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10 CFR 50.90

RS-04-069

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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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LaSalle County Station, Units 1 and 2
Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Subject: License Amendment Request
Activation of the Trip Outputs of the Oscillation Power Range Monitor System

Reference: 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

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," Exelon Generation Company, LLC (EGC), requests a change to the Technical Specifications (TS), Appendix A, of Facility Operating License Nos. NPF-11 and NPF-18 for LaSalle County Station (LCS), Units 1 and 2.

The proposed changes incorporate into the TS the Oscillation Power Range Monitor (OPRM) instrumentation that will be declared operational in accordance with the schedule provided in the referenced letter. The proposed changes revise Sections 3.3.1.3, "Oscillation Power Range Monitor (OPRM) Instrumentation," 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. Following NRC approval of the proposed TS changes, LCS will activate the reactor scram outputs of the OPRM instrumentation.

The referenced letter stated that EGC would provide the enclosed license amendment request by March 31, 2004. In a telephone conversation between Mr. A. R. Haeger of EGC and Mr. W. A. Macon, Jr. of the NRC, it was agreed that EGC would submit the license amendment request by April 30, 2004.

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.

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4. Attachment 4 includes the marked-up TS Bases pages. The TS Bases pages are provided for information only and do not require NRC approval.

EGC 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).

EGC requests approval of the proposed changes by March 31, 2005, but no earlier than completion of the next refueling outage for LCS, Unit 2, which is currently scheduled to complete in late February 2005. Once approved, the changes shall be implemented within 60 days for both Units 1 and 2.

The proposed changes have been reviewed by the Plant Operations Review Committee and approved by the Nuclear Safety Review Board.

If you have any questions, please contact Mr. Allan Haeger at (630) 657-2807.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 30th day of April 2004.

Respectfully,

Keith R. Jury

Keith R. Jury
Director, Licensing and Regulatory Affairs
Exelon Generation Company, LLC

Attachments:
1. Evaluation of the 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

cc: NRC Regional Administrator – Region III
Senior Resident Inspector – LaSalle County Station
Illinois Emergency Management Agency – Division of Nuclear Safety

Attachment 1

EVALUATION OF PROPOSED CHANGES

1.0 DESCRIPTION

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," Exelon Generation Company, LLC (EGC), requests a change to the Technical Specifications (TS), Appendix A, of Facility Operating License Nos. NPF-11 and NPF-18 for LaSalle County Station (LCS), Units 1 and 2.

The proposed changes incorporate into the TS the Oscillation Power Range Monitor (OPRM) instrumentation that will be declared operational in accordance with the schedule provided in Reference 1. The proposed changes revise Sections 3.3.1.3, "Oscillation Power Range Monitor (OPRM) Instrumentation," 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 current the thermal hydraulic instability administrative requirements, and add the appropriate references for the OPRM trip setpoints and methodology. Following NRC approval of the proposed TS changes, LCS will activate the reactor scram outputs of the OPRM instrumentation.

EGC requests approval of the proposed changes by March 31, 2005, but no earlier than completion of the next refueling outage for LCS, Unit 2, which is currently scheduled to complete in late February 2005. Once approved, the changes shall be implemented within 60 days for both Units 1 and 2.

2.0 PROPOSED CHANGES

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

A. 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 ≥ 25% Rated Thermal Power (RTP).

A note is placed in the Actions section that states, "Separate Condition entry is allowed for each channel."

An additional note is placed in the Actions section that states, "When OPRM channels are inoperable due to APRM indication not within limits in accordance with Specification 3.3.1.1, entry into associated Conditions and Required Actions may be delayed for up to 2 hours if the APRM is indicating a lower power value than the calculated power, and for up to 12 hours if the APRM is indicating a higher power value than the calculated power."

Limiting Condition for Operation (LCO) Condition A and associated Required Actions and Completion Times require that, with one or more channels inoperable, the inoperable channels or the associated trip system be placed in trip or that alternate methods to detect and suppress thermal hydraulic instabilities be implemented within 30 days

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

Condition C applies if the Completion Times for Required Actions are not met. The Required Action allows 4 hours to reduce reactor power to less than 25 percent.

The proposed SRs are as follows.

SR 3.3.1.3.1 Channel Functional Test. The OPRM instrumentation will have a Channel Functional Test requirement with a frequency of every 184 days (6 months).

SR 3.3.1.3.2 The OPRM instrumentation will have a Channel Calibration every 24 months. A clarifying statement is added to note that the setpoints for the trip function are 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 every 24 months.

SR 3.3.1.3.4 This SR verifies that the OPRM system is not bypassed when thermal power $\geq$ 28.6% rated thermal power and recirculation drive flow < 60% of rated recirculation drive 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 a inoperable status solely for the performance of required Surveillances, entry into the associated Conditions and Required Actions may be delayed for up to 6 hours provided the OPRM maintains reactor protection system (RPS) trip capability."

The proposed addition of 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 2, with the following exceptions. The basis for these exceptions is discussed in Section 4.0 below.

- The Actions note regarding Average Power Range Monitor (APRM) indication is not part of the Reference 2 TS changes.
- The note placed before the SRs regarding delayed entry into the associated Conditions and Required Actions is not part of the Reference 2 TS changes.

- The TS changes in Reference 2 include an SR that requires calibration of the Local Power Range Monitors (LPRMs) every 1000 megawatt days per metric ton uranium (MWD/MTU). 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 LCS TS. The surveillance frequency is updated to include plant-specific information.

- A clarifying statement has been added to SR 3.3.1.3.2 to state that the setpoints for the trip function are specified in the Core Operating Limits Report (COLR).

B. Section 3.4.1, "Recirculation Loops Operating"

Figure 3.4.1-1, "Power versus Flow," and associated references to the figure from the LCO, Actions, and SRs are deleted.

C. 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 3).

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 4, EGC committed to implement the long-term solution designated as Option III in NEDO-31960-A (including Supplement 1), "BWR Owner's Group Long-Term Stability Solutions Licensing Methodology," (Reference 5) 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.

The OPRM instrumentation modules, annunciators, and sequence of events recorder points were installed at LCS from 1999 to 2000. The OPRM trip functions were not activated at the time of installation in order to allow evaluation of the performance of the OPRM algorithms without the risk of spurious scrams. During this evaluation period, in 2001, General Electric (GE) Company initiated a report in accordance with 10 CFR 21, "Reporting of defects and noncompliances," 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. In the interim, EGC has continued to implement the ICAs to detect and suppress power oscillations.

4.0 TECHNICAL ANALYSIS

The OPRM instrumentation installation at LCS follows the industry approach for implementation/activation of the OPRM trip function in accordance with NRC approved Licensing Topical Reports. In addition, EGC has incorporated relevant industry operating experience into the system settings, as appropriate.

A. Technical Basis for Proposed Addition of TS Section 3.3.1.3

The OPRM Instrumentation System consists of four OPRM instrumentation trip channels. 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 21 or 22 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 stability 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 (one out of two, taken twice) is satisfied. As discussed in Reference 3, only the PBDA is used in the safety analysis. The remaining algorithms provide defense in depth and additional protection against unanticipated oscillations.

The PBDA detects a stability 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 a stability 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 two alarms are displayed on a single control room annunciator and can be distinguished via the status lights on the OPRM modules or the OPRM relay panels. 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. 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 redundancy 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 2.

The detailed TS requirements for the OPRM system, including the LCO, Applicability, Conditions, Required Actions, and Completion Times, are consistent with the TS approved by the NRC in Reference 2, with the exceptions described in Section 2.0. The basis for these exceptions follows.

- Note 2 has been added to the Actions section. This note allows delayed entry into the Conditions and Required Actions when OPRM channels are inoperable due to APRM indication not within limits in accordance with SR 3.3.1.1.2. Note 2 allows entry into associated Conditions and Required Actions to be delayed for up to 2 hours if the APRM is indicating a lower power value (i.e., the gain adjustment factor (GAF) is high (nonconservative)), and for up to 12 hours if the APRM is indicating a higher power value than the calculated power (i.e., the GAF is low (conservative)). The GAF for any APRM is defined as the power value determined by the heat balance divided by the APRM reading for that channel. Upon completion of the gain adjustment, or expiration of the allowed time, the OPRM channel must be returned to OPERABLE status or the applicable Condition entered and the Required Actions taken. This Note is consistent with the ACTIONS Note in Specification 3.3.1.1 and is based on the time required to perform gain adjustments on multiple APRM channels; additional time is allowed when the GAF is out of limits but conservative. This note is applicable to the OPRM instrumentation, since the APRM system provides input to enable the OPRM modules at the designated enable setpoint.

- The TS changes in Reference 2 include an SR (SR 3.3.1.3.2) that requires calibration of the LPRMs every 1000 MWD/MTU. This value is bracketed in Reference 2, indicating that plant-specific information should be substituted. LCS TS, in SR 3.3.1.1.8, currently require this calibration and specify a frequency of 1000 effective full power hours (EFPH). The TS bases state that the 1000 EFPH frequency is based on operating experience with LPRM sensitivity changes. Since 1 EFPH equals approximately 0.9 MWD/MTU at LCS, the 1000 EFPH calibration frequency in the LCS SR is more frequent, and thus more conservative than the 1000 MWD/MTU calibration frequency specified in Reference 2. Thus, current SR 3.3.1.1.8 meets the intent of the SR for LPRM calibration in Reference 2, and is not required to be duplicated in proposed Section 3.3.1.3. The TS Bases for TS Sections 3.3.1.3 and 3.3.1.1 have been marked up 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. A statement is added to note that the setpoints for the trip function are 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 ≥ 28.6% RTP and recirculation drive flow < 60% of rated recirculation drive flow. These values define the region in which the OPRM system is enabled, and are not protective limits.

> The 60% value is consistent with the value discussed in Reference 3, Section 2.2, "Licensing Compliance." The 28.6% RTP value is the plant-specific value for the 30% RTP value, which is bracketed in Reference 2. In Reference 7, LCS requested changes to implement a 5% 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 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 100%/105%, which reduces the power portion of the enabled region to 28.6% RTP. The LCS 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 3, 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 are defined 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 "tuning" parameters. 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 considered to be "tuning" parameters, they are not specifically listed within the TS.

Finally, there are also setpoints for the "defense-in-depth" algorithms discussed in the OPRM upscale function description in the TS Bases markup. These are also treated as nominal setpoints based on qualitative studies performed by the BWROG and documented in Appendix A of Reference 3. These algorithms are not credited in the safety analysis.

In Reference 2, 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. The NRC requested licensees to address the following plant-specific questions when referencing the Reference 2 report 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 LCS includes alarm, trip, inoperable/trouble annunciators and is consistent with the topical report design.

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

Response
Reports NEDO-32465-A and NEDO-31960-A were reviewed and determined to be applicable to LCS. In the safety evaluations for NEDO-31960-A and Supplement 1, the NRC found that Options III and III-A were acceptable long-term solutions for implementation in any type of BWR, subject to the following five conditions:

2.1 "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. "

Response

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.

2.2 "The validity of the scram setpoints selected should be demonstrated by analysis. 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 3. The PBDA is based upon explicit analysis methodology (Reference 3) 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 3. The analysis of Reference 3 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 which satisfy operability of a sufficient number of LPRM channels to maintain APRM system operability.

2.3 "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.

2.4 "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 LCS will be a full reactor scram. An automatic select rod insert (SRI) is not available at LCS.

2.5 "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

As described in Reference 5 and Reference 3, the "Four LPRMs per OPRM Cell - 4BL" configuration is used at LCS. The 4BL arrangement is one of six approved configurations discussed in Reference 3, Appendix D. As described in Reference 5, 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 2, 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 LCS, which are located in a mild environmental zone. The OPRM components, including the replacement power supply 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 LCS temperature and radiation environmental conditions. However, the LCS main control rooms may experience humidity values below the OPRM qualified range. This is discussed in Section 4.2.

Environmental Condition	LCS Environmental Conditions	OPRM Generic Qualification (continuous operation)
Temperature	50°F to 104°F	40°F to 120°F
Humidity	20% to 50% relative humidity (RH) normal	30% 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 LCS.

4.1 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 LCS control room temperature range is 50°F to 104°F, which is bounded by the design temperature range of the OPRM. The normal temperature range for the LCS control rooms is between 65°F and 85°F.

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

4.2 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 30% to 95% RH, non-condensing.

The low end of the generic OPRM qualified humidity range is 30% RH. The normal relative humidity range for the LCS control rooms is between 20% and 50% RH. However, the control room ventilation system is not equipped with humidification equipment, and thus, depending on outside air conditions, the relative humidity may be as low as 2.6% 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 4.4 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 LCS for several years. Thus, the OPRM equipment should continue to operate properly if relative humidity is temporarily below 30% RH.

4.3 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 LCS.

4.4 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 2, the testing was conducted to MILSTD-461C, "Guide for Instrumentation and Control Equipment Grounding in Generating Stations," and MIL-STD-462-1967, "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 LCS 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 withstand (burst) 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.

4.5 Seismic

As noted in Reference 2, 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 is 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 LCS control room response spectra are bounded by the test seismic response spectra in Reference 2.

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. The OPRM module trip circuits may be bypassed by keylock switches for each module located on a panel in the main control room. The bypass condition of the selected OPRM module is indicated by the sequence of events monitor and by indicating lights.

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 factor reviews per plant specific procedures."

Response
The changes made to the main control room panels for the OPRM system at LCS were evaluated by a human factors engineer in accordance with human factors engineering procedures for acceptability and conformance to human engineering design principles. The OPRM system instrumentation and associated components, controls, and annunciators were found acceptable from a human factors engineering perspective.

In the NRC safety evaluation contained in Reference 5, 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 replaced with new Class 1E qualified flow units capable of providing total flow signals to the OPRM modules.

Further, in the NRC safety evaluation contained in Reference 5, the NRC requested that the plant-specific submittal discuss the isolation devices between the OPRM system and the associated protection system. Input signal isolators are installed on the shared APRM channels, while relay contact output provides output isolation.

B. Technical Basis for Proposed Changes to TS Section 3.4.1

The incorporation of the OPRM instrumentation into the TS will allow the deletion of the Power versus Flow TS Figure and associated references. 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 LCS TS.

C. 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 2 and is consistent with the industry standard technical specifications, 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 2 and is also consistent with the industry standard technical specifications, 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

Exelon Generation Company, LLC (EGC), proposes changes to the Technical Specifications (TS) for LaSalle County Station (LCS), Units 1 and 2. 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, LCS will activate the reactor scram outputs of the OPRM instrumentation.

EGC 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. This proposed change has no impact on any of the existing neutron monitoring functions.

   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 will continue to 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.

   Therefore, the proposed changes 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 trip function is being implemented to automate the detection and subsequent suppression of an instability event prior to exceeding the MCPR Safety Limit. The OPRM trip provides a trip output of the same type as currently used for the APRM. Its failure modes and types are identical 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.

   Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

Based on the above, EGC 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 provides compliance with GDC 10 and GDC 12, thereby providing protection from exceeding the fuel MCPR safety limit.

The NRC issued GL 94-02, 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.

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 10 and 11, respectively.

5.3 Conclusion

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 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

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

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

4. Letter from J. C. Brons (Commonwealth Edison Company) to U. S. NRC, "Response to Generic Letter 94-02 (BWR Stability)," dated September 9, 1994

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

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 R. M. Krich, (Commonwealth Edison Company), to U. S. NRC, "Request for License Amendment for Power Uprate Operation," dated July 14, 1999

8. Letter from U. S. NRC to O. D. Kingsley (Commonwealth Edison Company), "LaSalle - Issuance of Amendments Regarding Power Uprate," dated May 9, 2000

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. 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

11. 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

Attachment 2

Marked-up Technical Specifications Pages for Proposed Changes

<u>Pages</u>

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3.3.1.3-1 (new page)

3.3.1.3-2 (new page)

3.3.1.3-3 (new page)

3.4.1-1

3.4.1-2

3.4.1-3

3.4.1-4

3.4.1-5

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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 ≥ 25% RTP.

ACTIONS

-----NOTES-----

1. Separate Condition entry is allowed for each channel.
2. When OPRM channels are inoperable due to APRM indication not within limits in accordance with Specification 3.3.1.1, entry into associated Conditions and Required Actions may be delayed for up to 2 hours if the APRM is indicating a lower power value than the calculated power, and for up to 12 hours if the APRM is indicating a higher power value than the calculated power.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more channels inoperable.	A.1 Place channel in trip. <u>OR</u> A.2 Place associated RPS trip system in trip. <u>OR</u> A.3 Initiate alternate method to detect and suppress thermal hydraulic instability oscillations.	30 days 30 days 30 days

(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
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 < 25% 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 ≥ 28.6% RTP and recirculation drive flow is < 60% of rated recirculation drive 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 Two recirculation loops with matched flows shall be in operation ~~within Region III of Figure 3.4.1-1~~.

<u>OR</u>

One recirculation loop shall be in operation ~~within Region III of Figure 3.4.1-1~~ with the following limits applied when the associated LCO is applicable:

a. LCO 3.2.1, "AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)," single loop operation limits specified in the COLR;

b. LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)," single loop operation limits specified in the COLR;

c. LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation," Function 2.b (Average Power Range Monitors Flow Biased Simulated Thermal Power – Upscale), Allowable Value of Table 3.3.1.1-1 is reset for single loop operation; and

d. LCO 3.3.2.1, "Control Rod Block Instrumentation," Function 1.a (Rod Block Monitor – Upscale), Allowable Value of Table 3.3.2.1-1, specified in the COLR, is reset for single loop operation.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or two recirculation loops operating within Region II of Figure 3.4.1-1.	A.1 -----NOTE----- Only applicable when 3 times baseline value is > 10% peak-to-peak value. ----- Verify APRM and LPRM flux noise levels ≤ 3 times baseline.	45 minutes AND Once per 12 hours thereafter AND 45 minutes from discovery of Condition A concurrent with any THERMAL POWER increase of ≥ 5% RTP
	AND	

(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. (continued)	A.2	-------NOTE------- Only applicable when 10% peak-to-peak value is ≥ 3 times baseline value -------------------- Verify APRM and LPRM flux noise levels ≤ 10% peak-to-peak.	45 minutes AND Once per 12 hours thereafter AND 45 minutes from discovery of Condition A concurrent with any THERMAL POWER increase of ≥ 5% RTP
	AND		
	A.3	Verify recirculation loop(s) are not operating in Region I of Figure 3.4.1-1.	Once per 12 hours
B. Required Action A.1 or A.2 and associated Completion Time not met.	B.1	Satisfy the requirements of the LCO.	2 hours

(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. One or two recirculation loops operating within Region I of Figure 3.4.1-1.	C.1	Exit Region I of Figure 3.4.1-1.	2 hours
D. No recirculation loops in operation.	D.1	Verify APRM and LPRM flux noise levels ≤ 10% peak-to-peak.	Immediately
	AND		
	D.2	Reduce THERMAL POWER to ≤ 36% RTP.	2 hours
	AND		
	D.3	Be in MODE 3.	12 hours
E. Required Action B.1 or D.1 and associated Completion Time not met.	E.1	Place the mode switch in the shutdown position.	Immediately
F. Recirculation loop flow mismatch not within limits.	F.1	Declare the recirculation loop with lower flow to be "not in operation."	2 hours

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Requirements of the LCO not met for reasons other than Condition A ~~C, D, or~~ or B.	C.1 Satisfy the requirements of the LCO.	24 hours
D. Required Action and associated Completion Time of Condition C not met.	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 operating at < 70% of rated core flow; and b. ≤ 5% of rated core flow when operating at ≥ 70% of rated core flow.	24 hours
~~SR 3.4.1.2~~	~~Verify operation is in Region III of Figure 3.4.1-1.~~	~~24 hours~~

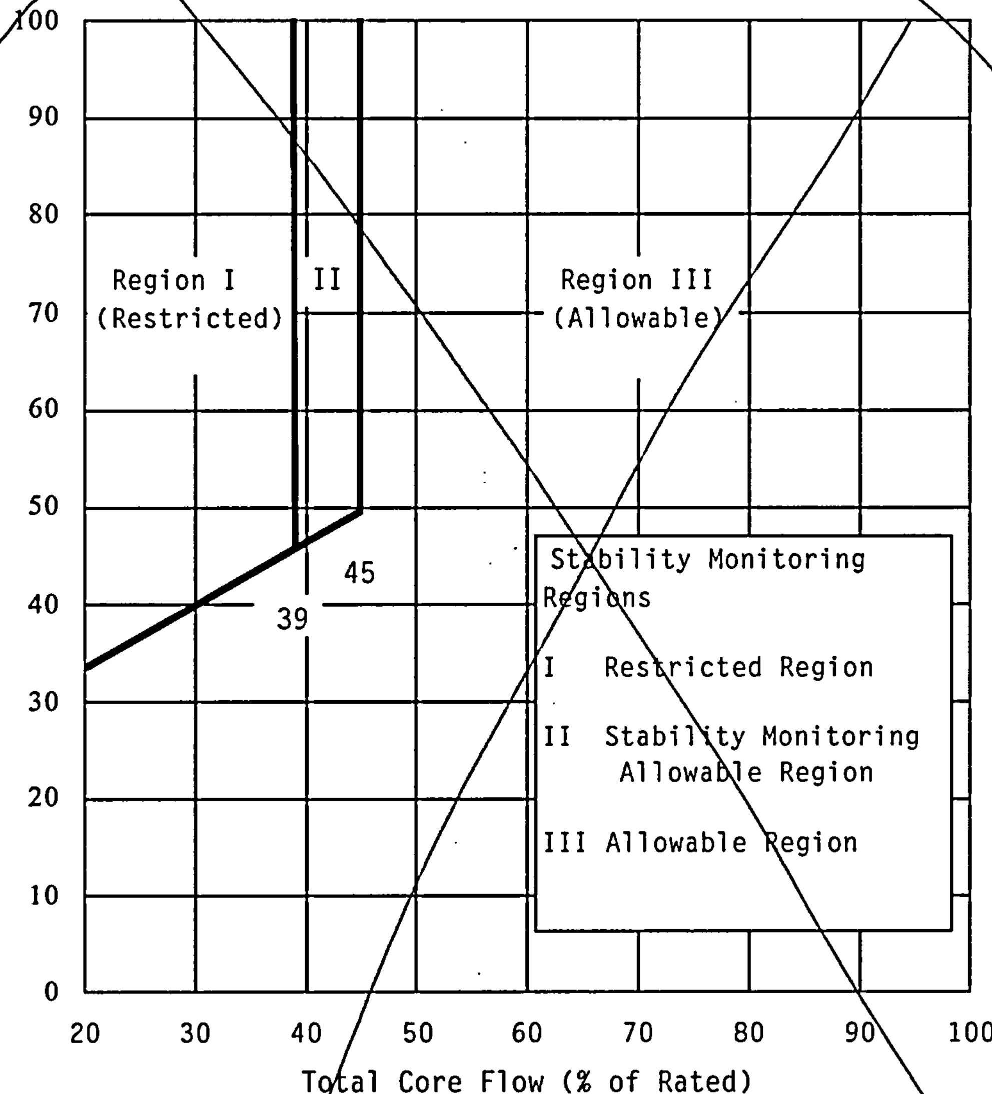

Figure 3.4.1-1 (Page 1 of 1)
Power versus Flow

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

4. The Rod Block Monitor Upscale Instrumentation Setpoint for the Rod Block Monitor—Upscale Function Allowable Value for Specification 3.3.2.1.

5. The OPRM setpoints for the trip function for SR 3.3.1.3.2.

b. The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

1. ANF-1125(P)(A), "ANFB Critical Power Correlation."

2. Letter, Ashok C. Thadani (NRC) to R.A. Copeland (SPC), "Acceptance for Referencing of ULTRAFLOW™ Spacer on 9x9-IX/X BWR Design," July 28, 1993.

3. XN-NF-524(P)(A), "ANF Critical Power Methodology for Boiling Water Reactors."

4. ANF-913(P)(A), "COTRANSA 2: A Computer Program for Boiling Water Reactor Transient Analysis."

5. ANF-CC-33(P)(A), "HUXY: A Generalized Multirod Heatup Code with 10 CFR 50, Appendix K Heatup Option."

6. XN-NF-80-19(P)(A), "Advanced Nuclear Fuel Methodology for Boiling Water Reactors."

7. XN-NF-85-67(P)(A), "Generic Mechanical Design for Exxon Nuclear Jet Pump BWR Reload Fuel."

8. ANF-89-014(P)(A), "ANF Corporation Generic Mechanical Design for ANF Corporation 9x9-IX and 9x9-9X BWR Reload Fuel."

9. EMF-CC-074(P)(A), Volume 4 - "BWR Stability Analysis: Assessment of STAIF with input from MICROBURN-B2."

10. XN-NF-81-58(P)(A), "RODEX2 Fuel Rod Thermal-Mechanical Response Evaluation Model."

11. XN-NF-84-105(P)(A), "XCOBRA-T: A Computer Code for BWR Transient Thermal-Hydraulic Core Analysis."

(continued)

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

12. ANF-91-048(P)(A), "ANF Corporation Methodology for Boiling Water Reactors EXEM BWR Evaluation Model."

13. EMF-2209(P)(A), "SPCB Critical Power Correlation."

14. ANF-89-98(P)(A), "Generic Mechanical Design Criteria for BWR Fuel Designs."

15. NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel."

16. NFSR-0091, "Benchmark of CASMO/MICROBURN BWR Nuclear Design Methods."

17. EMF-1125(P)(A), "ANFB Critical Power Correlation Application for Co-Resident Fuel."

18. ANF-1125(P)(A), "ANFB Critical Power Correlation Determination of ATRIUM-9B Additive Constant Uncertainties."

19. EMF-85-74(P)(A), "RODEX2A (BWR) Fuel Rod Thermal-Mechanical Evaluation Model."

20. EMF-2158(P)(A), "Siemens Power Corporation Methodology for Boiling Water Reactors: Evaluation and Validation of CASMO-4/MICROBURN-B2."

21. NEDC-32981P(A), "GEXL96 Corelation for Atrium-9B Fuel."

22. NEDC-33106P, "GEXL97 Correlation for Atrium-10 Fuel."

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

The COLR will contain the complete identification for each of the TS referenced topical reports used to prepare the COLR (i.e., report number, title, revision, date, and any supplements).

~~(continued)~~

Attachment 3

Revised Technical Specifications Pages for Proposed Changes

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3.3.1.3-1 (new page)

3.3.1.3-2 (new page)

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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 ≥ 25% RTP.

ACTIONS

------------------------------------NOTES------------------------------------

1. Separate Condition entry is allowed for each channel.
2. When OPRM channels are inoperable due to APRM indication not within limits in accordance with Specification 3.3.1.1, entry into associated Conditions and Required Actions may be delayed for up to 2 hours if the APRM is indicating a lower power value than the calculated power, and for up to 12 hours if the APRM is indicating a higher power value than the calculated power.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more 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

(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. OPRM trip capability not maintained.	B.1	Initiate alternate method to detect and suppress thermal hydraulic instability oscillations.	12 hours
	AND		
	B.2	Restore OPRM trip capability.	120 days
C. Required Action and associated Completion Time not met.	C.1	Reduce THERMAL POWER < 25% 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 ≥ 28.6% RTP and recirculation drive flow is < 60% of rated recirculation drive 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 Two recirculation loops with matched flows shall be in operation.

<u>OR</u>

One recirculation loop shall be in operation with the following limits applied when the associated LCO is applicable:

a. LCO 3.2.1, "AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)," single loop operation limits specified in the COLR;

b. LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)," single loop operation limits specified in the COLR;

c. LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation," Function 2.b (Average Power Range Monitors Flow Biased Simulated Thermal Power – Upscale), Allowable Value of Table 3.3.1.1-1 is reset for single loop operation; and

d. LCO 3.3.2.1, "Control Rod Block Instrumentation," Function 1.a (Rod Block Monitor – Upscale), Allowable Value of Table 3.3.2.1-1, specified in the COLR, is reset for single loop operation.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. No recirculation loops in operation.	A.1	Be in MODE 3.	12 hours
B. Recirculation loop flow mismatch not within limits.	B.1	Declare the recirculation loop with lower flow to be "not in operation."	2 hours
C. Requirements of the LCO not met for reasons other than Condition A or B.	C.1	Satisfy the requirements of the LCO.	24 hours
D. Required Action and associated Completion Time of Condition C not met.	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 operating at < 70% of rated core flow; and b. ≤ 5% of rated core flow when operating at ≥ 70% of rated core flow.	24 hours

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

4. The Rod Block Monitor Upscale Instrumentation Setpoint for the Rod Block Monitor—Upscale Function Allowable Value for Specification 3.3.2.1.

5. The OPRM setpoints for the trip function for SR 3.3.1.3.2.

b. The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

1. ANF-1125(P)(A), "ANFB Critical Power Correlation."

2. Letter, Ashok C. Thadani (NRC) to R.A. Copeland (SPC), "Acceptance for Referencing of ULTRAFLOW™ Spacer on 9x9-IX/X BWR Design," July 28, 1993.

3. XN-NF-524(P)(A), "ANF Critical Power Methodology for Boiling Water Reactors."

4. ANF-913(P)(A), "COTRANSA 2: A Computer Program for Boiling Water Reactor Transient Analysis."

5. ANF-CC-33(P)(A), "HUXY: A Generalized Multirod Heatup Code with 10 CFR 50, Appendix K Heatup Option."

6. XN-NF-80-19(P)(A), "Advanced Nuclear Fuel Methodology for Boiling Water Reactors."

7. XN-NF-85-67(P)(A), "Generic Mechanical Design for Exxon Nuclear Jet Pump BWR Reload Fuel."

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9. EMF-CC-074(P)(A), Volume 4 - "BWR Stability Analysis: Assessment of STAIF with input from MICROBURN-B2."

10. XN-NF-81-58(P)(A), "RODEX2 Fuel Rod Thermal-Mechanical Response Evaluation Model."

11. XN-NF-84-105(P)(A), "XCOBRA-T: A Computer Code for BWR Transient Thermal-Hydraulic Core Analysis."

(continued)

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

12. ANF-91-048(P)(A), "ANF Corporation Methodology for Boiling Water Reactors EXEM BWR Evaluation Model."

13. EMF-2209(P)(A), "SPCB Critical Power Correlation."

14. ANF-89-98(P)(A), "Generic Mechanical Design Criteria for BWR Fuel Designs."

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18. ANF-1125(P)(A), "ANFB Critical Power Correlation Determination of ATRIUM-9B Additive Constant Uncertainties."

19. EMF-85-74(P)(A), "RODEX2A (BWR) Fuel Rod Thermal-Mechanical Evaluation Model."

20. EMF-2158(P)(A), "Siemens Power Corporation Methodology for Boiling Water Reactors: Evaluation and Validation of CASMO-4/MICROBURN-B2."

21. NEDC-32981P(A), "GEXL96 Corelation for Atrium-9B Fuel."

22. NEDC-33106P, "GEXL97 Correlation for Atrium-10 Fuel."

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

The COLR will contain the complete identification for each of the TS referenced topical reports used to prepare the COLR (i.e., report number, title, revision, date, and any supplements).

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Attachment 4

Marked-up Technical Specifications Bases Pages for Proposed Changes

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.6 and SR 3.3.1.1.7 (continued)

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 effective full power hours (EFPH) 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 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 lease 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 10.

The 24 month Frequency of SR 3.3.1.1.12 is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned

(continued)

B 3.3 INSTRUMENTATION

B 3.3.1.3 OSCILLATION POWER RANGE MONITOR (OPRM) INSTRUMENTATION

BASES

BACKGROUND

General Design Criteria 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 effects 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 for safety analysis. 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. Upon detection of a stability related oscillation, a trip is generated for that OPRM channel.

(continued)

BASES

BACKGROUND (continued)

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 RPS average power range monitor (APRM) power and flow signals to automatically enable the trip function of the OPRM module. The outputs of the OPRM trip channels input to the associated RPS trip channels which are configured into a one-out-of-two taken twice trip logic as described in the Bases for Section 3.3.1.1.

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

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

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 5.

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 to maintain the APRM system OPERABLE per LCO 3.3.1.1 provides an adequate number of LPRMs to maintain an OPRM channel OPERABLE.

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 9, the region of anticipated oscillation is defined by THERMAL POWER ≥ 28.6% rated thermal power (RTP) and recirculation drive flow < 60% of

(continued)

BASES

APPLICABILITY (continued)

rated recirculation drive 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 $\geq$25% RTP. It is not necessary for the OPRM instrumentation to be OPERABLE with THERMAL POWER $<$ 25% RTP because the MCPR safety limit is not applicable below 25% RTP.

ACTIONS

Note 1 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 limit 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.

Note 2 allows delayed entry into the Conditions and Required Actions when OPRM channels are inoperable due to APRM indication not within limits in accordance with SR 3.3.1.1.2. This entry into associated Conditions and Required Actions may to be delayed for up to 2 hours if the APRM is indicating a lower power value (i.e., the gain adjustment factor (GAF) is high (nonconservative)), and for up to 12 hours if the APRM is indicating a higher power value than the calculated power (i.e., the GAF is low (conservative)). The GAF for any APRM is defined as the power value determined by the heat balance divided by the APRM reading for that channel. Upon completion of the gain adjustment, or expiration of the allowed time, the OPRM channel must be returned to OPERABLE status or the applicable Condition entered and the Required Actions taken. This Note is consistent with the ACTIONS

(continued)

BASES

ACTIONS (continued)

Note in Specification 3.3.1.1 and is based on the time required to perform gain adjustments on multiple APRM channels; additional time is allowed when the GAF is out of limits but conservative. This note is applicable to the OPRM instrumentation, since the APRM system provides input to enable the OPRM modules at the designated enable setpoint.

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. 6) to permit 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 Bases). The remaining OPERABLE OPRM channels continue to provide trip capability (see Condition B). 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, the alternate method of detecting and suppressing thermal hydraulic instability oscillation is required (Required Action A.3). This alternate method is described in Reference 7. 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 7, are

(continued)

BASES

ACTIONS

A.1, A.2, and A.3 (continued)

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 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. The OPRM trip function 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 both trip systems will generate a trip signal from the OPRM Period Based Trip Function on a valid signal.

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 Required 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. 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 < 25% RTP within 4 hours. Reducing THERMAL POWER to < 25% RTP places the plant in a region where instabilities cannot occur. The 4 hours is reasonable, based on operating experience, to reduce THERMAL POWER < 25% 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 the 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. 8) assumption of the average time required to perform channel surveillance. That analysis demonstrated that the 6 hours testing allowance does not significantly reduce the probability that the RPS will trip when necessary.

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 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.

A Frequency of 184 days provides an acceptable level of system average unavailability over the Frequency interval and is based on the reliability analysis (Ref. 6).

(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 COLR. As noted, neutron detectors are excluded from CHANNEL CALIBRATION because of difficulty of simulating a meaningful signal. Changes in neutron detector sensitivity are compensated for by performing the 1000 effective full power hour (EFPH) 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 Core Operating Limits Report. 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 (Ref. 6).

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

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.3.3 (continued)

Surveillance to provide 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 judgment 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 bypassed (i.e., fail to enable) when THERMAL POWER is ≥28.6% RTP and recirculation drive flow is < 60% of rated recirculation drive flow. This normally involves calibration of the bypass channels. The 28.6% RTP value is the plant specific value for the enable region, as described in Reference 9.

These values have been conservatively selected so that specific, additional uncertainty allowances need not be applied. Specifically, for THERMAL POWER, the Average Power Range Monitor (APRM) establishes the reference signal to enable the OPRM system at 28.6% RTP. Thus, the nominal setpoints corresponding to the values listed above (28.6% of RTP and 60% of rated recirculation drive flow) will be used to establish the enabled region of the OPRM System trips. (References 1, 2, 5, 9, and 11)

If any bypass channel setpoint is nonconservative (i.e., the OPRM module is bypassed at ≥28.6% RTP and < 60% of rated recirculation drive flow), then the affected OPRM module is considered inoperable. Alternately, the bypass channel can be placed in the conservative condition (nonbypass). If placed in the nonbypass condition, this SR is met and the module is considered OPERABLE.

The Frequency of 24 months is based on engineering judgment and reliability of the components.

(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. 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 Reference 10.

RPS RESPONSE TIME may be verified by actual response time measurements in any series of sequential, overlapping, or total channel measurements. 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 a 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. NEDC-39160, "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 Report 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. NEDO-32465-A, "BWR Owners Group Reactor Stability Detect and Suppress Solution Licensing Basis Methodology and Reload Application," August 1996.

(continued)

BASES

REFERENCES (continued)

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

7. BWROG Letter BWROG-9479, "Guidelines for Stability Interim Correction Action," June 6, 1994.

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

9. NEDC-32701P, "Power Uprate Safety Analysis Report for LaSalle County Station Units 1 and 2," Revision 2.

10. Technical Requirements Manual.

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

BACKGROUND (continued)

The subcooled water enters the bottom of the fuel channels and contacts the fuel cladding, where heat is transferred to the coolant. As it rises, the coolant begins to boil, creating steam voids within the fuel channel that continue until the coolant exits the core. Because of reduced moderation, the steam voiding introduces negative reactivity that must be compensated for to maintain or to increase reactor power. The recirculation flow control allows operators to increase recirculation flow and sweep some of the voids from the fuel channel, overcoming the negative reactivity void effect. Thus, the reason for having variable recirculation flow is to compensate for reactivity effects of boiling over a wide range of power generation (i.e., approximately 65 to 100% RTP) without having to move control rods and disturb desirable flux patterns. In addition, the combination of core flow and THERMAL POWER is normally maintained such that core thermal-hydraulic oscillations do not occur. These oscillations can occur during two recirculation loop operation, single recirculation loop, and no recirculation loop operation. Plant procedures include requirements of this LCO as well as other vendor and NRC recommended requirements and actions to minimize the potential of core thermal-hydraulic oscillations.

Each recirculation loop is manually started from the control room. The recirculation flow control valves provide regulation of individual recirculation loop drive flows. The flow in each loop can be manually or automatically controlled.

APPLICABLE SAFETY ANALYSES

The operation of the Reactor Recirculation System is an initial condition assumed in the design basis loss of coolant accident (LOCA) (Ref. 1). During a LOCA caused by a recirculation loop pipe break, the intact loop is assumed to provide coolant flow during the first few seconds of the accident. The initial core flow decrease is rapid because the recirculation pump in the broken loop ceases to pump reactor coolant to the vessel almost immediately. The pump in the intact loop coasts down relatively slowly. This pump coastdown governs the core flow response for the next several seconds until the jet pump suction is uncovered (Ref. 2). The analyses assume that both loops are operating at the same flow prior to the accident. However, the LOCA

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

analysis was reviewed for the case with a flow mismatch between the two loops, with the pipe break assumed to be in the loop with the higher flow. While the flow coastdown and core response are potentially more severe in this assumed case (since the intact loop starts at a lower flow rate and the core response is the same as if both loops were operating at a 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 transients (Ref. 2), which are analyzed in Chapter 15 of the UFSAR.

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 (Ref. 3).

The transient analyses in Chapter 15 of the UFSAR 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 requirements are modified. During single recirculation loop operation, modification to the Reactor Protection System average power range monitor (APRM) and the Rod Block Monitor (RBM) Allowable Values is also required to account for the different relationships between recirculation drive flow and reactor core flow. The APLHGR and MCPR limits for single loop operation are specified in the COLR. The APRM Flow Biased Simulated Thermal Power-Upscale Allowable Value is in LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation." The Rod Block Monitor-Upscale Allowable Value is specified in the COLR. ~~Safety analyses performed in References 1, 2, and 3 implicitly assume core conditions are stable. However, during operation at the high power/low flow region of the operating domain, a small probability of limit cycle neutron flux oscillations exists depending on combinations of operating conditions (e.g., power shape, bundle power, and bundle flow).~~

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

General Electric (GE) Service Information Letter (SIL) No. 380 (Ref. 4) addressed boiling instability and made several recommendations. In this SIL, the power/flow operating map was divided into several regions of varying concern. It also discussed the objectives and philosophy of "detect and suppress."

NRC Generic Letter 86-02 (Ref. 5) discussed both the GE and Siemens stability methodology and stated that due to uncertainties, 10 CFR 50, Appendix A, General Design Criteria (GDC) 10 and 12 could not be met using available analytical procedures on a BWR. The Generic Letter discussed SIL 380 and stated that GDC 10 and 12 could be met by imposing SIL 380 recommendations in operating regions of potential instability. The NRC concluded that regions of potential instability constituted decay ratios of 0.8 and greater by the GE methodology and 0.75 by the Siemens methodology. Figure 3.4.1-1 was generated as an interim solution to provide an increased margin of safety until the investigation is completed (Ref. 6)

Recirculation loops operating satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

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. With the limits specified in SR 3.4.1.1 not met, the recirculation loop with the lower flow must be considered not in operation. With only one recirculation loop in operation, 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)"), APRM Flow Biased Simulated Thermal Power—Upscale Allowable Value (LCO 3.3.1.1), and the Rod Block Monitor—Upscale Allowable Value (LCO 3.3.2.1) must be applied to allow continued operation ~~consistent with the assumptions~~ of Reference 3. ~~In addition, during two-loop and single-loop~~

(continued)

BASES

LCO (continued)

operation, the combination of core flow and THERMAL POWER must be in Region III of Figure 3.4.1-1 to ensure core thermal-hydraulic oscillations do not occur.

APPLICABILITY

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

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

ACTIONS

Insert A

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

With one or two recirculation loops in operation in Region II of Figure 3.4.1-1, the plant is operating in a region where the potential for thermal-hydraulic oscillations exists. To ensure oscillations are not occurring, APRM and LPRM neutron flux noise levels must be verified to be less than or equal to the larger of either 3 times the baseline noise levels or 10% peak-to-peak (Required Action A.1 and A.2) when Region II is entered. For the LPRM neutron flux noise verification, detector levels A and C of one LPRM string per core octant plus detector levels A and C of one LPRM string in the center region of the core should be monitored. Prompt action to monitor APRM and LPRM neutron flux noise levels should be taken to ensure oscillations are not occurring.

The 45 minute Completion Time of Required Actions A.1 and A.2 provides a reasonable time to stabilize operation in Region II and verify the neutron flux noise levels are within limits. A verification of the APRM and LPRM neutron flux noise levels once per 12 hours following the initial verification provides frequent periodic information of neutron flux noise levels to verify stable steady state operation. Also, a verification of neutron flux noise levels after any THERMAL POWER increase of ≥ 5% RTP while in Region II provides indication of operational stability following a potential for change of the thermal-hydraulic properties of the system.

(continued)

INSERT A

A.1

With no recirculation loops in operation, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to MODE 3 within 12 hours. In this condition, the recirculation loops are not required to be operating because of the reduced severity of design basis accidents and minimal dependence on the recirculation loop coastdown characteristics. The allowed Completion Time of 12 hours is reasonable, based on operating experience to reach MODE 3 from the full power condition in an orderly manner and without challenging plant systems.

BASES

ACTIONS

A.1, A.2, and A.3 (continued)

In addition, a verification that one or both recirculation loops are not operating within Region I of Figure 3.4.1-1 (Required Action A.3) is required to be performed once per 12 hours. The Completion Time of once per 12 hours is reasonable based on operating experience and the operator's knowledge of reactor status, including changes in reactor power and core flow.

B.1

If evidence of approaching reactor instability occurs (i.e., APRM or LPRM neutron flux noise levels exceed the associated limit of Required Actions A.1 or A.2, as applicable) while operating in Region II of Figure 3.4.1-1, prompt action should be taken to restore the APRM or LPRM neutron flux noise levels to within the associated limit or exit Region II of Figure 3.4.1-1. This may be accomplished by either increasing core flow by recirculation loop flow control valve manipulation or reduction of THERMAL POWER by control rod insertion. The 2 hour Completion Time is reasonable to restore plant parameters in an orderly manner and without challenging plant systems.

C.1

With one or both recirculation loops in operation in Region I of Figure 3.4.1-1, the plant is operating in a region where the potential for thermal-hydraulic oscillations is increased and sufficient margin may not be available for operator response to suppress potential thermal-hydraulic oscillations. As a result, prompt action should be taken to exit Region I of Figure 3.4.1-1. This may be accomplished by either increasing core flow by recirculation loop flow control valve manipulation or reduction of THERMAL POWER by control rod insertion. The 2 hour Completion Time is reasonable to restore plant parameters in an orderly manner and without challenging plant systems.

(continued)

BASES

ACTIONS (continued)

D.1, D.2, and D.3

With no recirculation loops in service, the probability of thermal-hydraulic oscillations is greatly increased. Therefore, prompt action should be taken to ensure oscillations are not occurring by verifying APRM and LPRM neutron flux noise levels are ≤ 10% peak-to-peak. If neutron flux noise levels are discovered to be > 10% peak-to-peak at anytime while in this Condition, Condition E must be immediately entered.

Also, prompt action should be taken to reduce THERMAL POWER low enough to avoid the region of potential instability in natural circulation (i.e., reduce THERMAL POWER below 36% RTP). The 2 hour Completion Time provides are reasonable time to restore operation to Region III of Figure 3.4.1-1.

In addition, with no recirculation loops in operation, plant operation is not allowed to continue in MODE 1 or 2. Therefore, the unit is required to be brought to a MODE in which the LCO does not apply. The allowed Completion Time of 12 hours is reasonable, based on operating experience, to reach MODE 3 in an orderly manner and without challenging plant systems.

E.1

In the event no recirculation loops are in operation and evidence is indicated of approaching reactor instability (i.e., APRM or LPRM neutron flux noise levels exceed the associated limit) or APRM or LPRM neutron flux noise levels cannot be restored within 2 hours while in Region II of Figure 3.4.1-1, action must be immediately initiated to eliminate the potential for a thermal-hydraulic instability event. As such, the reactor mode switch must be immediately placed in the shutdown position.

(continued)

BASES

ACTIONS (continued)

F.1 and G.1

With both recirculation loops operating but the flows not matched, the flows must be matched within 2 hours. If matched flows are not restored, the recirculation loop with lower flow must be declared "not in operation," as required by Required Action F.1. This Required Action does not require tripping the recirculation pump in the lowest flow loop when the mismatch between total jet pump flows of the two loops is greater than the required limits. However, in cases where large flow mismatches occur, low flow or reverse flow can occur in the low flow loop jet pumps, causing vibration of the jet pumps. If zero or reverse flow is detected, the condition should be alleviated by changing flow control valve position to re-establish forward flow or by tripping the pump.

With the requirements of the LCO not met for reasons other than Conditions A, C, D, and F (e.g., one loop is "not in operation"), compliance with the LCO must be restored within 24 hours. A recirculation loop is considered not in operation when the pump in that loop is idle or when the mismatch between total jet pump flows of the two loops is greater than required limits for greater than 2 hours (i.e., Required Action F.1 has been taken). Should a LOCA occur with one recirculation loop not in operation, the core flow coastdown and resultant core response may not be bounded by the LOCA analyses. Therefore, only a limited time is allowed to restore the inoperable loop to operating status.

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

The 2 hour and 24 hour Completion Times are 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.

(continued)

BASES

ACTIONS (continued)

~~H~~ D.1

If the Required Action and associated Completion Time of Condition ~~B~~ C is not met, the unit is required to be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to MODE 3 within 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 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 APLHGR and 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. If the flow mismatch exceeds the specified limits, the loop with the lower flow is considered not in operation. 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.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.1.2

The SR ensures the combination of core flow and THERMAL POWER, are within the appropriate limits to prevent inadvertent entry into a region of potential thermal-hydraulic instability. At low recirculation loop flow and high reactor power, the reactor exhibits increased susceptibility to thermal-hydraulic instability. Figure 3.4.1-1 is based on guidance provided in References 4 and 5. The 24 hour Frequency is based on operating experience and the operator's knowledge of the reactor status, including significant changes in THERMAL POWER and core flow.

REFERENCES

1. UFSAR, Sections 6.3 and 15.6.5.
2. UFSAR, Appendix G.3.1.2.
3. UFSAR, Section 6.B.
4. GE Service Information Letter (SIL) No. 380, "BWR Core Thermal Hydraulic Stability," Revision 1, February 10, 1984.
5. NRC Generic Letter 86-02, "Technical Resolution of Generic Issue B-19, Thermal Hydraulic Stability," January 22, 1986.
6. NRC Safety Evaluation supporting Amendment No. 60 to Facility Operating License No. 11 and Amendment No. 40 to Facility Operating License No. 18, Commonwealth Edison Company, LaSalle County Station, Units 1 and 2, dated September 7, 1988.