby maintains the margin of safety by providing automatic protection for the MCPR safety limit while reducing the burden on the control room operators significantly. The OPRM trip provides a trip output of the same type as currently used for the APRM. Its failure modes and types are similar to those for the present APRM output. Since the MCPR Safety Limit will not be exceeded as a result of an instability event following implementation of the OPRM trip function, it is concluded that the proposed change does not reduce the margin of safety.

Operation in regions currently restricted by the requirements of the ICAs and TS Section 3.4.1 is within the nominal operating domain assumed for identifying the range of initial conditions considered in the analysis of anticipated operational occurrences and postulated accidents. Therefore, operation in these regions does not involve a significant reduction in the margin of safety.

The proposed changes, which specify limiting conditions for operations, required actions and surveillance requirements of the OPRM system and allows operation in certain regions of the power to flow map, do not involve a significant reduction in a margin of safety.

Conclusion

Based on the above, AmerGen concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92, paragraph (c), and accordingly, a finding of no significant hazards consideration is justified.

5.2 Applicable Regulatory Requirements/Criteria

10 CFR 50, Appendix A, General Design Criterion (GDC) 10, "Reactor design," requires the reactor core and associated coolant, control, and protection systems to be designed with appropriate margin to assure that acceptable fuel design

limits are not exceeded during any condition of normal operation, including the affects of anticipated operational occurrences. Additionally, GDC 12, "Suppression of reactor power oscillations," requires the reactor core and associated coolant, control, and protection systems to be designed to assure that power oscillations which can result in conditions exceeding acceptable fuel design limits are either not possible or can be reliably and readily detected and suppressed. The OPRM Instrumentation System will provide the protection required in GDC 10 by reliably detecting and suppressing any such oscillations before acceptable fuel design limits (i.e., MCPR safety limit) are exceeded, as required in GDC 12.

The OPRM system is also considered to be a protection system. As a protection system, GDC 20, "Protection system functions," applies. GDC 20 requires the protection system to be designed (1) to initiate automatically the operation of appropriate systems including the reactivity control systems, to assure that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences, and (2) to sense accident conditions and to initiate the operation of systems and components important to safety. The OPRM system is designed to provide this protection under any condition of normal operation, including the effects of moderate frequency events, events expected to occur at least once in 20 years of reactor operation. GDC 20 is met by demonstrating that design basis thermal hydraulic instabilities do not result in a MCPR less than the safety limit.

The NRC issued GL 94-02, "Long-Term Solutions and Upgrade of Interim Operating Recommendations for Thermal-Hydraulic Instabilities in Boiling Water Reactors," which requested licensees to develop and submit to the NRC a plan for long-term stability corrective actions. The OPRM provides the long-term stability corrective actions requested in GL 94-02.

10 CFR 50.36, "Technical specifications," requires that a TS LCO be established for any structure, system or component that is part of the primary success path and which functions to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier. The OPRM instrumentation is part of the primary success path in providing protection from exceeding the MCPR safety limit for thermal hydraulic stability-related oscillations.

Additionally, the proposed changes are similar to those approved by the NRC for the Columbia Generating Station and the Perry Nuclear Power Plant, Unit 1, in References 11 and 12, respectively.

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

6.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, “Standards for Protection Against Radiation,” or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, and (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22, “Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review,” Paragraph (c)(9). Therefore, in accordance with 10 CFR 51.22(b), no environmental impact statement, or environmental assessment need be prepared in connection with the proposed amendment.

7.0 REFERENCES

1. Letter from U. S. NRC to R. A. Pinelli (BWR Owners' Group), “Acceptance of Licensing Topical Report CENPD-400-P, 'Generic Topical Report for the ABB Option III Oscillation Power Range Monitor,'“ dated August 16, 1995

2. NEDO-32465-A, “BWR Owners' Group Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology and Reload Applications,” August 1996

3. Letter from J. G. Cook (Illinois Power Company) to U. S. NRC, “Illinois Power’s (IP’s) Response to Generic Letter (GL) 94-02, ‘Long-Term Solutions and Upgrade of Interim Operating Recommendations for Thermal-Hydraulic Instabilities in Boiling Water Reactors’,” dated September 2, 1994

4. Letter from U. S. NRC to L. A. England (BWR Owners' Group), “Acceptance for Referencing NEDO-31960 and NEDO-31960 Supplement 1, 'BWR Owners’ Group Long-Term Stability Solutions Licensing Methodology,'“ dated July 12, 1993

5. Letter from I. Rickard (ABB) to U. S. NRC, “Report of a Defect Pursuant to 10 CFR 21 Concerning ABB Oscillation Power Range Monitors for BWRs,” dated June 29, 1999

6. Letter from K. S. Putnam (Boiling Water Reactor Owners' Group) to U. S. NRC, “Resolution of Reportable Condition for Stability Reload Licensing

Calculations Using Generic Regional Mode DIVOM Curve," dated September 30, 2003

7. Letter from J. M. Heffley (AmerGen Energy Company) to U. S. NRC, "Request for License Amendment for Extended Power Uprate Operation," dated June 18, 2001

8. Letter from U. S. NRC to O. D. Kingsley (Exelon Generation Company, LLC), "Clinton Power Station, Unit 1 – Issuance of Amendment (TAC NO. MB2 0)," dated April 5, 2002

9. Letter from K. P. Donovan (BWR Owners' Group) to U. S. NRC, "Guidelines for Stability Option III 'Enabled Region,'" dated September 17, 1996

10. CENPD-400-P-A, Rev. 1, "Generic Topical Report for the ABB Option III Oscillation Power Range Monitor (OPRM)," dated May 1995

11. Letter from U. S. NRC to J. V. Parrish (Energy Northwest), "Columbia Generating Station – Issuance of Amendment RE: Oscillation Power Range Monitoring Technical Specifications," dated April 5, 2001

12. Letter from U. S. NRC to J. K. Wood (FirstEnergy Nuclear Operating Company), "Perry Nuclear Power Plant, Unit 1 – Issuance of Amendment RE: Activation of Thermal-Hydraulic Stability Monitoring Instrumentation," dated April 5, 2001

13. GE letter MFN 01-046 from Jason S. Post, "Stability Reload Licensing Calculations Using Generic DIVOM Curves," dated August 31, 2001

Attachment 2

Marked-up Technical Specifications Pages for Proposed Changes

<u>Pages</u>
3.3-14a (new page)
3.3-14b (new page)
3.4-1
3.4-2
3.4-3
3.4-4
3.4-5
5.0-18
5.0-19

3.3 INSTRUMENTATION

3.3.1.3 Oscillation Power Range Monitor (OPRM) Instrumentation

LCO 3.3.1.3 Four channels of the OPRM instrumentation shall be OPERABLE.

APPLICABILITY: THERMAL POWER ≥ 21.6% RTP.

ACTIONS

---------------------------NOTE---------------------------
Separate Condition entry is allowed for each channel.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more required channels inoperable.	A.1	Place channel in trip.	30 days
	<u>OR</u>		
	A.2	Place associated RPS trip system in trip.	30 days
	<u>OR</u>		
	A.3	Initiate alternate method to detect and suppress thermal hydraulic instability oscillations.	30 days
B. OPRM trip capability not maintained.	B.1	Initiate alternate method to detect and suppress thermal hydraulic instability oscillations	12 hours
	<u>AND</u>		
	B.2	Restore OPRM trip capability.	120 days
C. Required Action and associated Completion Time not met.	C.1	Reduce THERMAL POWER < 21.6% RTP.	4 hours

SURVEILLANCE REQUIREMENTS

-------------------------------------NOTE-------------------------------------
When a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed for up to 6 hours provided the OPRM maintains trip capability.

SURVEILLANCE		FREQUENCY
SR 3.3.1.3.1	Perform CHANNEL FUNCTIONAL TEST.	184 days
SR 3.3.1.3.2	-------------------NOTE------------------- Neutron detectors are excluded. --- Perform CHANNEL CALIBRATION. The setpoints for the trip function shall be as specified in the COLR.	24 months
SR 3.3.1.3.3	Perform LOGIC SYSTEM FUNCTIONAL TEST.	24 months
SR 3.3.1.3.4	Verify OPRM is not bypassed when THERMAL POWER is ≥ 25% RTP and recirculation drive flow is ≤ the value corresponding to 60% of rated core flow.	24 months
SR 3.3.1.3.5	-------------------NOTE------------------- Neutron detectors are excluded. --- Verify the RPS RESPONSE TIME is within limits.	24 months on a STAGGERED TEST BASIS

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.1 Recirculation Loops Operating

LCO 3.4.1

A. Two recirculation loops shall be in operation with Matched flows;

~~1. Matched flows; and~~

~~2. Total core flow and THERMAL POWER within limits.~~

OR

B. One recirculation loop shall be in operation with:

1. THERMAL POWER ≤ 58% RTP;

~~2. Total core flow and THERMAL POWER within limits;~~

2 ~~3~~. Required limits modified for single recirculation loop operation as specified in the COLR; and

3 ~~4~~. LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation," Function 2.b (Average Power Range Monitors Flow Biased Simulated Thermal Power-High), Allowable Value of Table 3.3.1.1-1 reset for single loop operation.

~~NOTE~~
~~Required limit and setpoint modifications for single recirculation loop operation may be delayed for up to 12 hours after transition from two recirculation loop operation to single recirculation loop operation.~~

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Recirculation loop jet pump flow mismatch not within limits.	A.1 Shut down one recirculation loop.	2 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~B. Total core flow as a function of THERMAL POWER within Region A or B of Figure 3.4.1-1.~~	~~B.1 Determine Average Power Range Monitor (APRM) and Local Power Range Monitor (LPRM) neutron flux noise levels.~~	~~Once per 8 hours~~ ~~AND~~ ~~30 minutes after an increase of ≥ 5% RTP~~
~~C. Total core flow as a function of THERMAL POWER within Region B of Figure 3.4.1-1.~~ ~~AND~~ ~~APRM or LPRM neutron flux noise level > 3 times established baseline noise level.~~	~~C.1 Restore APRM and LPRM neutron flux noise level to ≤ 3 times established baseline levels.~~	~~2 hours~~
~~D. Total core flow as a function of THERMAL POWER within Region A of Figure 3.4.1-1.~~	~~D.1 Restore total core flow as a function of THERMAL POWER to within Region B or C of Figure 3.4.1-1.~~	~~4 hours~~
B ~~E~~. THERMAL POWER > 58% RTP during single recirculation loop operation.	~~E~~ B.1 Reduce THERMAL POWER to ≤ 58% RTP.	4 hours

(continued)

Requirements B.2 or B.3 of the LCO not met.

Satisfy the requirements of the LCO.

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C ~~F~~. ~~One or more required limit or setpoint modifications not performed.~~	C ~~F~~.1 ~~Declare associated limit(s) and setpoint(s) not met.~~	~~Immediately~~ 24 hours
D ~~G~~. No recirculation loops in operation.	~~G.1 Reduce THERMAL POWER to within Region C of Figure 3.4.1-1.~~	~~4 hours~~
	~~AND~~	
	~~G.2 Be in MODE 2.~~	~~6 hours~~
	~~AND~~	
	~~G.3~~ D.1 Be in MODE 3.	12 hours

Required Action and associated Completion time of Condition A, B, or C not met.
OR

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.1.1	--------------------NOTE-------------------- Not required to be performed until 24 hours after both recirculation loops are in operation. --	
	Verify recirculation loop jet pump flow mismatch with both recirculation loops in operation is: a. $\leq$ 10% of rated core flow when operatting at < 70% of rated core flow; and b. $\leq$ 5% of rated core flow when operating at $\geq$ 70% of rated core flow.	24 hours

~~(continued)~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.4.1.2 Verify: a. Total core flow ≥ 45% rated core flow; or b. THERMAL POWER and total core flow within Region C of Figure 3.4.1-1.	24 hours

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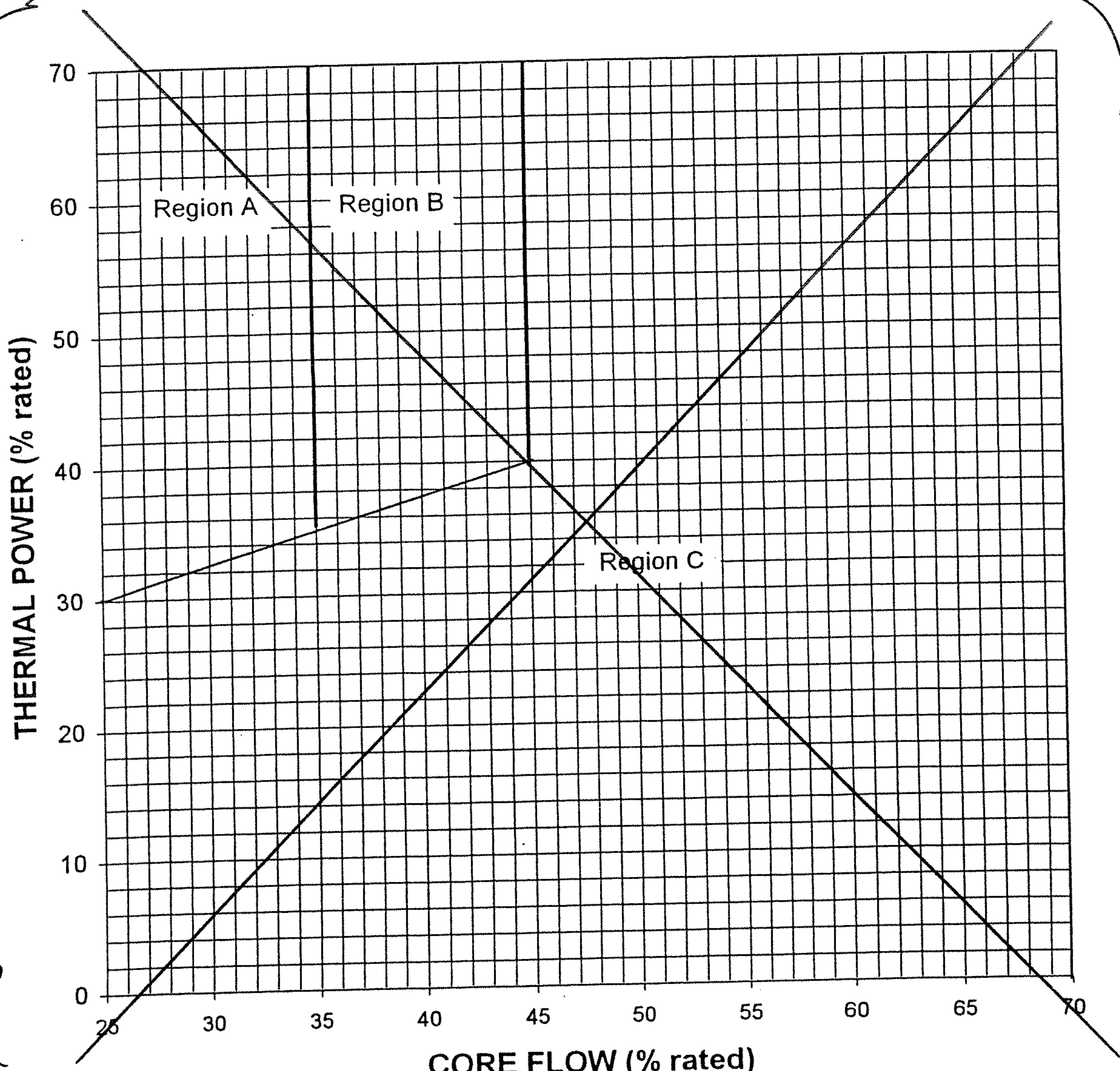

~~Figure 3.4.1-1 (page 1 of 1)~~
~~Thermal Power/Core Flow Stability Regions~~

5.6 Reporting Requirements

5.6.2 Annual Radiological Environmental Operating Report (continued)

report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted in a supplementary report as soon as possible.

5.6.3 Radioactive Effluent Release Report

The Radioactive Effluent Release Report covering the operation of the unit during the previous calendar year shall be submitted by May 1 of each year. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit. The material provided shall be consistent with the objectives outlined in the ODCM and process control program and in conformance with 10 CFR 50.36a and 10 CFR 50, Appendix I, Section IV.B.1.

5.6.4 Monthly Operating Reports

Routine reports of operating statistics and shutdown experience, including documentation of all challenges to the main steam safety/relief valves, shall be submitted on a monthly basis no later than the 15th of each month following the calendar month covered by the report.

5.6.5 CORE OPERATING LIMITS REPORT (COLR)

a. Core operating limits shall be established prior to each reload cycle, or prior to any remaining portion of a reload cycle, and shall be documented in the COLR for the following:

1. LCO 3.2.1, Average Planar Linear Heat Generation Rate (APLHGR),
2. LCO 3.2.2, Minimum Critical Power Ratio (MCPR),
3. LCO 3.2.3, Linear Heat Generation Rate (LHGR), ~~and~~
4. LCO 3.3.1.1, RPS Instrumentation (SR 3.3.1.1.14), and
5. LCO 3.3.1.3, Oscillation Power Range Monitor (OPRM) Instrumentation.

(continued)

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

b. The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC in (1) General Electric Standard Application for Reactor Fuel (GESTAR), NEDE-24011-P-A.

c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.

d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

or (2) NEDO-32465, "BWR Owners' Group Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology and Reload Applications."

Attachment 3

Revised Technical Specifications Pages for Proposed Changes

<u>Pages</u>
3.3-14a (new page)
3.3-14b (new page)
3.4-1
3.4-2
3.4-3
3.4-4
3.4-5
5.0-18
5.0-19

3.3 INSTRUMENTATION

3.3.1.3 Oscillation Power Range Monitor (OPRM) Instrumentation

LCO 3.3.1.3 Four channels of the OPRM instrumentation shall be OPERABLE.

APPLICABILITY: THERMAL POWER ≥ 21.6% RTP.

ACTIONS

----------------------------NOTE----------------------------
Separate Condition entry is allowed for each channel.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required channels inoperable.	A.1 Place channel in trip. OR A.2 Place associated RPS trip system in trip. OR A.3 Initiate alternate method to detect and suppress thermal hydraulic instability oscillations.	30 days 30 days 30 days
B. OPRM trip capability not maintained.	B.1 Initiate alternate method to detect and suppress thermal hydraulic instability oscillations AND B.2 Restore OPRM trip capability.	12 hours 120 days
C. Required Action and associated Completion Time not met.	C.1 Reduce THERMAL POWER < 21.6% RTP.	4 hours

SURVEILLANCE REQUIREMENTS

------------------------------------NOTE----------------------------
When a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed for up to 6 hours provided the OPRM maintains trip capability.

SURVEILLANCE		FREQUENCY
SR 3.3.1.3.1	Perform CHANNEL FUNCTIONAL TEST.	184 days
SR 3.3.1.3.2	-------------------NOTE-------------------- Neutron detectors are excluded. -- Perform CHANNEL CALIBRATION. The setpoints for the trip function shall be as specified in the COLR.	24 months
SR 3.3.1.3.3	Perform LOGIC SYSTEM FUNCTIONAL TEST.	24 months
SR 3.3.1.3.4	Verify OPRM is not bypassed when THERMAL POWER is ≥ 25% RTP and recirculation drive flow is ≤ the value corresponding to 60% of rated core flow.	24 months
SR 3.3.1.3.5	-------------------NOTE------------------- Neutron detectors are excluded. -- Verify the RPS RESPONSE TIME is within limits.	24 months on a STAGGERED TEST BASIS

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.1 Recirculation Loops Operating

LCO 3.4.1

A. Two recirculation loops shall be in operation with matched flows;

<u>OR</u>

B. One recirculation loop shall be in operation with:

1. THERMAL POWER ≤ 58% RTP;
2. Required limits modified for single recirculation loop operation as specified in the COLR; and
3. LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation," Function 2.b (Average Power Range Monitors Flow Biased Simulated Thermal Power-High), Allowable Value of Table 3.3.1.1-1 reset for single loop operation.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Recirculation loop jet pump flow mismatch not within limits.	A.1 Shut down one recirculation loop.	2 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. THERMAL POWER > 58% RTP during single recirculation loop operation.	B.1	Reduce THERMAL POWER to ≤ 58% RTP.	4 hours
C. Requirements B.2 or B.3 of the LCO not met.	C.1	Satisfy the requirements of the LCO.	24 hours
D. Required Action and associated completion time of Condition A, B, or C not met. <u>OR</u> No recirculation loops in operation.	D.1	Be in MODE 3.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.1.1	-------------------NOTE------------------- Not required to be performed until 24 hours after both recirculation loops are in operation. -- Verify recirculation loop jet pump flow mismatch with both recirculation loops in operation is: a. ≤ 10% of rated core flow when operat- ting at < 70% of rated core flow; and b. ≤ 5% of rated core flow when operating at ≥ 70% of rated core flow.	24 hours

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5.6 Reporting Requirements

5.6.2 Annual Radiological Environmental Operating Report (continued)

report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted in a supplementary report as soon as possible.

5.6.3 Radioactive Effluent Release Report

The Radioactive Effluent Release Report covering the operation of the unit during the previous calendar year shall be submitted by May 1 of each year. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit. The material provided shall be consistent with the objectives outlined in the ODCM and process control program and in conformance with 10 CFR 50.36a and 10 CFR 50, Appendix I, Section IV.B.1.

5.6.4 Monthly Operating Reports

Routine reports of operating statistics and shutdown experience, including documentation of all challenges to the main steam safety/relief valves, shall be submitted on a monthly basis no later than the 15th of each month following the calendar month covered by the report.

5.6.5 CORE OPERATING LIMITS REPORT (COLR)

a. Core operating limits shall be established prior to each reload cycle, or prior to any remaining portion of a reload cycle, and shall be documented in the COLR for the following:

1. LCO 3.2.1, Average Planar Linear Heat Generation Rate (APLHGR),

2. LCO 3.2.2, Minimum Critical Power Ratio (MCPR),

3. LCO 3.2.3, Linear Heat Generation Rate (LHGR),

4. LCO 3.3.1.1, RPS Instrumentation (SR 3.3.1.1.14),and

5. LCO 3.3.1.3, Oscillation Power Range Monitor (OPRM) Instrumentation.

(continued)

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

b. The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC in

   (1) General Electric Standard Application for Reactor Fuel (GESTAR), NEDE-24011-P-A; or

   (2) NEDO-32465, "BWR Owners' Group Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology and Reload Applications."

c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.

d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

Attachment 4

Marked-up Technical Specifications Bases Pages for Proposed Changes
(Provided for information only)

<u>Pages</u>

ii
B 3.3-26
B 3.3-39a (new page)
B 3.3-39b (new page)
B 3.3-39c (new page)
B 3.3-39d (new page)
B 3.3-39e (new page)
B 3.3-39f (new page)
B 3.3-39g (new page)
B 3.3-39h (new page)
B 3.3-39i (new page)
B 3.3-39j (new page)
B 3.3-39k (new page)
B 3.4-3
B 3.4-4
B 3.4-5
B 3.4-6
B 3.4-7
B 3.4-8

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.6 and SR 3.3.1.1.7 (continued)

block. Overlap between SRMs and IRMs similarly exists when, prior to withdrawing the SRMs from the fully inserted position, IRMs are above the downscale value of 5 and increasing as neutron flux increases, prior to the SRMs indication reaching their upscale limit.

As noted, SR 3.3.1.1.7 is only required to be met during entry into MODE 2 from MODE 1. That is, after the overlap requirement has been met and indication has transitioned to the IRMs, maintaining overlap is not required (APRMs may be reading downscale once in MODE 2).

If overlap for a group of channels is not demonstrated (e.g., IRM/APRM overlap), the reason for the failure of the Surveillance should be determined and the appropriate channel(s) declared inoperable. Only those appropriate channel(s) that are required in the current MODE or condition should be declared inoperable.

A Frequency of 7 days is reasonable based on engineering judgment and the reliability of the IRMs and APRMs.

SR 3.3.1.1.8

LPRM gain settings are determined from the local flux profiles measured by the Traversing Incore Probe (TIP) System. This establishes the relative local flux profile for appropriate representative input to the APRM System. The 1000 MWD/T Frequency is based on operating experience with LPRM sensitivity changes.

SR 3.3.1.1.8 also ensures the operability of the OPRM system (Specification 3.3.1.3).

SR 3.3.1.1.9 and SR 3.3.1.1.12

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the intended function. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable CHANNEL FUNCTIONAL TEST of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. The 92 day Frequency of SR 3.3.1.1.9 is based on the reliability analysis of Reference 9.

(continued)

B 3.3 INSTRUMENTATION

B 3.3.1.3 Oscillation Power Range Monitor (OPRM) Instrumentation

BASES

BACKGROUND

General Design Criterion 10 (GDC 10) requires the reactor core and associated coolant, control, and protection systems to be designed with appropriate margin to assure that acceptable fuel design limits are not exceeded during any condition of normal operation, including the affects of anticipated operational occurrences. Additionally, GDC 12 requires the reactor core and associated coolant, control, and protection systems to be designed to assure that power oscillations which can result in conditions exceeding acceptable fuel design limits are either not possible or can be reliably and readily detected and suppressed. The OPRM System provides compliance with GDC 10 and GDC 12, thereby providing protection from exceeding the fuel Minimum Critical Power Ratio (MCPR) safety limit.

References 1, 2, and 3 describe three separate algorithms for detecting stability related oscillations: the period based detection algorithm, the amplitude based algorithm, and the growth rate algorithm. The OPRM System hardware implements these algorithms in microprocessor based modules. These modules execute the algorithms based on Local Power Range Monitor (LPRM) inputs and generate alarms and trips based on these calculations. These trips result in tripping the Reactor Protection System (RPS) when the appropriate RPS trip logic is satisfied, as described in the Bases for LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation." Only the period based detection algorithm is used in the safety analysis (Ref. 1, 2, 6, and 7). The remaining algorithms provide defense in depth and additional protection against unanticipated oscillations.

The period based detection algorithm detects a stability related oscillation based on the occurrence of a fixed number of consecutive LPRM signal period confirmations coincident with the LPRM signal peak to average amplitude exceeding a specified setpoint.

(continued)

BASES

BACKGROUND (continued)	Upon detection of a stability related oscillation, a trip is generated for that OPRM channel. The OPRM System consists of 4 OPRM trip channels, each channel consisting of two OPRM modules. Each OPRM module receives input from LPRMs. Each OPRM module also receives input from the Neutron Monitoring System (NMS) Average Power Range Monitor (APRM) power and flow signals to automatically enable the trip function of the OPRM module. Each OPRM module is continuously tested by a self-test function. On detection of any OPRM module failure, either a Trouble alarm or INOP alarm is activated. The OPRM module provides an INOP alarm when the self-test feature indicates that the OPRM module may not be capable of meeting its functional requirements.
APPLICABLE SAFETY ANALYSES	It has been shown that BWR cores may exhibit thermal-hydraulic reactor instabilities in high power and low flow portions of the core power to flow operating domain (Reference 4). GDC 10 requires the reactor core and associated coolant, control, and protection systems to be designed with appropriate margin to assure that acceptable fuel design limits are not exceeded during any condition of normal operation, including the affects of anticipated operational occurrences. GDC 12 requires assurance that power oscillations which can result in conditions exceeding acceptable fuel design limits are either not possible or can be reliably and readily detected and suppressed. The OPRM System provides compliance with GDC 10 and GDC 12 by detecting the onset of oscillations and suppressing them by initiating a reactor scram. This assures that the MCPR safety limit will not be violated for anticipated oscillations. The OPRM Instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii). The OPERABILITY of the OPRM System is dependent on the OPERABILITY of the four individual instrumentation

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

channels with their setpoints within the specified nominal setpoint. Each channel must also respond within its assumed response time.

The nominal setpoints for the OPRM Period Based Trip Function are specified in the Core Operating Limits Report. The trip setpoints are treated as nominal setpoints and do not require additional allowances for uncertainty.

Trip setpoints are those predetermined values of output at which an action should take place. The setpoints are compared to the actual process parameter value and when the measured output value of the process parameter exceeds the setpoint, the associated device (e.g., trip unit) changes state.

The OPRM period based setpoint is determined by cycle specific analysis based on positive margin between the Safety Limit MCPR and the Operating Limit MCPR minus the change in CPR (ΔCPR). This methodology was approved for use by the NRC in Reference 6.

LCO

Four channels of the OPRM System are required to be OPERABLE to ensure that stability related oscillations are detected and suppressed prior to exceeding the MCPR safety limit. Only one of the two OPRM modules (with an active period based detection algorithm) is required for OPRM channel OPERABILITY. The minimum number of LPRMs required OPERABLE to maintain an OPRM channel OPERABLE is consistent with the minimum number of LPRMs required to maintain the APRM System OPERABLE per LCO 3.3.1.1.

(continued)

BASES

APPLICABILITY

The OPRM instrumentation is required to be OPERABLE in order to detect and suppress neutron flux oscillations in the event of thermal-hydraulic instability. As described in References 1, 2, 3, and 10, the region of anticipated oscillation is defined by THERMAL POWER ≥ 25% Rated Thermal Power (RTP) and recirculation drive flow is ≤ the value corresponding to 60% of rated core flow. The OPRM trip is required to be enabled in this region, and the OPRM must be capable of enabling the trip function as a result of anticipated transients that place the core in that power/flow condition. Therefore, the OPRM instrumentation is required to be OPERABLE with THERMAL POWER ≥ 21.6% RTP. It is not necessary for the OPRM instrumentation to be OPERABLE with THERMAL POWER < 21.6% RTP because the MCPR safety limit is not applicable below 21.6% RTP.

ACTIONS

A Note has been provided to modify the ACTIONS related to the OPRM instrumentation channels. Section 1.3, Completion Times, specifies that once a Condition has been entered, subsequent divisions, subsystems, components, or variables expressed in the Condition discovered to be inoperable or not within limits will not result in separate entry into the Condition. Section 1.3 also specifies that Required Actions of the Condition continue to apply for each additional failure, with Completion Times based on initial entry into the Condition. However, the Required Actions for inoperable OPRM instrumentation channels provide appropriate compensatory measures for separate inoperable channels. As such, a Note has been provided that allows separate Condition entry for each inoperable OPRM instrumentation channel.

A.1, A.2, and A.3

Because of the reliability and on-line self-testing of the OPRM instrumentation and the redundancy of the RPS design, an allowable out of service time of 30 days has been shown to be acceptable (Ref. 7) to permit

(continued)

BASES

ACTIONS (continued)

restoration of any inoperable channel to OPERABLE status. However, this out of service time is only acceptable provided the OPRM instrumentation still maintains OPRM trip capability (refer to Required Actions B.1 and B.2). The remaining OPERABLE OPRM channels continue to provide trip capability (see Condition B) and provide operator information relative to stability activity. The remaining OPRM modules have high reliability. With this high reliability, there is a low probability of a subsequent channel failure within the allowable out of service time. In addition, the OPRM modules continue to perform on-line self-testing and alert the operator if any further system degradation occurs.

If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, the OPRM channel or associated RPS trip system must be placed in the tripped condition per Required Actions A.1 and A.2. Placing the inoperable OPRM channel in trip (or the associated RPS trip system in trip) would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue. Alternately, if it is not desired to place the OPRM channel (or RPS trip system) in trip (e.g., as in the case where placing the inoperable channel in trip would result in a full scram), the alternate method of detecting and suppressing thermal-hydraulic instability oscillations is required (Required Action A.3). This alternate method is described in Reference 5. It consists of avoidance of the region where oscillations are possible, exiting this region if it is entered due to unforeseen circumstances, and increased operator awareness and monitoring for neutron flux oscillations while taking action to exit the region. If indications of oscillation, as described in Reference 5, are observed by the operator, the operator will take the actions described by procedures, which include initiating a manual scram of the reactor. Continued operation with one OPRM channel inoperable, but not tripped, is permissible if the OPRM System maintains trip capability, since the

(continued)

BASES

ACTIONS (continued)

combination of the alternate method and the OPRM trip capability provides adequate protection against oscillations.

B.1 and B.2

Required Action B.1 is intended to ensure that appropriate actions are taken if multiple, inoperable, untripped OPRM channels within the same RPS trip system result in not maintaining OPRM trip capability. OPRM trip capability is considered to be maintained when sufficient OPRM channels are OPERABLE or in trip (or the associated RPS trip system is in trip), such that a valid OPRM signal will generate a trip signal in both RPS trip systems. This would require both RPS trip systems to have one OPRM channel OPERABLE or in trip (or the associated RPS trip system in trip).

Because of the low probability of the occurrence of an instability, 12 hours is an acceptable time to initiate the alternate method of detecting and suppressing thermal-hydraulic instability oscillations described in the Bases for Action A.3 above. The alternate method of detecting and suppressing thermal-hydraulic instability oscillations avoids the region where oscillations are possible and would adequately address detection and mitigation in the event of instability oscillations. Based on industry operating experience with actual instability oscillations, the operator would be able to recognize instabilities during this time and take action to suppress them through a manual scram. In addition, the OPRM System may still be available to provide alarms to the operator if the onset of oscillations were to occur. Since plant operation is minimized in areas where oscillations may occur, operation for 120 days without OPRM trip capability is considered acceptable with implementation of an alternate method of detecting and suppressing thermal-hydraulic instability oscillations.

(continued)

BASES

ACTIONS (continued)

C.1

With any Required Action and associated Completion Time not met, the plant must be placed in a MODE or other specified condition in which the LCO does not apply. To achieve this status, THERMAL POWER must be reduced to < 21.6% RTP within 4 hours. Reducing THERMAL POWER to < 21.6% RTP places the plant in a region where instabilities cannot occur. The 4 hours is reasonable, based on operating experience, to reduce THERMAL POWER < 21.6% RTP from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

The Surveillances are modified by a Note to indicate that, when a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed for up to 6 hours, provided the associated Function maintains trip capability. Upon completion of the Surveillance, or expiration of the 6 hour allowance, the channel must be returned to OPERABLE status or the applicable Condition entered and Required Actions taken. This Note is based on the RPS reliability analysis (Ref. 9) assumption of the average time required to perform channel surveillance. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that the RPS will trip when necessary.

For the following OPRM instrumentation Surveillances, both OPRM modules are tested, although only one is required to satisfy the Surveillance Requirement.

SR 3.3.1.3.1

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the channel will perform the intended function. A Frequency of 184 days provides an acceptable level of system average unavailability over the Frequency interval and is based on the reliability of the channel (Reference 7).

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.3.2

The CHANNEL CALIBRATION is a complete check of the instrument loop. This test verifies the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations, consistent with the plant specific setpoint methodology. Calibration of the channel provides a check of the internal reference voltage and the internal processor clock frequency. It also compares the desired trip setpoint with those in the processor memory. Since the OPRM is a digital system, the internal reference voltage and processor clock frequency are, in turn, used to automatically calibrate the internal analog to digital converters. The nominal setpoints for the period based detection algorithm are specified in the Core Operating Limits Report (COLR). As noted, neutron detectors are excluded from CHANNEL CALIBRATION because of the difficulty of simulating a meaningful signal. Changes in neutron detector sensitivity are compensated for by performing the 1000 MWD/T LPRM calibration against the TIPs (SR 3.3.1.1.8). SR 3.3.1.1.8 thus also ensures the operability of the OPRM instrumentation.

The nominal setpoints for the OPRM trip function for the period based detection algorithm (PBDA) are specified in the COLR. The PBDA trip setpoints are the number of confirmation counts required to permit a trip signal and the peak to average amplitude required to generate a trip signal.

The Frequency of 24 months is based upon the assumption of the magnitude of equipment drift provided by the equipment supplier (Reference 7).

SR 3.3.1.3.3

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required trip logic for a specific channel. The functional testing of control rods in LCO 3.1.3, "Control Rod OPERABILITY," and scram discharge volume (SDV) vent and drain valves in LCO 3.1.8, "Scram Discharge Volume (SDV) Vent and Drain Valves," overlaps this Surveillance to provide

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

complete testing of the assumed safety function. The OPRM self-test function may be utilized to perform this testing for those components that it is designed to monitor.

The 24 month Frequency is based on engineering judgement and reliability of the components. Operating experience has shown these components usually pass the surveillance when performed at the 24 month Frequency.

SR 3.3.1.3.4

This SR ensures that trips initiated from the OPRM System will not be inadvertently bypassed when THERMAL POWER is ≥ 25% RTP and recirculation drive flow is ≤ the value corresponding to 60% of rated core flow. This normally involves calibration of the bypass channels. The 25% RTP value is the plant specific value for the enable region, as described in Reference 10.

These values have been conservatively selected so that specific, additional uncertainty allowances need not be applied. Specifically, for the THERMAL POWER, the Average Power Range Monitor (APRM) establishes the reference signal to enable the OPRM System at 25% RTP. Thus, the nominal setpoints corresponding to the values listed above (25% RTP and the value corresponding to 60% of rated core flow) will be used to establish the enabled region of the OPRM System trips. (References 1, 2, 6, 10, and 11)

The Frequency of 24 months is based on engineering judgement, high reliability of the components, and operating experience.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.3.5

This SR ensures that the individual channel response times are less than or equal to the maximum values assumed in the accident analysis (Reference 6). The OPRM self-test function may be utilized to perform this testing for those components it is designed to monitor. The RPS RESPONSE TIME acceptance criteria are included in plant Surveillance procedures.

As noted, neutron detectors are excluded from RPS RESPONSE TIME testing because the principles of detector operation virtually ensure an instantaneous response time. RPS RESPONSE TIME tests are conducted on an 24 month STAGGERED TEST BASIS. This Frequency is consistent with the refueling cycle and is based upon operating experience, which shows that random failures of instrumentation components causing serious time degradation, but not channel failure, are infrequent.

REFERENCES

1. NEDO-31960, "BWR Owners' Group Long-Term Stability Solutions Licensing Methodology," June 1991.

2. NEDO-31960, "BWR Owners' Group Long-Term Stability Solutions Licensing Methodology," Supplement 1, March 1992.

3. NRC Letter, A. Thadani to L. A. England, "Acceptance for Referencing of Topical Reports NEDO-31960, Supplement 1, 'BWR Owners' Group Long-Term Stability Solutions Licensing Methodology'," July 12, 1994.

4. Generic Letter 94-02, "Long-Term Solutions and Upgrade of Interim Operating Recommendations for Thermal-Hydraulic Instabilities in Boiling Water Reactors," July 11, 1994.

5. BWROG Letter BWROG-94079, "Guidelines for Stability Interim Corrective Action," June 6, 1994.

(continued)

6. NEDO-32465-A, "BWR Owners' Group Reactor Stability Detect and Suppress Solution Licensing Basis Methodology and reload Application," August 1996

7. CENPD-400-P, Rev. 01, "Generic Topical Report for the ABB Option III Oscillation Power Range Monitor (OPRM)," May 1995.

8. NRC Letter, B. Boger to R. Pinelli, "Acceptance of Licensing Topical Report CENPD-400-P, 'Generic Topical Report for the ABB Option III Oscillation Power Range Monitor (OPRM)'," August 16, 1995.

9. NEDO-30851-P-A, "Technical Specification Improvement Analyses for BWR Reactor Protection System," March 1988.

10. NEDC-32989P, "Safety Analysis Report for Clinton Power Station Extended Power Uprate," dated June 2001.

11. Letter from K. P. Donovan (BWR Owners' Group) to U. S. NRC, "Guidelines for Stability Option III 'Enabled Region'," dated September 17, 1996.

BASES

APPLICABLE SAFETY ANALYSES (continued)

operating at the lower flow rate), a small mismatch has been determined to be acceptable based on engineering judgement. The recirculation system is also assumed to have sufficient flow coastdown characteristics to maintain fuel thermal margins during abnormal operational occurrences (AOOs) (Ref. 2), which are analyzed in Chapter 15 of the USAR.

A plant specific LOCA analysis has been performed assuming only one operating recirculation loop. This analysis has demonstrated that, in the event of a LOCA caused by a pipe break in the operating recirculation loop, the Emergency Core Cooling System response will provide adequate core cooling, provided the APLHGR requirements are modified accordingly (Refs. 3 and 7 5).

The transient analyses of Chapter 15 of the USAR have also been performed for single recirculation loop operation (Ref. 3) and demonstrate sufficient flow coastdown characteristics to maintain fuel thermal margins during the abnormal operational transients analyzed provided the MCPR, APLHGR and LHGR requirements are modified. During single recirculation loop operation, modification to the Reactor Protection System average power range monitor (APRM) instrument setpoints is also required to account for the different relationships between recirculation drive flow and reactor core flow. The MCPR, APLHGR and LHGR limits for single loop operation are specified in the COLR. The APRM flow biased simulated thermal power setpoint is in LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation."

Recirculation loops operating satisfies Criterion 2 of the NRC Policy Statement.

LCO

Two recirculation loops are normally required to be in operation with their flows matched within the limits specified in SR 3.4.1.1 to ensure that during a LOCA caused by a break of the piping of one recirculation loop the assumptions of the LOCA analysis are satisfied. ~~In addition, the total core flow must be ≥ 45% of rated core flow or total core flow expressed as a function of THERMAL POWER must be in Region C as identified in Figure 3.4.1-1, "THERMAL POWER/Core Flow Stability Regions."~~ Alternatively, with only one recirculation loop in operation, THERMAL POWER must be ≤ 58% RTP, ~~total core flow must be ≥ 45% of rated~~

(continued)

BASES

LCO (continued)

~~core flow or total core flow expressed as a function of THERMAL POWER must be in Region C of Figure 3.4.1-1,~~ and modifications to the required APLHGR limits (LCO 3.2.1, "AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)"), MCPR limits (LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)"), LHGR limits (LCO 3.2.3, "LINEAR HEAT GENERATION RATE (LHGR)"), and APRM Flow Biased Simulated Thermal Power—High setpoint (LCO 3.3.1.1) must be applied to allow continued operation consistent with the assumptions of References 3 and 7 5.

~~The LCO is modified by a Note which allows up to 12 hours before having to put in effect the required modifications to required limits and setpoints after a change in the reactor operating conditions from two recirculation loops operating to single recirculation loop operation. If the required limits and setpoints are not in compliance with the applicable requirements at the end of this period, the associated equipment must be declared inoperable or the limits "not satisfied," and the ACTIONS required by nonconformance with the applicable Specifications implemented. This time is provided due to the need to stabilize operation with one recirculation loop, including the procedural steps necessary to limit flow (to less than the volumetric recirculation loop flow) in the operating loop, monitor for excessive APRM and local power range monitor (LPRM) neutron flux noise levels; and the complexity and detail required to fully implement and confirm the required limit and setpoint modifications.~~

APPLICABILITY

In MODES 1 and 2, requirements for operation of the Reactor Coolant Recirculation System are necessary since there is considerable energy in the reactor core and the limiting AOOs and LOCAs are assumed to occur.

In MODES 3, 4, and 5, the consequences of an accident or AOO are reduced and the coastdown characteristics of the recirculation loops are not important.

ACTIONS

A.1

With both recirculation loops operating but the flows not matched, the recirculation loops must be restored to operation with matched flows within 2 hours. If the flow mismatch cannot be restored to within limits within 2 hours, one recirculation loop must be shut down.

(continued)

BASES

ACTIONS

A.1 (continued)

Alternatively, if the single loop requirements of the LCO are applied to operating limits and RPS setpoints, operation with only one recirculation loop would satisfy the requirements of the LCO and the initial conditions of the accident sequence.

The 2 hour Completion Time is based on the low probability of an accident occurring during this time period, on a reasonable time to complete the Required Action, and on frequent core monitoring by operators allowing abrupt changes in core flow conditions to be quickly detected.

B.1, C.1, and D.1

Due to thermal hydraulic stability concerns, operation of the plant is divided into three regions based on THERMAL POWER and core flows. Region A is a power/flow ratio with power > 80% rod line and core flow ≤ 35.5% of rated core flow. Region B is a power/flow ratio with the power > 80% rod line and core flow > 35.5% and < 45% of rated core flow, respectively. A core flow of 35.5% of rated core flow corresponds to the core flow with both recirculation pumps at rated speed and minimum control valve position. Because the plant is susceptible to instability in power/flow Regions A and B, APRM and LPRM neutron flux noise levels are required to be determined to assure that thermal hydraulic instability is not occurring. For the LPRM neutron flux noise determination, detector levels A and C of one LPRM string per core octant plus detectors A and C of one LPRM string in the center of the core are monitored. If evidence of approaching instability occurs (i.e., APRM or LPRM neutron flux noise levels exceed three times the established baseline levels) prompt action must be initiated to restore the power/flow ratio to within Region C by increasing core flow to ≥ 45% of rated core flow or by reducing THERMAL POWER to less than or equal to the limits for the existing core flow. The allowed Completion Times are reasonable, based on operating experience, to restore plant parameters in an orderly manner and without challenging plants systems.

Baseline values are determined uniquely for each cycle during operation in Regions A or B. Within 2 hours of entering Region A and B, the baseline is established. This initial baseline is then used for comparison to all

(continued)

BASES

ACTIONS

B.1, C.1, and D.1 (continued)

subsequent neutron flux noise levels during operation in this region.

A determination of APRM and LPRM neutron flux noise levels every 8 hours provides frequent periodic information relative to established baseline noise levels (see Condition C) that indicate stable steady state operation. A determination of these noise levels within 30 minutes after an increase of ≥ 5% RTP provides a more frequent indication of the stability of operation following any significant potential for change of the thermal hydraulic properties of the system. These Frequencies provide early detection of neutron flux oscillations due to core thermal hydraulic instabilities. Action must be initiated to restore the plant to a more stable power/flow ratio if such indications of limit cycle neutron flux oscillations are detected.

B E.1

Should a LOCA occur with THERMAL POWER > 58% RTP during single loop operation, the core response may not be bounded by the LOCA analyses. Therefore, only a limited time is allowed to reduce THERMAL POWER TO ≤ 58% RTP.

The 4 hour Completion Time is based on the low probability of an accident occurring during this time period, on a reasonable time to complete the Required Action, and on frequent core monitoring by the operators allowing changes in THERMAL POWER conditions to be quickly detected.

C F.1

If the required limit or setpoint modifications for single loop operation (i.e., LCO requirements B.2 and B.3) are not met performed within 12 hours after transition from two recirculation loop operation to single recirculation loop operation, the required limits and setpoints which have not been modified must be immediately declared not met. The Required Actions for the associated limits and instrument channels must then be taken. Insert #1

(continued)

BASES INSERT #1 (Page B 3.4-6)

then the requirements of the LCO must be satisfied within 24 hours. The 24 hour Completion Time of the Condition provides time before the required modifications to required limits and setpoints have to be in effect after a change in the reactor operating conditions from two recirculation loops operating to single recirculation loop operation. This time is provided due to the need to stabilize operation with one recirculation loop, including the procedural steps necessary to limit flow and adjust the flow control mode in the operating loop, and the complexity and detail required to fully implement and confirm the required limit and setpoint modifications. The 24 hour Completion Time is also based on the low probability of an accident occurring during this period, on a reasonable time to complete the Required Action, and on frequent monitoring by operators allowing abrupt changes in core flow conditions to be quickly detected.

BASES INSERT #2 (Page B 3.4-7)

or the Required Action and associated Completion Time of Conditions A, B, or C not met,

BASES

ACTIONS (continued)

~~G.1, G.2, and G.3~~ D.1

Insert #2

With no recirculation loops in operation, the unit is required to be brought to a MODE in which the LCO does not apply. ~~Prompt action must be initiated to reduce THERMAL POWER to be within the limits to assure thermal hydraulic stability concerns are addressed.~~ The plant is ~~then~~ required to be placed in ~~MODE 2 in 6 hours and~~ MODE 3 in 12 hours. In this condition, the recirculation loops are not required to be operating because of the reduced severity of DBAs and minimal dependence on the recirculation loop coastdown characteristics. The allowed Completion Time~~s~~ ~~are~~ of 12 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.4.1.1

This SR ensures the recirculation loop flows are within the allowable limits for mismatch. At low core flow (i.e., < 70% of rated core flow), the MCPR requirements provide larger margins to the fuel cladding integrity Safety Limit such that the potential adverse effect of early boiling transition during a LOCA is reduced. A larger flow mismatch can therefore be allowed when core flow is < 70% of rated core flow. The recirculation loop jet pump flow, as used in this Surveillance, is the summation of the flows from all of the jet pumps associated with a single recirculation loop.

The mismatch is measured in terms of percent of rated core flow. This SR is not required when both loops are not in operation since the mismatch limits are meaningless during single loop or natural circulation operation. The Surveillance must be performed within 24 hours after both loops are in operation. The 24 hour Frequency is consistent with the Frequency for jet pump OPERABILITY verification and has been shown by operating experience to be adequate to detect off normal jet pump loop flows in a timely manner.

With regard to recirculation loop flow values obtained pursuant to this SR, as read from plant indication instrumentation, the specified limit is considered to be a nominal value and therefore does not require compensation for instrument indication uncertainties (Ref. ~~4~~ 6).

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.4.1.2

This SR ensures the reactor THERMAL POWER and core flows are within appropriate parameter limits to prevent uncontrolled power oscillations. At low recirculation flows and high reactor power, the reactor exhibits increased susceptibility to thermal hydraulic instability. Actions have been developed based on the guidance provided in References 4 and 5 to respond to operation in these conditions. This SR identifies when the conditions requiring these actions are necessary. The Frequency is based on operating experience and the operators' inherent knowledge of reactor status, including significant changes in THERMAL POWER and core flow.

With regard to THERMAL POWER and core flow values obtained pursuant to this SR, as read from plant indication instrumentation, the specified limit is considered to be a nominal value and therefore does not require compensation for instrument indication uncertainties (Ref. 6).

REFERENCES

1. USAR, Section 6.3.3.7.

2. USAR, Section 5.4.1.1.

3. USAR, Chapter 15, Appendix 15B.

~~4. NRC Bulletin 88-07, Supplement 1, "Power Oscillations in Boiling Water Reactors," December 1988.~~

~~5. GE Letter, "Interim Recommendations for Stability Actions," November 1988.~~

4 ~~6~~. Calculation IP-0-0029.

5 ~~7~~. "Clinton Power Station SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis," NEDC-32945P, June 2000

ATTACHMENT 5
Commitments

LIST OF COMMITMENTS

The following table identifies those actions committed to by AmerGen Energy Company, LLC (AmerGen), in this document. Any other statements in this submittal are provided for information purposes and are not to be considered commitments.

COMMITMENT	Due Date/Event
(1) Provide administrative procedures for manually bypassing OPRM instrumentation channels or protective functions and for controlling access to the OPRM functions.	Upon implementation of the License Amendment