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10 CFR 50.90

February 8, 2001

Docket Nos. 50-277
50-278

License Nos. DPR-44
DPR-56

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: Peach Bottom Atomic Power Station, Units 2 and 3
License Change Application ECR No. 99-00015

Dear Sir/Madam:

Exelon Generation Company, LLC is submitting License Change Application ECR No. 99-00015, in accordance with 10 CFR 50.90, requesting an amendment to the TS (Appendix A) of Operating License Nos. DPR-44 and DPR-56 for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3. This proposed change will revise TS Section 3.3.1.1, "Reactor Protection System Instrumentation" and 3.4.1, "Recirculation Loops Operating Reporting Requirements" and their associated TS Bases and TS Section 5.6.5 Core Operating Limits Report (COLR) to reflect changes to support the activation of the trip outputs of the Oscillation Power Range Monitor (OPRM) portion of the Power Range Neutron Monitoring (PRNM) system and deletes the Interim Corrective Action requirements from the Recirculation Loops Operating Technical Specification. Information supporting this TS Change Request is contained in Attachment 1 to this letter, and the proposed TS pages (including marked-up pages) showing the proposed changes to the PBAPS Units 2 and 3 TS are contained in Attachment 2. In addition, descriptions and justifications for each deviation from the generically approved NUMAC PRNM Licensing Topical Report (LTR), or changes not addressed in the LTR are provided in the "Plant-Specific Responses Required by NUMAC PRNM Retrofit Plus Option III Stability Trip Function Topical Report (NEDC-32410P-A) Phase 2 OPRM Trip Activation/Deletion of ICAs" (Attachment 3). This information is being submitted under affirmation, and the required affidavit is enclosed.

In order to support the schedule for system activation, we request approval of this TS Change Request by August 15, 2001, and that the amendments become effective within 30 days of issuance.

If you have any questions, please do not hesitate to contact us.

Very truly yours,

G. L. Keller /FOR

James A. Hutton
Director - Licensing

Enclosures: Attachments; Affidavit

cc: H. J. Miller, Administrator, Region I, USNRC
A. C. McMurtray, USNRC Senior Resident Inspector, PBAPS
J. Boska, Senior Project Manager, USNRC
R. R. Janati, PA Bureau of Radiological Protection

A001

COMMONWEALTH OF PENNSYLVANIA :

: ss.

COUNTY OF CHESTER :

J. J. Hagan, being first duly sworn, deposes and says:

That he is Senior Vice President of Exelon Generation Company, LLC, the Applicant herein; that he has read the foregoing Application for Amendment of Facility Operating License Nos. DPR-44 and DPR-56 for Peach Bottom Atomic Power Station Units 2 and 3, concerning "Activation of the Trip Outputs of the Oscillation Power Range Monitor Portion of the Power Range Neutron Monitoring System," and knows the contents thereof; and that the statements and matters set forth therein are true and correct to the best of his knowledge, information and belief.

Senior Vice President

Subscribed and sworn to before me

this 8th day February

of 2001.

Notary Public

Notarial Seal
Carol A. Walton, Notary Public
Tredyffrin Twp., Chester County
My Commission Expires May 28, 2002

Member, Pennsylvania Association of Notaries

ATTACHMENT 1

PEACH BOTTOM ATOMIC POWER STATION
UNITS 2 and 3

DOCKET NOS.	50-277 50-278
LICENSE NOS.	DPR-44 DPR-56

License Change Application ECR No. 99-00015

Activation of the Trip Outputs of the Oscillation Power Range Monitor Portion of the Power Range Neutron Monitoring System

Supporting Information for Change - 13 Pages

Introduction

Exelon Generation Company, LLC, Licensee under Facility Operating License Nos. DPR-44 and DPR-56 for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3, requests that the Technical Specifications (TS) contained in Appendix A to the Operating Licenses be amended to revise TS Sections 3.3.1.1, "Reactor Protection System Instrumentation", and 3.4.1, "Recirculation Loops Operating Reporting Requirements" and their associated TS Bases and TS Section 5.6.5 Core Operating Limits Report (COLR) to reflect changes to support the activation of the trip outputs of the Oscillation Power Range Monitor (OPRM) portion of the Power Range Neutron Monitoring (PRNM) system to delete the Interim Corrective Action requirements from the Recirculation Loops Operating Technical Specification.

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 requires Exelon Generation Company, LLC to develop and submit to the NRC a plan for long term stability corrective actions. In response to GL 94-02, (Letter dated March 2, 1998, from G. D. Edwards, PECO Energy Company to the USNRC), Exelon Generation Company, LLC 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."

The functionality required for the Option III stability solution was implemented as part of the initial phase of Power Range Neutron Monitoring (PRNM) system replacement modification P00507, which has been completed for both PBAPS Units 2 and 3. That modification replaced the original PRNM system, including the APRM system, the Rod Block Monitor system and the LPRM system except for the detectors and signal cables, with General Electric's (GE) Nuclear Measurement Analysis and Control (NUMAC) Power Range Neutron Monitor (PRNM) System.

The NUMAC PRNM System utilizes the OPRM detect-and-suppress function to implement Option III. The safety function of the OPRM function within the PRNM is to monitor its LPRM signals for signs of neutron flux oscillations. The OPRM also monitors power and recirculation flow conditions 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. A TS change request to support the activation of the trip outputs of the OPRM portion of the PRNM system has been requested by Nine Mile Point 2; Browns Ferry Units 2 and 3; Hatch Units 1 and 2; and Fermi Unit 2. During the current Unit 2 and Unit 3 operating cycles, the first following installation of the new PRNM System, the OPRM has been fully operational except for the trip and associated trip alarm functions. These OPRM trip functions have been de-activated (not connected to the Reactor Protection System logic) in order to allow evaluation of the performance of the OPRM algorithms without the risk of spurious scrams. Consistent with NRC Bulletin 88-07 Supplement 1, as committed to in the letter dated September 9, 1994, from G. A. Hunger, PECO Nuclear to USNRC, Exelon Generation, LLC has continued to implement the Interim Corrective Actions (ICAs) to detect and suppress power oscillations. During this time frame, the OPRM system has been tuned per GE criteria to establish proper sensitivity. Performance of the system at Peach Bottom during this interim phase, as well as at other plants, has been reliable thus warranting activation of the trip outputs.

The final phase of this modification will accomplish the following:

- Activate the OPRM trip (OPRM Upscale Function) and annunciator;
- Add OPRM Technical Specifications;
- Delete the Recirculation Loops Operating Technical Specification requirements associated with the Interim Corrective Actions; and
- Implement equipment modifications limited to minor wiring changes in the PRNM Panel 2(3)0C037 and an annunciator window label change.
- Implement appropriate procedures and training to reflect the OPRM system.

Concurrent with the OPRM Technical Specification changes, some of the APRM related Technical Specification Bases will be changed to clarify some issues that have arisen during the time since the installation of the PRNM.

Implementation of this phase of the modification is planned for both Units 2 and 3, at the same time while on-line, prior to the 3R13 refueling outage scheduled for September 2001. The reason for this near simultaneous implementation for both units is so that the operators will have the same stability detection and action procedures for both units.

The proposed changes to the PBAPS Units 2 and 3, TS are indicated by the markups on the affected TS pages (Attachment 2). In addition, descriptions and justifications for each deviation from the generically approved NUMAC PRNM Licensing Topical Report (LTR), or changes not addressed in the LTR are provided in the "Plant-Specific Responses Required by NUMAC PRNM Retrofit Plus Option III Stability Trip Function Topical Report Phase 2 OPRM Trip Activation/Deletion of ICAs (NEDC-32410P-A)" (Attachment 3).

This License Change Application provides a discussion and description of the proposed TS changes, a safety assessment of the proposed TS changes, information supporting a finding of No Significant Hazards Consideration, and information supporting an Environmental Assessment.

Discussion and Description of the Proposed Changes

The proposed Technical Specifications (TS) Change Request involves changes to PBAPS, Units 2 and 3, TS Sections 3.3.1.1 "Reactor Protection System Instrumentation" and 3.4.1, "Recirculation Loops Operating Reporting Requirements" and their associated TS Bases and TS Section 5.6.5 Core Operating Limits Report (COLR) to reflect the activation of the OPRM automatic trip function in the PRNM system.

The Units 2 and 3 Technical Specifications changes (including markups) associated with this modification are provided as an attachment. The significant TS Action Statement changes are as follows:

PRNM System

A. RPS Instrumentation, Section 3.3.1.1, APRM Related Functions

A.1 Functions

This modification has no impact on any of the existing PRNM functions. The OPRM monitoring function is currently installed and fully functional but is not connected to the associated RPS or trip annunciator circuitry. The only change in this modification is connecting the existing OPRM trip outputs in series with the APRM trip outputs. This has the effect of "ORing" one OPRM trip output with each of the existing APRM trip outputs to the RPS.

A new OPRM Upscale Function 2.f will be added.

A.2 Minimum Number of Operable OPRM Channels

The required minimum number of operable OPRM channels will be three channels.

The OPRM Upscale Function will have operability requirements associated with OPRM cells of a minimum of 2 LPRMs per cell for a cell to be operable and a minimum of 25 OPRM cells per OPRM channel for channel operability. The specific numerical values for these two parameters are identified as "plant specific" in the NUMAC PRNM LTRs.

A.3 Applicable Modes of Operation

The OPRM Instability Detect-and-Suppress Trip (new OPRM Upscale Function) is a safety-related function and will be required to be operable only with Reactor Power ≥ 25% Reactor Thermal Power (RTP).

A.4 Channel Check Surveillance Requirements

The new OPRM Upscale Function will have a Channel Check requirement, SR 3.3.1.1.1, of once per 12 hours.

A.5 Channel Functional Test Surveillance Requirements

The new OPRM Upscale Function will have a Channel Functional Test requirement, SR 3.3.1.1.11, with a frequency of every 184 days (6 months). The Channel Functional Test includes both the OPRM channels and the 2-out-of-4 voter channels plus the flow input function, excluding the flow transmitters. Note 2 of SR 3.3.1.1.11 will be modified to show that the flow transmitter exclusion also applies to Function 2.f. A notation will be added to the SR 3.3.1.1.11 Bases to clarify that the actual OPRM Upscale trip auto-enable setpoints are confirmed by SR 3.3.1.1.19 (a new SR added to support the OPRM Upscale function).

A.6 Channel Calibration Surveillance Requirements

The new OPRM Upscale Function will have a Channel Calibration requirement, SR 3.3.1.1.12, with a frequency of every 24 months, and an LPRM calibration requirement, SR 3.3.1.1.8, with a frequency of every 1000 MWD/T. Channel Calibration of the recirculation loop flow channel will be included in the SR 3.3.1.1.12 Channel Calibration of this function (flow is an input to the auto-enable logic of the OPRM Upscale function), the same as the current requirement for APRM Simulated Thermal Power – High Function at 24-month intervals. The only change required for OPRM Upscale is to modify Note 3 of SR 3.3.1.1.12 to include Function 2.f. The flow channel calibration requirements associated with the OPRM Upscale function are the same as those previously added for the APRM Simulated Thermal Power – High Function.

A.7 Response Time Testing Surveillance Requirements

The new OPRM Upscale Function will have no Response Time Testing Surveillance Requirement. [Note: The NUMAC PRNM LTR describes response time testing as including the output relays for the 2-out-of-4 voter, however, the original PRNM installation licensing submittal justified response time testing from the PRNM panel terminals for PBAPS. This was based on the current response time testing commitments for PBAPS. The OPRM implementation is consistent with that justification. Since the OPRM Upscale trip outputs are in series with the APRM High/Inop trip outputs, no change is required to the 2-out-of-4 Voter Function response time testing requirements.]

A.8 Logic System Functional Testing (LSFT) Surveillance Requirements

The new OPRM Upscale Function will have no LSFT Surveillance Requirement. However, the SR 3.3.1.1.17 Bases description will be modified slightly to add "OPRM" to show that the simulated trip conditions must include the OPRM logic as well as the APRM High/Inop logic. This clarification is required because the 2-out-of-4 Voter, Function 2.e, votes the OPRM trip independently from the APRM High/Inop trip. The Bases description for Function 2.e will be modified to document the independent voting of the OPRM and APRM trips. In addition to these Function 2.e Bases changes required to support the OPRM Upscale function addition, some bases discussion will be added. The addition will clarify that the 2-out-of-4 Voter Function does not need to be declared inoperable if portions of the 2-out-of-4 Logic Module hardware that are not part of the 2-out-of-4 voter are found to be inoperable.

A.9 Verify OPRM auto-enable setpoints

The new OPRM Upscale Function will have a new surveillance requirement, SR 3.3.1.1.19, to confirm, with a frequency of every 24 months, that the OPRM auto-enable setpoints are correctly set.

A.10 LCO Conditions and Actions

LCO Condition A, and the associated Required Actions apply to the OPRM Upscale function the same as for the APRM Functions 2.a, 2.b., 2.c and 2.d. Required Action A.2 and Condition B do not apply to Function 2.f. Therefore, the "Notes" for Action A.2 and Condition B will be modified to add "2.f" to the functions excepted.

New Conditions I and J with associated Required Actions and Completion Times will be defined. These new Conditions apply when the OPRM channel Condition A Required Actions and associated Completion Times are not met. Required Action I.1 allows a Completion Time of 12 hours to initiate alternate methods of detecting and suppressing instabilities. Required Action I.2 allows a Completion time of 120 days to restore the OPRM Operability. Condition J applies if the Completion Times for Required Actions I.1 or I.2 are not met. The Required Action J.1 will allow 4 hours to reduce power to less than 25 percent.

The alternate method for detection and suppression required by Required Action I.1 is intended to be temporary re-establishment of the ICAs, but controlled by plant procedures rather than Technical Specifications. An exception to LCO 3.0.4 has been noted for Required Action I.2. This exception note is not discussed in the NUMAC PRNM LTR. This exception allows restarting the plant in the event of a shutdown during the 120-day Completion Time for Required Action I.2, consistent with the original intent of the LTR which was to allow normal plant operations to continue during the recovery time from a hypothesized design problem with the Option III algorithms or equipment.

A.11 Setpoints and Allowable Values

There are no allowable values associated with the OPRM Upscale Function. The OPRM period based detection algorithm (PBDA) upscale trip setpoints are determined based on the Option III licensing methodology developed by the BWROG and described in NEDO-32465-A, "BWR Owners' Group Long-Term Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications," previously approved by the NRC. The PBDA trip setpoints will be documented in the COLR. There are also Technical Specification related setpoints for the auto-enable (not-bypassed) region, which are established as nominal setpoints only as described in the Tech Spec Basis markup, and defined in SR 3.3.1.1.19. The minimum operable OPRM cells setpoint (25) is defined by GE analyses based on PBAPS's selection of the OPRM cell assignments and a minimum of 2 LPRMs per cell. The setpoint is established to conform to the licensing bases defined in NEDO-31960-A (including Supplement 1) and NEDO-32465-A. This setpoint, along with the PBAPS selection of a minimum of 2 LPRMs per cell, is documented in the TS Bases as part of the

operability requirement for Function 2.f. The PBDA algorithm includes several "tuning" parameters. These are established in accordance with PBAPS procedures as part of the system setup, and are not defined in Technical Specifications. Finally, there are also setpoints for the "defense-in-depth" algorithms discussed in the OPRM Upscale Function description in the Technical Specification Basis markup. These are treated as nominal setpoints based on qualitative studies performed by the BWROG and documented in Appendix A of NEDO-32465-A. Use of this LTR as a basis for establishing these defense-in-depth settings is consistent with the approach used by previous Licensees for activating the OPRM trip function. These algorithms are not credited in the safety analysis and their settings are documented only in the PBAPS procedures. A note will be added to Table 3.3.1.1-1 for the OPRM Upscale Function to state that the PBDA setpoint limits are defined in the COLR.

Some PRNM Technical Specification Bases changes, beyond those required for inclusion of the OPRM Upscale Function, are being implemented to clarify system requirements. Specifically, text has been added to the Bases discussion for Function 2.b (APRM Simulated Thermal Power – High) to clarify the basis for the "ΔW" flow offset, applicable to single loop operation (SLO). A minor change is being made to note (b) in Table 3.3.1.1-1 to show the SLO equation as "0.66(W–ΔW) + 64.9%" instead of "0.66W + 64.9% – 0.66ΔW". The change, while mathematically equivalent, states the equation in the same form that is actually implemented in the equipment. This change is being made to clarify the system's calculation of this setpoint.

Bases discussion for Function 2.e (2-out-of-4 Voter) has been added to clarify that inoperability of those portions of the 2-out-of-4 Logic Module that do not affect the voter function does not require that the voter function be declared inoperable. The Bases discussion for SR 3.3.1.1.12 has been modified to clarify that the SR applies also to the recirculation flow loop, and includes once-per-cycle correlation adjustments between drive flow and core flow measurements.

B. Recirculation Loops Operating, Section 3.4.1

B.1 Functions

This modification has no impact on any of the recirculation loop functions. It does remove Technical Specification required prohibitions against operating in the "restricted region". These prohibitions and other restrictions were implemented as part of the "Interim Corrective Actions" (ICAs). Present Technical Specification 3.4.1 requirements to operate outside the restricted region, and associated surveillances and actions will be deleted. Surveillance requirements related to monitoring LPRM and APRM indications for oscillations, will also be deleted. Technical Specification requirements not related to ICAs will be retained unchanged.

B-1 LCO Conditions and Actions

LCO restrictions on operating region (references to Figure 3.4.1-1) will be deleted from the LCO both for two loop and single loop operating conditions. Conditions A, B and C

and their associated Required Actions, and Required Action F.1, each associated with operation in the Restricted Region and included previously as part of the ICA actions, will be deleted. These changes, along with deletion of the related Bases discussions, effectively delete the Technical Specification requirements for the ICAs. [Note: The NUMAC PRNM LTR do not address deletion of ICA related Technical Specifications. Therefore, all Specification 3.4.1 changes are beyond those covered by the NUMAC PRNM LTR NEDC-32410P-A.]

A change in the "no loops operating" Completion Time (for Required Action F.2), unrelated to OPRM, is being implemented concurrently with the OPRM. Specifically, the Completion Time for Required Action F.2 will be increased from 6 hours to 12 hours. The 12-hour Completion Time is more reasonable for an orderly shutdown of the plant, and more consistent with both the current Completion Time for Required Action E.1 and the ISTS equivalent Completion Time for the no loops operating Condition, both of which are 12 hours. This change will be accomplished by combining the current Condition F as an "OR" with the current Condition E, and retaining the current Required Action E.1 and Completion Time of 12 hours for Required Action E.1. The present Required Action F.2 and associated Completion Time will be deleted.

The new Conditions D and E will then be renumbered as Conditions A and B, with references to deleted Conditions also deleted.

C. Reporting Requirements, Core Operating Limits, Section 5.6.5

The procedural method of controlling the limits used to establish the OPRM period based detection algorithm (PBDA) upscale trip setpoints is not discussed in the NUMAC PRNM LTR, but a required utility action is to identify the method that will be used. The requirements for cycle specific confirmation or change of the limits is established in the BWROG LTRs but not the specific method of documentation. The required information will be included in the reload licensing report. It has been determined that recording the PBDA limits in the COLR is the preferred method. This method is utilized at PBAPS for documenting similar cycle specific limits such as Rod Block Monitor limits, and has been utilized by other Licensees (e.g. Hatch) for the OPRM.

To document this requirement, a new item will be added under 5.6.5a to note that the OPRM limits associated with Specification 3.3.1.1 will be included in the COLR. Also, a new item has been added under 5.6.5b to identify the BWROG LTR NEDO-32465-A as the NRC approved documentation of the method for establishing the limits.

PRNM Hardware Impact

The only hardware impact is a "disconnect and tie back" of a few terminations to remove connections which were "jumpering out" the OPRM trip outputs, addition of jumpers to connect the OPRM trip to the annunciator and plant computer inputs, and minor relabeling of one annunciator window. All jumper removal/addition is accomplished in Panel 2(3)0C037.

BASIS:

PRNM System

The bases for the requested Technical Specification changes are documented in Section 8.0 of the NUMAC PRNM Licensing Topical Report NEDC-32410P-A including Supplement 1 (both of which have been approved by the NRC) with the following exceptions:

Function 2.b APRM Simulated Thermal Power -- High

The Bases text will be expanded to include specific discussion of the "ΔW" term in the simulated thermal power high equation, and the limits of applicability of the required adjustment. This is being added to document the basis for the "offset" and to clarify that a hardware "clamp" limits the Allowable Value to 64.9% for flow values of $W < \Delta W$.

Function 2.e 2-out-of-4 Voter

The Bases text for Function 2.e will be modified slightly differently from that shown in the NUMAC PRNM LTR. The LTR Discussion of "partial operability" related to the separate voting of the APRM High/Inop and the OPRM Upscale function will not be included. Deletion of this discussion is conservative and provides simplicity based on the determination that the added alternatives discussed in the LTR are complicated to evaluate and are very unlikely to ever be applied. However, discussion will be added to clarify that the "APRM Interface" part of the 2-out-of-4 Logic Module hardware is separate from the voter functions, and that inoperability of APRM Interface only hardware does not necessitate declaring the voter function inoperable. Specific examples are inoperable APRM Interface output modules, which might affect only annunciator functions or even rod block functions, but which do not affect any of the RPS functions and should not require entering an RPS LCO.

Function 2.f

The specific number of LPRMs per OPRM cell, the minimum required number of LPRMs for an OPRM cell to be considered OPERABLE, and the minimum number of OPRM cells required to be OPERABLE for an OPRM channel to be considered OPERABLE are identified as plant specific values in the NUMAC PRNM LTRs with no specific criteria on selection or calculation of the values. The NUMAC LTR also does not discuss the specific assignment of LPRMs to OPRM cells or any criteria for those assignments. The NRC approved BWROG Topical Reports, NEDO-31960-A, "BWR Owner's Group Long-Term Stability Solutions Licensing Methodology" including

Supplement 1, November 1995 and NEDO-332465-A, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Application, August 1996, provide the criteria related to determination of those values.

Based on the criteria in the BWROG LTRs, PBAPS has selected an LPRM-to-OPRM Cell assignment pattern that includes either 3 or 4 LPRMs per OPRM cell, depending on where the cell is located in the core. This selection meets the criteria in the BWROG LTRs. Similarly, PBAPS has selected 2 LPRMs as the minimum required per OPRM cell for OPRM cell operability. Based on these two PBAPS selected aspects of the OPRM system, cell assignments and minimum number of LPRMs per cell, GE has performed an analysis for Unit-2 in accordance with the methodology defined in the BWROG LTRs to establish the period based detection algorithm (PBDA) trip setpoint limit criteria. An assessment will be performed to validate the applicability of the Unit-2 analysis to Unit -3. The setpoint values will be documented in the COLR prior to trip activation. Also, based on the PBAPS selected cell assignments and minimum number of LPRMs per cell, GE has performed analyses to establish a recommended minimum of 25 OPRM cells required for OPRM channel operability. The minimum number of LPRMs per cell, and minimum required OPRM cells are included in the PBAPS specific Tech Spec Bases markups.

The bases description of the OPRM power level for operability (25% RTP) and for "trip enable" (30% RTP, 60% rated flow) has been modified somewhat from the NUMAC LTR version for clarity. There is no technical change from the intent. These values are identified as plant-specific in the NUMAC PRNM LTRs. Based on a BWROG Letter to the NRC providing background and guidance (the letter is included as a reference in the SR 3.3.1.1.19 Bases), PBAPS has selected the above values. The values will be treated as nominal values with no additional margin added to determine the actual setpoints to be entered in the equipment.

Action I.2

The PBAPS Required Action I.2 differs from that shown in the NUMAC PRNM LTRs in that an LCO 3.0.4 "exception" is identified. The LCO 3.0.4 exception is consistent with the intent of the original Required Action I.2, which was to allow 120 days to resolve a significant OPRM design issue. However, as written in the LTR, plant restart during the 120-day Completion Time would not be allowed by LCO 3.0.4. The PBAPS TS Bases description has been expanded from that in the NUMAC LTR to address the inclusion of the LCO 3.0.4 exception.

Channel Functional Test, SR 3.3.1.1.11

The bases description for PBAPS has been modified slightly from that in the NUMAC LTR to clarify that this SR coverage of the recirculation flow loop function also supports the automatic trip enable function in the OPRM. In addition, a notation has been included to clarify that the actual OPRM trip auto-enable setpoints are confirmed by SR 3.3.1.1.19, not 3.3.1.1.11.

Channel Calibration, SR 3.3.1.1.12

The NUMAC PRNM LTRs identify no specific changes to the Channel Calibration Bases. However, reviews associated with the OPRM Upscale Technical Specification changes identified a concern that the SR 3.3.1.1.12 Bases discussion of the flow channel calibration requirements previously added (to support the APRM Simulated Thermal Power – High function channel calibration) was not clear. In addition, the Bases should identify that the flow channel calibration also applies to the OPRM Upscale function (auto-enable of the trip). To address these issues and assure that the flow channel calibration requirements are correctly and completely understood, the SR 3.3.1.1.12 Bases discussion related to flow channel calibration will be expanded. That expanded discussion will also clarify that SR 3.3.1.1.12 includes the once-per-cycle drive flow / core flow correlation adjustment. [Note: The NUMAC PRNM LTR Bases discussion includes only the statement that the APRM Simulated Thermal Power – High Function channel calibration includes the flow channel. The NUMAC PRNM LTR Bases discussions do not address the applicability of the flow channel calibration to the OPRM Upscale, or include any additional discussion of the flow channel calibration specifics.]

The Bases section that includes SR 3.3.1.1.12 also includes three other non-related Channel Calibration SRs. The section has been reorganized somewhat to improve the flow of the discussion and reduce the risk of confusion.

Confirmation of OPRM trip enable setpoints, SR 3.3.1.1.19

The bases description of this SR has been reworded somewhat from that in the NUMAC LTR to clarify that the surveillance is only a confirmation of setpoints, that the setpoints are considered "nominal" (reference to a BWROG letter supporting this position has been added), and that the APRM STP/THERMAL POWER and core flow/recirculation flow correlations are confirmed by SR 3.3.1.1.2 and SR 3.3.1.1.12, respectively. Some additional rewording has been done to clarify the intent of the SR and to identify alternate actions available to satisfy the SR.

Response Time Testing Surveillance Requirements

The LTR describes response time testing including the APRM "sensors". PBAPS, per SR 3.3.1.1.18, is only required to verify response time testing of the RPS logics (NRC SERs dated October 14, 1999 [Unit 3] and August 1, 2000 [Unit 2]). Therefore, the changes included in the LTR that relate to response time testing of the PRNM electronics and logic are not applicable to PBAPS, and no change to SR 3.3.1.1.18 is required for the OPRM Upscale addition.

Safety Assessment

The OPRM trip actuation phase of PBAPS Modification P00507 and its associated Technical Specification changes will not adversely affect the ability of the RPS to perform its intended function. The significant change in this phase of the modification involves removing jumpers across the existing OPRM trip outputs to RPS. The Surveillance Requirements and their

frequency of performance will assure reliability of the OPRM portion of the PRNM systems. The modification replaces procedural actions (ICAs) with an NRC approved automatic detection and suppression function which provides an RPS trip input if acceptable reactor operational limits are exceeded. Therefore, the proposed modifications and associated TS changes will not adversely affect the health and safety of the public.

Information Supporting a Finding of No Significant Hazards Consideration

We have concluded that the changes to the Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3 Technical Specifications (TS), which will revise TS Sections 3.3.1.1, "Reactor Protection System Instrumentation" and 3.4.1, "Recirculation Loops Operating Reporting Requirements" and their associated TS Bases and TS Section 5.6.5 for COLR contents to support the activation of the Oscillation Power Range Monitor (OPRM) automatic trip function in the Power Range Neutron Monitoring (PRNM) system do not involve a Significant Hazards Consideration. The proposed change also deletes the Interim Corrective Action requirements from the Recirculation Loops Operating Technical Specification. This also does not involve a Significant Hazards Consideration. In support of this determination, an evaluation of each of the three (3) standards set forth in 10 CFR 50.92 is provided below.

1. The proposed TS changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

   This modification has no impact on any of the existing PRNM functions. It connects the OPRM trip function to the RPS; connects the associated trip alarm to the annunciator circuitry; updates the Technical Specifications to add the OPRM-related functions and to delete Interim Corrective Actions (ICAs) related requirements; and revises affected procedures.

   Plant operation in portions of the former restricted region may cause an increase in the probability of occurrence of an instability. This potential increase in probability is acceptable because the OPRM function will automatically detect the condition and initiate a reactor scram before the Minimum Critical Power Ratio (MCPR) Safety Limit is reached. Because of the more reliable detection of an instability event, should it occur, the automatic scram if preset limits are exceeded and the elimination of dependence on the operator, the consequences of an instability event are not increased with this modification due to the slight increase in the probability of the occurrence of an instability event.

   Based on the above discussion, the OPRM trip actuation phase of PBAPS Modification P00507 does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. <u>The proposed TS changes do not create the possibility of a new or different kind of accident from any accident previously evaluated.</u>

The modification replaces, with an NRC approved automatic detect and suppress function (OPRM), procedural actions (ICAs) that were established to avoid operating conditions where reactor instabilities might occur and to manually detect instabilities by observing neutron flux signals.

Enabling the OPRM Upscale trip implements the long-term stability solution required by Generic Letter 94-02. The PRNM hardware incorporates the Option III detect and suppress solution reviewed and approved by the NRC. The OPRM meets GDC 10 and 12 requirements by automatically detecting and suppressing design basis thermal-hydraulic oscillations prior to exceeding the fuel MCPR Safety Limit.

The current plant design utilizing the ICAs depends on operator action to, if possible, avoid regions where instability may occur, to exit such regions when necessary, and to detect an actual instability and take mitigating action by manual means. The modification replaces procedural actions (ICAs) with an NRC approved automatic detect and suppress function (OPRM). The OPRM function includes sophisticated algorithms that can automatically detect an instability condition and provide an RPS trip input if the oscillation magnitude exceeds acceptable limits.

The OPRM function is capable of more quickly and reliably detecting a true reactor instability than was possible with the manual procedures. The OPRM also provides a scram trip only if an actual instability is detected while the current ICAs require reactor shutdown if the plant is in a condition that <u>may</u> result in an instability, regardless of whether or not an instability occurs. Extensive analyses performed by the BWROG and reviewed and approved by the NRC demonstrate that the OPRM can detect reactor instabilities and initiate a scram trip before the MCPR safety limit is exceeded, thus maintaining the integrity of the fuel.

Potential failures in the OPRM Upscale function could result in either failure to take the required mitigating action or an unintended reactor scram which are the same potential effects of failure of the operator to take the correct appropriate action under the current ICAs. The net effect of the modification is to change the method by which an instability event is detected, and by which mitigating action is initiated but does not change the type of stability event that could occur. 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, since no radiological barrier will be challenged as a result of activating the OPRM trip function, it is concluded that this activity will not increase the consequences of an accident previously evaluated nor can OPRM failure cause an accident of a kind not previously evaluated.

Based on the above discussion, the OPRM trip activation phase of PBAPS Modification P00507 will not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. The proposed TS changes do not involve a significant reduction in the margin of safety.

The current safety analyses assume that the existing ICA related Technical Specification requirements are adequate to prevent an instability event. As a result, there is currently no quantitative or qualitative assessment of an instability event with respect to its impact on MCPR.

The OPRM trip function is being implemented to automate the detection (via direct measurement of neutron flux) and subsequent suppression (via scram) 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. Currently, the MCPR Safety Limit is not impacted by an instability event since the event is "mitigated" by manual means via the ICAs, which prevent plant operating conditions where an instability event is possible. In both methods of mitigation (manual and automated), the margin of safety associated with the MCPR Safety Limit is maintained.

Therefore, based on the fact that the MCPR Safety Limit will not be exceeded as a result of an instability event following implementation of the OPRM trip function in place of the existing manual ICAs, it is concluded that the proposed change does not reduce the margin of safety.

Therefore, based on the above discussion the OPRM trip activation phase of PBAPS Modification P00507 does not result in a significant reduction in the margin of safety.

Information Supporting an Environmental Assessment

An Environmental Assessment is not required for the changes proposed by this Technical Specifications Change Request because the requested changes to the Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3, TS conform to the criteria for "actions eligible for categorical exclusion" as specified in 10 CFR 51.22 (c)(9). The requested changes will have no impact on the environment. The proposed changes do not involve a Significant Hazards Consideration as discussed in the preceding section. The proposed changes do not involve a significant change in the types, or a significant increase in the amounts, of any effluents that may be released offsite. In addition, the proposed changes do not involve a significant increase in individual or cumulative occupational radiation exposure.

Conclusion

The Plant Operations Review Committee and the Nuclear Safety Review Board have reviewed and concurred with these proposed changes to the Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3, Technical Specifications.

ATTACHMENT 2

PEACH BOTTOM ATOMIC POWER STATION
UNITS 2 and 3

DOCKET NOS. 50-277
50-278

LICENSE NOS. DPR-44
DPR-56

License Change Application ECR No. 99-00015

Activation of the Trip Outputs of the Oscillation Power Range Monitor Portion of the Power Range Neutron Monitoring System

LIST OF AFFECTED PAGES

UNIT 2	UNIT 2	UNIT 3	UNIT 3
3.3-1	B 3.3-27	3.3-1	B 3.3-27
3.3-3	B 3.3-27a	3.3-3	B 3.3-27a
3.3-3a	B 3.3-32	3.3-3a	B 3.3-32
3.3-5	B 3.3-33	3.3-5	B 3.3-33
3.3-6	B 3.3-34	3.3-6	B 3.3-34
3.3-7	B 3.3-35	3.3-7	B 3.3-35
3.4-1	B 3.3-35a	3.4-1	B 3.3-36
3.4-2	B 3.3-35b	3.4-2	B 3-3-36a
3.4-3	B 3.4-3	3.4-3	B 3.4-3
3.4-4	B 3.4-4	3.4-4	B 3.4-4
3.4-5	B 3.4-5	3.4-5	B 3.4-5
B 3.3-7	B 3.4-6	B 3.3-7	B 3.4-6
B 3.3-8	B 3.4-7	B 3.3-8	B 3.4-7
B 3.3-9	B 3.4-8	B 3.3-9	B 3.4-8
B 3.3-12	B 3.4-9	B 3.3-12	B 3.4-9
B 3.3-12a	B 3.4-10	B 3.3-12a	B 3.4-10
B 3.3-12b	5.0-21	B 3.3-12b	5.0-21
B 3.3-24	5.0-22	B 3.3-24	5.0-22
B 3.3-25		B 3.3-25	

TECH SPEC MARKUP
for
Stability (PRNM) OPRM
Trip Activation MOD
at
PEACH BOTTOM UNIT 2

3.3 INSTRUMENTATION

3.3.1.1 Reactor Protection System (RPS) Instrumentation

LCO 3.3.1.1 The RPS instrumentation for each Function in Table 3.3.1.1-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.1.1-1.

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required channels inoperable.	A.1 Place channel in trip.	12 hours
	OR	
	A.2 -----NOTE----- Not applicable for Functions 2.a, 2.b, 2.c, ~~or~~ 2.d, or 2.f. ----- Place associated trip system in trip.	12 hours
B. -----NOTE----- Not applicable for Functions 2.a, 2.b, 2.c, ~~or~~ 2.d, or 2.f. ----- One or more Functions with one or more required channels inoperable in both trip systems.	B.1 Place channel in one trip system in trip.	6 hours
	OR	
	B.2 Place one trip system in trip.	6 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
H. As required by Required Action D.1 and referenced in Table 3.3.1.1-1.	H.1 Initiate action to fully insert all insertable control rods in core cells containing one or more fuel assemblies.	Immediately

INSERT 1

SURVEILLANCE REQUIREMENTS

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

1. Refer to Table 3.3.1.1-1 to determine which SRs apply for each RPS Function.

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

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.1.1.2	------------------NOTE------------------ Not required to be performed until 12 hours after THERMAL POWER $\geq$ 25% RTP. -- Verify the absolute difference between the average power range monitor (APRM) channels and the calculated power is $\leq$ 2% RTP while operating at $\geq$ 25% RTP.	7 days

(continued)

TECH SPEC MARKUP

INSERT 1:

I. As required by Required Action D.1 and referenced in Table 3.3.1.1-1.	I.1 Initiate alternate method to detect and suppress thermal hydraulic instability oscillations. AND I.2 ----------------NOTE---------------- LCO 3.0.4 is not applicable. -- Restore required channels to OPERABLE.	12 hours 120 days
J. Required Action and associated Completion Time of Condition I not met.	J.1 Reduce THERMAL POWER to <25% RTP.	4 hours

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Dwg ____
Sht ____ Rev ____
initials OMW

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.9	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.1.1.10	------------------NOTE------------------ Radiation detectors are excluded. -- Perform CHANNEL CALIBRATION.	92 days
SR 3.3.1.1.11	------------------NOTES------------------ 1. For Function 2.a, not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2. 2. For Function[s] 2.b [and 2.f], the CHANNEL FUNCTIONAL TEST includes the recirculation flow input processing, excluding the flow transmitters. -- Perform CHANNEL FUNCTIONAL TEST.	184 days
SR 3.3.1.1.12	------------------NOTES------------------ 1. Neutron detectors are excluded. 2. For Function 1, not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2. 3. For Function[s] 2.b [and 2.f], the recirculation flow transmitters that feed the APRMs are included. -- Perform CHANNEL CALIBRATION.	24 months

(continued)

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Dwg
Sht Rev
initials [handwritten initials]

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.13	Verify Turbine Stop Valve—Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure—Low Functions are not bypassed when THERMAL POWER is ≥ 30% RTP.	24 months
SR 3.3.1.1.14	Perform CHANNEL FUNCTIONAL TEST.	24 months
SR 3.3.1.1.15	Perform CHANNEL CALIBRATION.	24 months
SR 3.3.1.1.16	Calibrate each radiation detector.	24 months
SR 3.3.1.1.17	Perform LOGIC SYSTEM FUNCTIONAL TEST.	24 months
SR 3.3.1.1.18	Verify the RPS RESPONSE TIME is within limits.	24 months

INSERT 2

TECH SPEC MARKUP

INSERT 2:

SR 3.3.1.1.19	Verify OPRM is not bypassed when APRM Simulated Thermal Power is ≥ 30% and recirculation drive flow is < 60%.	24 months

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initials OMW ____

Table 3.3.1.1-1 (page 1 of 3)
Reactor Protection System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	CONDITIONS REFERENCED FROM REQUIRED ACTION D.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Wide Range Neutron Monitors					
a. Period-Short	2	3	G	SR 3.3.1.1.1 SR 3.3.1.1.5 SR 3.3.1.1.12 SR 3.3.1.1.17 SR 3.3.1.1.18	≥ 13 seconds
	5(a)	3	H	SR 3.3.1.1.1 SR 3.3.1.1.6 SR 3.3.1.1.12 SR 3.3.1.1.17 SR 3.3.1.1.18	≥ 13 seconds
b. Inop	2	3	G	SR 3.3.1.1.5 SR 3.3.1.1.17	NA
	5(a)	3	H	SR 3.3.1.1.6 SR 3.3.1.1.17	NA
2. Average Power Range Monitors					
a. Neutron Flux-High (Setdown)	2	3(c)	G	SR 3.3.1.1.1 SR 3.3.1.1.8 SR 3.3.1.1.11 SR 3.3.1.1.12	≤ 15.0% RTP
b. Simulated Thermal Power-High	1	3(c)	F	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.8 SR 3.3.1.1.11 SR 3.3.1.1.12	≤ 0.66 W + 64.9% RTP(b) and ≤ 118.0% RTP
c. Neutron Flux-High	1	3(c)	F	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.8 SR 3.3.1.1.11 SR 3.3.1.1.12	≤ 119.7% RTP
d. Inop	1,2	3(c)	G	SR 3.3.1.1.11	NA
e. 2-Out-Of-4 Voter	1,2	2	G	SR 3.3.1.1.1 SR 3.3.1.1.11 SR 3.3.1.1.17 SR 3.3.1.1.18	NA

INSERT 3 →

(continued)

(a) With any control rod withdrawn from a core cell containing one or more fuel assemblies.

(b) ~~0.66 W + 64.9% − 0.66 ΔW~~ RTP when reset for single loop operation per LCO 3.4.1, "Recirculation Loops Operating."

(c) Each APRM channel provides inputs to both trip systems.

INSERT 3A →

0.66 (W − ΔW) + 64.9%

TECH SPEC MARKUP

INSERT 3:

f.	OPRM Upscale	≥ 25% RTP	3[(c)]	I	SR 3.3.1.1.1 SR 3.3.1.1.8 SR 3.3.1.1.11 SR 3.3.1.1.12 SR 3.3.1.1.19	NA[(d)]

INSERT 3A:

(d) See COLR for OPRM period based detection algorithm (PBDA) setpoint limits.

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Dwg ____
Sht ____ Rev ____
initials ____

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 with core flow as a function of THERMAL POWER in the "Unrestricted" Region of Figure 3.4.1-1.

OR

One recirculation loop shall be in operation with core flow as a function of THERMAL POWER in the "Unrestricted" Region of Figure 3.4.1-1 and 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; and

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

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

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or two recirculation loops in operation with core flow as a function of THERMAL POWER in the "Restricted" Region of Figure 3.4.1-1.	A.1	Verify APRM and LPRM neutron flux noise levels are ≤ 4% and ≤ 3 times baseline noise levels.	1 hour AND Once per 8 hours thereafter AND 1 hour after completion of any THERMAL POWER increase ≥ 5% RTP
B. Required Action and associated Completion Time of Condition A not met.	B.1	Restore APRM and LPRM neutron flux noise levels to ≤ 4% and ≤ 3 times baseline noise levels.	2 hours
C. One recirculation loop in operation with core flow ≤ 39% of rated core flow and THERMAL POWER in the "Restricted" Region of Figure 3.4.1-1.	C.1	Reduce THERMAL POWER to the "Unrestricted" Region of Figure 3.4.1-1.	4 hours
	OR		
	C.2	Increase core flow to > 39% of rated core flow.	4 hours

(continued)

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Dwg ____
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initials [handwritten initials] ____

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initials ____

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. D. Requirements of the LCO not met for reasons other than Conditions A, B, C, and F.	A.1 D.1	Satisfy the requirements of the LCO.	24 hours
B. E. Required Action and associated Completion Time of Condition B, C, or D A not met.	B.1 E.1	Be in MODE 3.	12 hours
OR F. No recirculation loops in operation.	F.1	Initiate action to reduce THERMAL POWER to the "Unrestricted" Region of Figure 3.4.1-1.	Immediately
	AND		
	F.2	Be in MODE 3.	6 hours

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Dwg ____
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initials MAD ____

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.4.1.1	--------------------NOTE-------------------- Not required to be performed until 24 hours after both recirculation loops are in operation. -- Verify recirculation loop jet pump flow mismatch with both recirculation loops in operation is: a. $\leq$ 10.25 X 10^6 lbm/hr when operating at < 71.75 X 10^6 lbm/hr; and b. $\leq$ 5.125 X 10^6 lbm/hr when operating at $\geq$ 71.75 X 10^6 lbm/hr.	24 hours
SR 3.4.1.2	Verify core flow as a function of THERMAL POWER is in the "Unrestricted" Region of Figure 3.4.1-1.	24 hours

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initials [signature]

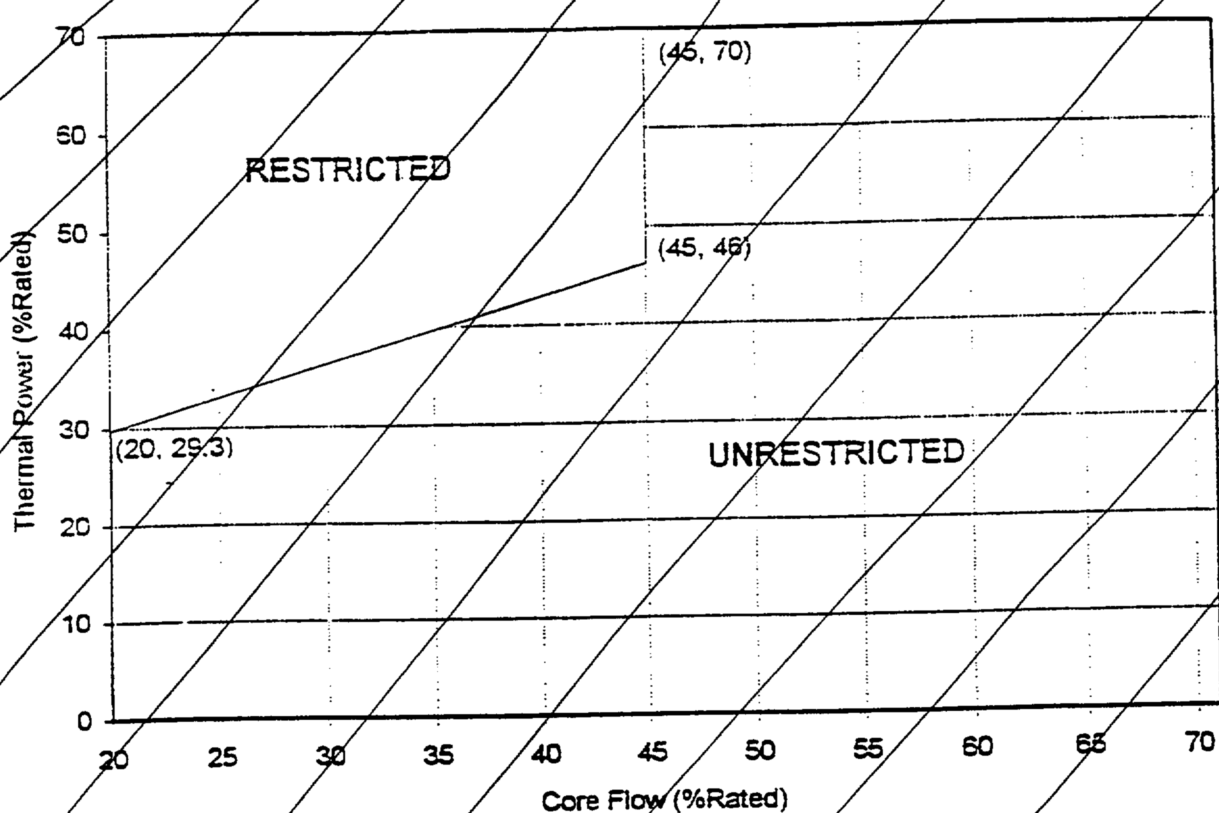

Figure 3.4.1-1 (page 1 of 1)

THERMAL POWER VERSUS CORE FLOW
STABILITY REGIONS

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

1.b. Wide Range Neutron Monitor – Inop (continued)

Six channels of the Wide Range Neutron Monitor – Inop Function, with three channels in each trip system, are required to be OPERABLE to ensure that no single instrument failure will preclude a scram from this Function on a valid signal. Since this Function is not assumed in the safety analysis, there is no Allowable Value for this Function.

This Function is required to be OPERABLE when the Wide Range Neutron Monitor Period-Short Function is required.

Average Power Range Monitor (APRM)

The APRM channels provide the primary indication of neutron flux within the core and respond almost instantaneously to neutron flux increases. The APRM channels receive input signals from the local power range monitors (LPRMs) within the reactor core to provide an indication of the power distribution and local power changes. The APRM channels average these LPRM signals to provide a continuous indication of average reactor power from a few percent to greater than RTP. INSERT 4

The APRM System is divided into four APRM channels and four 2-out-of-4 voter channels. Each APRM channel provides inputs to each of the four voter channels. The four voter channels are divided into two groups of two each, with each group of two providing inputs to one RPS trip system. The system is designed to allow one APRM channel, but no voter channels, to be bypassed. A trip from any one unbypassed APRM will result in a "half-trip" in all four of the voter channels, but no trip inputs to either RPS trip system. INSERT 5 A trip from any two unbypassed APRM channels will result in a full trip in each of the four voter channels, which in turn results in two trip inputs into each RPS trip system, INSERT 6 thus resulting in a full scram signal. INSERT 7 Three of the four APRM channels and all four of the voter channels are required to be OPERABLE to ensure that no single failure will preclude a scram on a valid signal. In addition, to provide adequate coverage of the entire core, consistent with the design bases for the APRM ~~functions~~, INSERT 8 at least 20 LPRM inputs, with at least three LPRM inputs from each of the four axial levels at which the LPRMs are located, must be operable for each APRM channel, and the number of LPRM inputs that have become inoperable (and bypassed) since the last APRM calibration (SR 3.3.1.1.2) must be less than ten for each APRM channel. INSERT 9

(continued)

TECH SPEC MARKUP

INSERT 4:

Each APRM also includes an Oscillation Power Range Monitor (OPRM) Upscale Function which monitors small groups of LPRM signals to detect thermal-hydraulic instabilities.

INSERT 5:

APRM trip Functions 2.a, 2.b, 2.c, and 2.d are voted independently from OPRM Upscale Function 2.f. Therefore, any Function 2.a, 2.b, 2.c, or 2.d

INSERT 6:

logic channel (A1, A2, B1, and B2)

INSERT 7:

Similarly, a Function 2.f trip from any two unbypassed APRM channels will result in a full trip from each of the four voter channels.

INSERT 8:

Functions 2.a, 2.b, and 2.c

INSERT 9:

For the OPRM Upscale, Function 2.f, LPRMs are assigned to "cells" of 3 or 4 detectors. A minimum of 25 cells, each with a minimum of 2 LPRMs, must be OPERABLE for the OPRM Upscale Function 2.f to be OPERABLE.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

2.a. Average Power Range Monitor Neutron Flux-High (Setdown) (continued)

For operation at low power (i.e., MODE 2), the Average Power Range Monitor Neutron Flux-High (Setdown) Function is capable of generating a trip signal that prevents fuel damage resulting from abnormal operating transients in this power range. For most operation at low power levels, the Average Power Range Monitor Neutron Flux-High (Setdown) Function will provide a secondary scram to the Wide Range Neutron Monitor Period-Short Function because of the relative setpoints. At higher power levels, it is possible that the Average Power Range Monitor Neutron Flux-High (Setdown) Function will provide the primary trip signal for a corewide increase in power.

No specific safety analyses take direct credit for the Average Power Range Monitor Neutron Flux-High (Setdown) Function. However, this Function indirectly ensures that before the reactor mode switch is placed in the run position, reactor power does not exceed 25% RTP (SL 2.1.1.1) when operating at low reactor pressure and low core flow. Therefore, it indirectly prevents fuel damage during significant reactivity increases with THERMAL POWER < 25% RTP.

The Allowable Value is based on preventing significant increases in power when THERMAL POWER is < 25% RTP.

The Average Power Range Monitor Neutron Flux-High (Setdown) Function must be OPERABLE during MODE 2 when control rods may be withdrawn since the potential for criticality exists. In MODE 1, the Average Power Range Monitor Neutron Flux-High Function provides protection against reactivity transients and the RWM and rod block monitor protect against control rod withdrawal error events.

2.b. Average Power Range Monitor Simulated Thermal Power-High

The Average Power Range Monitor Simulated Thermal Power-High Function monitors average neutron flux to approximate the THERMAL POWER being transferred to the reactor coolant. The APRM neutron flux is electronically filtered with a time constant representative of the fuel heat transfer dynamics to generate a signal proportional to the THERMAL POWER in the reactor. The trip level is varied as a function of recirculation drive flow (i.e., at lower core flows, the setpoint is reduced proportional to the reduction in power experienced as core flow is reduced with a fixed control rod pattern) but is clamped at an upper limit that is always lower than the Average Power Range Monitor Neutron Flux-High Function Allowable Value.

INSERT 9a

(continued)

TECH SPEC MARKUP

INSERT 9a:

A note is included, applicable when the plant is in single recirculation loop operation per LCO 3.4.1, which requires the flow value, used in the Allowable Value equation, be reduced by ΔW. The value of ΔW is established to conservatively bound the inaccuracy created in the core flow/drive flow correlation due to back flow in the jet pumps associated with the inactive recirculation loop. The allowable value thus maintains thermal margins essentially unchanged from those for two loop operation. The value of ΔW is plant specific and is defined in plant procedures. The allowable value equation for single loop operation is only valid for flows down to $W = \Delta W$; the allowable value does not go below 64.9% RTP. This is acceptable because back flow in the inactive recirculation loop is only evident with drive flows of approximately 35% or greater (Reference 19).

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2.d. Average Power Range Monitor - Inop

Three of the four APRM channels are required to be OPERABLE for each of the APRM Functions. This Function (Inop) provides assurance that the minimum number of APRM channels are OPERABLE.

For any APRM channel, any time its mode switch is not in the "Operate" position, an APRM module required to issue a trip is unplugged, or the automatic self-test system detects a critical fault with the APRM channel, an Inop trip is sent to all four voter channels. Inop trips from two or more ~~non-bypassed~~ unbypassed APRM channels result in a trip output from each of the four voter channels to it's associated trip system. This Function was not specifically credited in the accident analysis, but it is retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

There is no Allowable Value for this Function.

This Function is required to be OPERABLE in the MODES where the APRM Functions are required.

2.e. 2-Out-Of-4 Voter

The 2-Out-Of-4 Voter Function provides the interface between the APRM Functions [INSERT 10] and the final RPS trip system logic. As such, it is required to be OPERABLE in the MODES where the APRM Functions are required and is necessary to support the safety analysis applicable to each of those Functions. Therefore, the 2-Out-Of-4 Voter Function needs to be OPERABLE in MODES 1 and 2.

All four voter channels are required to be OPERABLE. Each voter channel includes self-diagnostic functions. If any voter channel detects a critical fault in its own processing, a trip is issued from that voter channel to the associated trip system.

[INSERT 11] ¶

There is no Allowable Value for this Function.

[INSERT 12]

(continued)

TECH SPEC MARKUP

INSERT 10:

, including the OPRM Upscale Function,

INSERT 11:

The Two-Out-Of-Four Logic Module includes 2-Out-Of-4 Voter hardware and the APRM Interface hardware. The 2-Out-Of-4 Voter Function 2.e votes APRM Functions 2.a, 2.b, 2.c, and 2.d independently of Function 2.f. This voting is accomplished by the 2-Out-Of-4 Voter hardware in the Two-Out-Of-Four Logic Module. The voter includes separate outputs to RPS for the two independently voted sets of Functions, each of which is redundant (four total outputs). The analysis in Reference 12 took credit for this redundancy in the justification of the 12-hour Completion Time for Condition A., so the voter Function 2.e must be declared inoperable if any of its functionality is inoperable. The voter Function 2.e does not need to be declared inoperable due to any failure affecting only the APRM Interface hardware portion of the Two-Out-Of-Four Logic Module.

TECH SPEC MARKUP

INSERT 12:

2.f. Oscillation Power Range Monitor (OPRM) Upscale

The OPRM Upscale Function provides compliance with 10 CFR 50, Appendix A, General Design Criteria (GDC) 10 and 12, thereby providing protection from exceeding the fuel MCPR safety limit (SL) due to anticipated thermal-hydraulic power oscillations.

References 14, 15 and 16 describe three algorithms for detecting thermal-hydraulic instability related neutron flux oscillations: the period based detection algorithm, the amplitude based algorithm, and the growth rate algorithm. All three are implemented in the OPRM Upscale Function, but the safety analysis takes credit only for the period based detection algorithm. The remaining algorithms provide defense in depth and additional protection against unanticipated oscillations. OPRM Upscale Function OPERABILITY for Technical Specification purposes is based only on the period based detection algorithm.

The OPRM Upscale Function receives input signals from the local power range monitors (LPRMs) within the reactor core, which are combined into "cells" for evaluation by the OPRM algorithms. Each channel is capable of detecting thermal-hydraulic instabilities, by detecting the related neutron flux oscillations, and issuing a trip signal before the MCPR SL is exceeded. Three of the four channels are required to be OPERABLE.

The OPRM Upscale trip is automatically enabled (bypass removed) when THERMAL POWER is ≥ 30% RTP, as indicated by the APRM Simulated Thermal Power, and reactor core flow is < 60% of rated flow, as indicated by APRM measured recirculation drive flow. This is the operating region where actual thermal-hydraulic instability and related neutron flux oscillations may occur (Reference 18). These setpoints, which are sometimes referred to as the "auto-bypass" setpoints, establish the boundaries of the OPRM Upscale trip enabled region. The APRM Simulated Thermal Power auto-enable setpoint has 1% deadband while the drive flow setpoint has a 2% deadband. The deadband for these setpoints is established so that it increases the enabled region.

The OPRM Upscale Function is required to be OPERABLE when the plant is at ≥ 25% RTP. The 25% RTP level is selected to provide margin in the unlikely event that a reactor power increase transient occurring while the plant is operating below 30% RTP causes a power increase to or beyond the 30% APRM Simulated Thermal Power OPRM Upscale trip auto-enable setpoint without operator action. This OPERABILITY requirement assures that the OPRM Upscale trip auto-enable function will be OPERABLE when required.

An OPRM Upscale trip is issued from an APRM channel when the period based detection algorithm in that channel detects oscillatory changes in the neutron flux, indicated by the combined signals of the LPRM detectors in a cell, with period confirmations and relative cell amplitude exceeding specified setpoints. One or more cells in a channel exceeding the trip conditions will result in a channel trip. An OPRM Upscale trip is also issued from the channel if either the growth rate or amplitude based algorithms detect oscillatory changes in the neutron flux for one or more cells in that channel.

There are four "sets" of OPRM related setpoints or adjustment parameters: a) OPRM trip auto-enable setpoints for STP (30%) and drive flow (60%); b) period based detection algorithm (PBDA) confirmation count and amplitude setpoints; c) period based detection algorithm tuning parameters; and d) growth rate algorithm (GRA) and amplitude based algorithm (ABA) setpoints.

The first set, the OPRM auto-enable region setpoints, as discussed in the SR 3.3.1.1.19 Bases, are treated as nominal setpoints with no additional margins added. The settings, 30% APRM Simulated Thermal Power and 60% drive flow, are defined (limit values) in and confirmed by SR 3.3.1.1.19. The second set, the OPRM PBDA trip setpoints, are established in accordance with methodologies defined in Reference 16, and are documented in the COLR. There are no allowable values for these setpoints. The third set, the OPRM PBDA "tuning" parameters, are established or adjusted in accordance with and controlled by PBAPS procedures. The forth set, the GRA and ABA setpoints, in accordance with References 14 and 15, are established as nominal values only, and controlled by PBAPS procedures.

ACTIONS

A.1 and A.2 (continued)

Function's inoperable channel is in one trip system and the Function still maintains RPS trip capability (refer to Required Actions B.1, B.2, and C.1 Bases). If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, the channel or the associated trip system must be placed in the tripped condition per Required Actions A.1 and A.2. Placing the inoperable channel in trip (or the associated trip system in trip) would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue. Alternatively, if it is not desired to place the channel (or trip system) in trip (e.g., as in the case where placing the inoperable channel in trip would result in a full scram), Condition D must be entered and its Required Action taken.

As noted, Action A.2 is not applicable for APRM Functions 2.a, 2.b, 2.c, and 2.d. Inoperability of one required APRM channel affects both trip systems. For that condition, Required Action A.1 must be satisfied, and is the only action (other than restoring operability) that will restore capability to accommodate a single failure. Inoperability of more than one required APRM channel of the same trip function results in loss of trip capability and entry into Condition C, as well as entry into Condition A for each channel.

B.1 and B.2

Condition B exists when, for any one or more Functions, at least one required channel is inoperable in each trip system. In this condition, provided at least one channel per trip system is OPERABLE, the RPS still maintains trip capability for that Function, but cannot accommodate a single failure in either trip system.

Required Actions B.1 and B.2 limit the time the RPS scram logic, for any Function, would not accommodate single failure in both trip systems (e.g., one-out-of-one and one-out-of-one arrangement for a typical four channel Function). The reduced reliability of this logic arrangement was not evaluated in References 9, 12 or 13 for the 12 hour Completion Time. Within the 6 hour allowance, the associated Function will have all required channels OPERABLE or in trip (or any combination) in one trip system.

(continued)

ACTIONS

B.1 and B.2 (continued)

Completing one of these Required Actions restores RPS to a reliability level equivalent to that evaluated in References 9, 12 or 13, which justified a 12 hour allowable out of service time as presented in Condition A. The trip system in the more degraded state should be placed in trip or, alternatively, all the inoperable channels in that trip system should be placed in trip (e.g., a trip system with two inoperable channels could be in a more degraded state than a trip system with four inoperable channels if the two inoperable channels are in the same Function while the four inoperable channels are all in different Functions). The decision of which trip system is in the more degraded state should be based on prudent judgment and take into account current plant conditions (i.e., what MODE the plant is in). If this action would result in a scram or RPT, it is permissible to place the other trip system or its inoperable channels in trip.

The 6 hour Completion Time is judged acceptable based on the remaining capability to trip, the diversity of the sensors available to provide the trip signals, the low probability of extensive numbers of inoperabilities affecting all diverse Functions, and the low probability of an event requiring the initiation of a scram.

Alternately, if it is not desired to place the inoperable channels (or one trip system) in trip (e.g., as in the case where placing the inoperable channel or associated trip system in trip would result in a scram, Condition D must be entered and its Required Action taken.

As noted, Condition B is [handwritten: , or 2.f.] not applicable for APRM Functions 2.a, 2.b, 2.c, ~~and~~ 2.d, Inoperability of an APRM channel affects both trip systems and is not associated with a specific trip system as are the APRM 2-Out-Of-4 voter and other non-APRM channels for which Condition B applies. For an inoperable APRM channel, Required Action A.1 must be satisfied, and is the only action (other than restoring operability) that will restore capability to accommodate a single failure. Inoperability of [handwritten: a Function in] more than one required APRM channel results in loss of trip capability [handwritten: for that Function] and entry into Condition C, as well as entry into Condition A for each channel. Because Condition A and C provide Required Actions that are appropriate for the inoperability of APRM Functions 2.a, 2.b, 2.c, ~~and 2.d,~~ [handwritten: 2.d, or 2.f,] and these functions are not associated with specific trip systems as are the APRM 2-Out-Of-4 voter and other non-APRM channels, Condition B does not apply.

(continued)

BASES

ACTIONS (continued)

E.1, F.1, ~~and~~ G.1 and J.1

If the channel(s) is not restored to OPERABLE status or placed in trip (or the associated trip system placed in trip) within the allowed Completion Time, the plant must be placed in a MODE or other specified condition in which the LCO does not apply. The allowed Completion Times are reasonable, based on operating experience, to reach the specified condition from full power conditions in an orderly manner and without challenging plant systems. In addition, the Completion Time of Required Actions E.1 AND J.1 ~~is~~ ARE consistent with the Completion Time provided in LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)."

H.1

If the channel(s) is not restored to OPERABLE status or placed in trip (or the associated trip system placed in trip) within the allowed Completion Time, the plant must be placed in a MODE or other specified condition in which the LCO does not apply. This is done by immediately initiating action to fully insert all insertable control rods in core cells containing one or more fuel assemblies. Control rods in core cells containing no fuel assemblies do not affect the reactivity of the core and are, therefore, not required to be inserted. Action must continue until all insertable control rods in core cells containing one or more fuel assemblies are fully inserted.

INSERT 13

SURVEILLANCE REQUIREMENTS

As noted at the beginning of the SRs, the SRs for each RPS instrumentation Function are located in the SRs column of Table 3.3.1.1-1.

The Surveillances are modified by a Note to indicate that when a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed for up to 6 hours, provided the associated Function maintains RPS 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 reliability analysis (Refs. 9, 12 & 13) assumption of the average time required to perform channel Surveillance. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that the RPS will trip when necessary.

(continued)

TECH SPEC MARKUP

INSERT 13:

I.1

If OPRM Upscale trip capability is not maintained, Condition I exists. References 12 and 13 justified use of alternate methods to detect and suppress oscillations for a limited period of time. The alternate methods are procedurally established consistent with the guidelines identified in Reference 17 requiring manual operator action to scram the plant if certain predefined events occur. The 12-hour allowed Completion Time for Required Action I.1 is based on engineering judgment to allow orderly transition to the alternate methods while limiting the period of time during which no automatic or alternate detect and suppress trip capability is formally in place. Based on the small probability of an instability event occurring at all, the 12 hours is judged to be reasonable.

I.2

The alternate method to detect and suppress oscillations implemented in accordance with I.1 was evaluated (References 12 and 13) based on use up to 120 days only. The evaluation, based on engineering judgment, concluded that the likelihood of an instability event that could not be adequately handled by the alternate methods during this 120-day period was negligibly small. The 120-day period is intended to be an outside limit to allow for the case where design changes or extensive analysis might be required to understand or correct some unanticipated characteristic of the instability detection algorithms or equipment. This action is not intended and was not evaluated as a routine alternative to returning failed or inoperable equipment to OPERABLE status. Correction of routine equipment failure or inoperability is expected to be normally be accomplished within the completion times allowed for Actions for Condition A.

A note is provided to indicate that LCO 3.0.4 is not applicable. The intent of that note is to allow plant start-up while within the 120-day completion time for action I.2. The primary purpose of this exclusion is to allow an orderly completion of design and verification activities, in the event of a required design change, without undue impact on plant operation.

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.9 and SR 3.3.1.1.14 (continued)

In addition, Function 5 and 7 instruments are not accessible while the unit is operating at power due to high radiation and the installed indication instrumentation does not provide accurate indication of the trip setting. For the Function 9 channels, verification that the trip settings are less than or equal to the specified Allowable Value during the CHANNEL FUNCTIONAL TEST is not required since the instruments are not accessible while the unit is operating at power due to high radiation and the installed indication instrumentation does not provided accurate indication of the trip setting. Waiver of these verifications for the above functions is considered acceptable since the magnitude of drift assumed in the setpoint calculation is based on a 24 month calibration interval. The 92 day Frequency of SR 3.3.1.1.9 is based on the reliability analysis of Reference 9.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components will pass the Surveillance when performed at the 24 month Frequency.

SR 3.3.1.1.10, SR 3.3.1.1.12, SR 3.3.1.1.15, and SR 3.3.1.1.16

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies that 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 current plant specific setpoint methodology. ~~SR 3.3.1.1.16, however, is only a calibration of the radiation detectors using a standard radiation source.~~

INSERT 13a

As noted for SR 3.3.1.1.12, neutron detectors are excluded from CHANNEL CALIBRATION because they are passive devices, with minimal drift, and because of the difficulty of simulating a meaningful signal. Changes in

(continued)

TECH SPEC MARKUP

INSERT 13a:

As noted for SR 3.3.1.1.10, radiation detectors are excluded from CHANNEL CALIBRATION due to ALARA reasons (when the plant is operating, the radiation detectors are generally in a high radiation area; the steam tunnel). This exclusion is acceptable because the radiation detectors are passive devices, with minimal drift. To complete the radiation CHANNEL CALIBRATION, SR 3.3.1.1.16 requires that the radiation detectors be calibrated on a once per 24 months Frequency.

The once per 92 days Frequency of SR 3.3.1.1.10 is conservative with respect to the magnitude of equipment drift assumed in the setpoint analysis. The Frequency of SR 3.3.1.1.16 is based upon the assumption of a 24-month calibration interval used in the determination of the equipment drift in the setpoint analysis.

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.10, SR 3.3.1.1.12, SR 3.3.1.1.15, and SR 3.3.1.1.16 (continued)

neutron detector sensitivity are compensated for by performing the 7 day calorimetric calibration (SR 3.3.1.1.2) and the 1000 MWD/T LPRM calibration against the TIPs (SR 3.3.1.1.8). [INSERT ¶ BREAK] A second note is provided for SR 3.3.1.1.12 that allows the WRNM SR to be performed within 12 hours of entering MODE 2 from MODE 1. Testing of the MODE 2 WRNM Functions cannot be performed in MODE 1 without utilizing jumpers, lifted leads or movable links. This Note allows entry into MODE 2 from MODE 1, if the 24 month Frequency is not met per SR 3.0.2. Twelve hours is based on operating experience and in consideration of providing a reasonable time in which to complete the SR. For the APRM Simulated Thermal Power-High Function, SR 3.3.1.1.12 also includes calibrating the associated recirculation loop flow channel. A third note is provided for SR 3.3.1.1.12 to include the recirculation flow transmitters that feed the APRMs as applied to Function 2.b. The Average Power Range Monitor Simulated Thermal Power-High Function uses the recirculation loop drive flows to vary the trip setpoint. This SR ensures that the recirculation flow transmitters that supply the recirculation flow signal to the APRMs respond to the measured recirculation flow within the necessary range and accuracy by use of a standard pressure source.

As noted for SR 3.3.1.1.10, radiation detectors are excluded from CHANNEL CALIBRATION due to ALARA reasons (when the plant is operating, the radiation detectors are generally in a high radiation area; the steam tunnel). This exclusion is acceptable because the radiation detectors are passive devices, with minimal drift. The radiation detectors are calibrated in accordance with SR 3.3.1.1.16 on a 24 month Frequency.

The 92 day Frequency of SR 3.3.1.1.10 is conservative with respect to the magnitude of equipment drift assumed in the setpoint analysis. The Frequencies of SR 3.3.1.1.12, SR 3.3.1.1.15 and SR 3.3.1.1.16 are based upon the assumption of a 24 month calibration interval in the determination of the magnitude of equipment drift in the applicable setpoint analysis.

[INSERT 13b]

SR 3.3.1.1.11

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the

(continued)

TECH SPEC MARKUP

INSERT 13b:

A third note is provided for SR 3.3.1.1.12 that includes in the SR the recirculation flow (drive flow) transmitters, which supply the flow signal to the APRMs. The APRM Simulated Thermal Power-High Function (Function 2.b) and the OPRM Upscale Function (Function 2.f), both require a valid drive flow signal. The APRM Simulated Thermal Power-High Function uses drive flow to vary the trip setpoint. The OPRM Upscale Function uses drive flow to automatically enable or bypass the OPRM Upscale trip output to RPS. A CHANNEL CALIBRATION of the APRM drive flow signal requires both calibrating the drive flow transmitters and establishing a valid drive flow / core flow relationship. The drive flow / core flow relationship is established once per refuel cycle, while operating at or near rated power and flow conditions. This method of correlating core flow and drive flow is consistent with GE recommendations. Changes throughout the cycle in the drive flow / core flow relationship due to the changing thermal hydraulic operating conditions of the core are accounted for in the margins included in the bases or analyses used to establish the setpoints for the APRM Simulated Thermal Power-High Function and the OPRM Upscale Function.

The Frequencies of SR 3.3.1.1.12 and SR 3.3.1.1.15 are based upon the assumption of a 24-month calibration interval used in the determination of the equipment drift in the setpoint analysis.

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.11 (continued)

intended function. For the APRM Functions, this test supplements the automatic self-test functions that operate continuously in the APRM and voter channels. The APRM CHANNEL FUNCTIONAL TEST covers the APRM channels (including recirculation flow processing - applicable to Function 2.b only), the 2-Out-Of 4 voter channels, and the interface connections into the RPS trip systems from the voter channels. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. The 184 day Frequency of SR 3.3.1.1.11 is based on the reliability analyses of References 12 and 13. (NOTE: The actual voting logic of the 2-Out-Of-4 Voter Function is tested as part of SR 3.3.1.1.17.)

INSERT 13c

INSERT 13d

A Note is provided for Function 2.a that requires this SR to be performed within 12 hours of entering MODE 2 from MODE 1. Testing of the MODE 2 APRM Function cannot be performed in MODE 1 without utilizing jumpers or lifted leads. This Note allows entry into MODE 2 from MODE 1 if the associated Frequency is not met per SR 3.0.2.

A second Note is provided for Function 2.b that clarifies that the CHANNEL FUNCTIONAL TEST for Function 2.b includes testing of the recirculation flow processing electronics, excluding the flow transmitters.

SR 3.3.1.1.13

This SR ensures that scrams initiated from the Turbine Stop Valve – Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure – Low Functions will not be inadvertently bypassed when THERMAL POWER is ≥ 30% RTP. This involves calibration of the bypass channels. Adequate margins for the instrument setpoint methodologies are incorporated into the Allowable Value (≤ 29.4% RTP which is equivalent to ≤ 138.4 psig as measured from turbine first stage pressure) and the actual setpoint. Because main turbine bypass flow can affect this setpoint nonconservatively (THERMAL POWER is derived from turbine first stage pressure), the main turbine bypass valves must remain closed during the calibration at THERMAL POWER ≥ 30% RTP to ensure that the calibration is valid.

If any bypass channel's setpoint is nonconservative (i.e., the Functions are bypassed at ≥ 30% RTP, either due to open main turbine bypass valve(s) or other reasons), then the

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TECH SPEC MARKUP

INSERT 13c:

and the auto-enable portion of Function 2.f

INSERT 13d:

The actual auto-enable setpoints for the OPRM Upscale trip are confirmed by SR 3.3.1.1.19.

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.13 (continued)

affected Turbine Stop Valve—Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure—Low Functions are considered inoperable. Alternatively, the bypass channel can be placed in the conservative condition (nonbypass). If placed in the nonbypass condition, this SR is met and the channel is considered OPERABLE.

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

SR 3.3.1.1.17

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required trip logic for a specific channel. The functional testing of control rods (LCO 3.1.3), and SDV vent and drain valves (LCO 3.1.8), overlaps this Surveillance to provide complete testing of the assumed safety function.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components will pass the Surveillance when performed at the 24 month Frequency.

The LOGIC SYSTEM FUNCTIONAL TEST for APRM Function 2.e simulates APRM [handwritten insertion: and OPRM] trip conditions at the 2-Out-Of-4 voter channel inputs to check all combinations of two tripped inputs to the 2-Out-Of-4 logic in the voter channels and APRM related redundant RPS relays.

SR 3.3.1.1.18

This SR ensures that the individual channel response times are maintained less than or equal to the original design value. The RPS RESPONSE TIME acceptance criterion is included in Reference 11.

RPS RESPONSE TIME tests are conducted on a 24 month Frequency. The 24 month Frequency is consistent with the PBAPS refueling cycle and is based upon plant operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences.

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TECH SPEC MARKUP

INSERT 14:

SR 3.3.1.1.19

This surveillance involves confirming the OPRM Upscale trip auto-enable setpoints. The auto-enable setpoint values are considered to be nominal values as discussed in Reference 18. This surveillance ensures that the OPRM Upscale trip is enabled (not bypassed) for the correct values of APRM Simulated Thermal Power and recirculation drive flow. Other surveillances ensure that the APRM Simulated Thermal Power and recirculation drive flow properly correlate with THERMAL POWER (SR 3.3.1.1.2) and core flow (SR 3.3.1.1.12), respectively.

If any auto-enable setpoint is nonconservative (i.e., the OPRM Upscale trip is bypassed when APRM Simulated Thermal Power ≥ 30% and recirculation drive flow < 60%), then the affected channel is considered inoperable for the OPRM Upscale Function. Alternatively, the OPRM Upscale trip auto-enable setpoint(s) may be adjusted to place the channel in a conservative condition (not bypassed). If the OPRM Upscale trip is placed in the not-bypassed condition, this SR is met and the channel is considered OPERABLE.

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

REFERENCES

1. UFSAR, Section 7.2.

2. UFSAR, Chapter 14.

3. NEDO-32368, "Nuclear Measurement Analysis and Control Wide Range Neutron Monitoring System Licensing Report for Peach Bottom Atomic Power Station, Units 2 and 3," November 1994.

4. NEDC-32183P, "Power Rerate Safety Analysis Report for Peach Bottom 2 & 3," dated May 1993.

5. UFSAR, Section 14.6.2.

6. UFSAR, Section 14.5.4.

7. UFSAR, Section 14.5.1.

8. P. Check (NRC) letter to G. Lainas (NRC), "BWR Scram Discharge System Safety Evaluation," December 1, 1980.

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

10. MDE-87-0485-1, "Technical Specification Improvement Analysis for the Reactor Protection System for Peach Bottom Atomic Power Station Units 2 and 3," October 1987.

11. UFSAR, Section 7.2.3.9.

12. NEDC-32410P-A, "Nuclear Measurement Analysis and Control Power Range Neutron Monitor (NUMAC PRNM) Retrofit Plus Option III Stability Trip Function", ~~March~~ October 1995.

13. NEDC-32410P Supplement 1, "Nuclear Measurement Analysis and Control Power Range Neutron Monitor (NUMAC PRNM) Retrofit Plus Option III Stability Trip Function, Supplement 1", November 1997.

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TECH SPEC MARKUP

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14. NEDO-31960-A, "BWR Owners' Group Long-Term Stability Solutions Licensing Methodology," November 1995.

15. NEDO-31960-A, Supplement 1, "BWR Owners' Group Long-Term Stability Solutions Licensing Methodology," November 1995.

16. NEDO-32465-A, "BWR Owners' Group Long-Term Stability Detect and Suppress Solutions Licensing Basis Methodology And Reload Applications," August 1996.

17. Letter, L. A. England (BWROG) to M. J. Virgilio, "BWR Owners' Group Guidelines for Stability Interim Corrective Action", June 6, 1994.

18. BWROG Letter 96113, K. P. Donovan (BWROG) to L. E. Phillips (NRC), "Guidelines for Stability Option III 'Enable Region' (TAC M92882)," September 17, 1996.

19. NEDO-24229-1, "Peach Bottom Atomic Power Station Units 2 and 3 Single-Loop Operation," May 1980.

APPLICABLE SAFETY ANALYSES (continued)

Plant specific LOCA and average power range monitor/rod block monitor Technical Specification/maximum extended load line limit analyses have been performed assuming only one operating recirculation loop. These analyses demonstrate 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 (Refs. 2, 3, and 4).

The transient analyses of Chapter 14 of the UFSAR have also been performed for single recirculation loop operation (Ref. 5) 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 (RPS) average power range monitor (APRM) instrument setpoints is also required to account for the different relationships between recirculation drive flow and reactor core flow. The MCPR limits and APLHGR limits (power-dependent APLHGR multipliers, $MAPFAC_p$, and flow-dependent APLHGR multipliers, $MAPFAC_f$) for single loop operation are specified in the COLR. The APRM Simulated Thermal Power-High Allowable Value is in LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation."

Safety analyses performed for UFSAR Chapter 14 implicitly assume core conditions are stable. However, at the high power/low flow corner of the power/flow map, an increased probability for limit cycle oscillations exists (Ref. 6) depending on combinations of operating conditions (e.g., power shape, bundle power, and bundle flow). Generic evaluations indicate that when regional power oscillations become detectable on the APRMs, the safety margin may be insufficient under some operating conditions to ensure actions taken to respond to the APRMs signals would prevent violation of the MCPR Safety Limit (Ref. 7). NRC Generic Letter 86-02 (Ref. 8) addressed stability calculation methodology and stated that due to uncertainties, 10 CFR 50, Appendix A, General Design Criteria (GDC) 10 and 12 could not be met using analytic procedures on a BWR 4 design. However, Reference 8 concluded that operating limitations which provide for the detection (by monitoring neutron flux noise levels) and suppression of flux oscillations in operating regions of potential instability consistent with

(continued)

APPLICABLE SAFETY ANALYSES (continued)

the recommendations of Reference 6 are acceptable to demonstrate compliance with GDC 10 and 12. The NRC concluded that regions of potential instability could occur at calculated decay ratios of 0.8 or greater by the General Electric methodology.

Stability tests at operating BWRs were reviewed to determine a generic region of the power/flow map in which surveillance of neutron flux noise levels should be performed. A conservative decay ratio was chosen as the basis for determining the generic region for surveillance to account for the plant to plant variability of decay ratio with core and fuel designs. This decay ratio also helps ensure sufficient margin to an instability occurrence is maintained. The generic region ("Restricted" Region of Figure 3.4.1-1) has been determined to be bounded by the 80% rod line and the 45% core flow line. This conforms to Reference 6 recommendations. Operation is permitted in the "Restricted" Region when two recirculation loops are in operation provided neutron flux noise levels are verified to be within limits. Operation is permitted in the "Restricted" Region when only one recirculation loop is in operation provided core flow is > 39% of rated core flow and neutron flux levels are verified to be within limits. Single recirculation loop operation in the "Restricted" Region with core flow ≤ 39% of rated core flow shall be avoided due to the increased potential for thermal hydraulic instability in this condition. The "Unrestricted" Region of Figure 3.4.1-1 is the area of the power/flow map where unrestricted operation (with respect to thermal hydraulic stability concerns) is allowed, and includes any area not shown as the "Restricted" Region of the figure. The full power/flow map is not shown in Figure 3.4.1-1 to enhance the readability of the bounds of the "Restricted" Region. Operation outside the bounds of Figure 3.4.1-1 is governed by the plant operating procedures.

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

LCO

Two recirculation loops are normally required to be in operation with their flows matched within the limits specified in SR 3.4.1.1 to ensure that during a LOCA caused by a break of the piping of one recirculation loop the

(continued)

LCO

assumptions of the LOCA analysis are satisfied. In addition, the core flow expressed as a function of THERMAL POWER must be in the "Unrestricted" Region of Figure 3.4.1-1, "THERMAL POWER Versus Core Flow Stability Regions." Alternatively, with only one recirculation loop in operation, modifications to the required APLHGR limits (power- and flow-dependent APLHGR multipliers, $MAPFAC_P$ and $MAPFAC_f$, respectively of LCO 3.2.1, "AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)"), MCPR limits (LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)") and APRM Simulated Thermal Power-High Allowable Value (LCO 3.3.1.1) must be applied to allow continued operation consistent with the assumptions of References 5 and 6.

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

APPLICABILITY

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

(continued)

ACTIONS

A.1

With one or two recirculation loops in operation with core flow as a function of THERMAL POWER in the "Restricted" Region of Figure 3.4.1-1, the plant is operating in a region where the potential for thermal hydraulic instability exists. In order to assure sufficient margin is provided for operator response to detect and suppress potential limit cycle oscillations, APRM and local power range monitor

(LPRM) neutron flux noise levels must be periodically monitored and verified to be ≤ 4% and ≤ 3 times baseline noise levels. Detector levels A and C of one LPRM string per core quadrant plus detectors A and C of one LPRM string in the center of the core shall be monitored. A minimum of three APRMs shall also be monitored. The Completion Times of this verification (within 1 hour and once per 8 hours thereafter and within 1 hour after completion of any THERMAL POWER increase ≥ 5% RATED THERMAL POWER) are acceptable for ensuring potential limit cycle oscillations are detected to allow operator response to suppress the oscillation. These Completion Times were developed considering the operator's inherent knowledge of reactor status and sensitivity to potential thermal hydraulic instabilities when operating in this condition.

B.1

With the Required Action and associated Completion Time of Condition A not met, sufficient margin may not be available for operator response to suppress potential limit cycle oscillations since APRM or LPRM neutron flux noise levels may be > 4% and > 3 times baseline noise levels. As a result, action must be immediately initiated to restore noise levels to within required limits. The 2 hour Completion Time for restoring APRM and LPRM neutron flux noise levels to within required limits is acceptable because it minimizes risk while allowing time for restoration before subjecting the plant to transients associated with shutdown.

(continued)

BASES

ACTIONS (continued)

C.1 and C.2

With one recirculation loop in operation with core flow ≤ 39% of rated core flow and THERMAL POWER in the "Restricted" Region of Figure 3.4.1-1, an increased potential for thermal hydraulic instability exists. As a result, immediate action should be initiated to reduce THERMAL POWER to the "Unrestricted" Region of Figure 3.4.1-1 or increase core flow to > 39% of rated core flow. The

4 hour Completion Time provides a reasonable amount of time to complete the Required Action and is considered acceptable based on the frequent core monitoring by the operators (Required Action A.1) allowing potential limit cycle oscillations to be quickly detected.

A.1 D.1

With the requirements of the LCO not met for reasons other than Conditions A, B, C, and F, NO RECIRCULATION LOOPS IN OPERATION the recirculation loops must be restored to operation with matched flows 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. The loop with the lower flow must be considered not in operation. (However, the flow rate of both loops shall be used for the purposes of determining if the THERMAL POWER and core flow combination is in the Unrestricted Region of Figure 3.4.1-1.) 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 operating limits and RPS setpoints, operation with only one recirculation loop would satisfy the requirements of the LCO and the initial conditions of the accident sequence.

The 24 hour Completion Time is based on the low probability of an accident occurring during this time period, on a reasonable time to complete the Required Action, and on frequent core monitoring by operators allowing abrupt changes in core flow conditions to be quickly detected.

(continued)

ACTIONS A.1 ~~D.1~~ (continued)

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 pump speeds to re-establish forward flow or by tripping the pump.

B.1 ~~E.1~~

With no recirculation loops in operation or the ~~any~~ Required Action A and associated Completion Time of Condition ~~B, C, or D~~ not met, the plant must 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.

~~F.1~~

~~With no recirculation loops in operation, the plant must be brought to a MODE in which the LCO does not apply. Action must be initiated immediately to reduce THERMAL POWER to be within the "Unrestricted" Region of Figure 3.4.1-1 to assure thermal hydraulic stability concerns are addressed. The plant is then required to be placed in MODE 3 in 6 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 is reasonable to reach MODE 3 considering the potential for thermal hydraulic instability in this condition.~~

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.4.1.1

This SR ensures the recirculation loops are within the allowable limits for mismatch. At low core flow (i.e., < 71.75 X 10^6 lbm/hr), the MCPR requirements provide larger margins to the fuel cladding integrity Safety Limit such that the potential adverse effect of early boiling transition during a LOCA is reduced. A larger flow mismatch can therefore be allowed when core flow is < 71.75 X 10^6 lbm/hr. 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 core flow. (Rated core flow is 102.5 X 10^6 lbm/hr. The first limit is based on mismatch ≤ 10% of rated core flow when operating at < 70% of rated core flow. The second limit is based on mismatch ≤ 5% of rated core flow when operating at ≥ 70% of rated core flow.) If the flow mismatch exceeds the specified limits, the loop with the lower flow is considered not in operation. ~~(However, for the purposes of performing SR 3.4.1.2, the flow rate of both loops shall be used.)~~ The 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 Surveillance 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.

~~SR 3.4.1.2~~

~~This SR ensures the reactor THERMAL POWER and core flow are within appropriate parameter limits to prevent uncontrolled power oscillations. At low recirculation flows and high reactor power, the reactor exhibits increased susceptibility to thermal hydraulic instability. Figure 3.4.1-1 is based on guidance provided in Reference 6, which is used to respond to operation in these conditions. The 24 hour Frequency is based on operating experience and the operators' inherent knowledge of reactor status, including significant changes in THERMAL POWER and core flow.~~

(continued)

BASES

REFERENCES

1. UFSAR, Section 14.6.3.

2. NEDC-32163P, "PBAPS Units 2 and 3 SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis," January 1993.

3. NEDC-32162P, "Maximum Extended Load Line Limit and ARTS Improvement Program Analyses for Peach Bottom Atomic Power Station Unit 2 and 3," Revision 1, February 1993.

4. NEDC-32428P, "Peach Bottom Atomic Power Station Unit 2 Cycle 11 ARTS Thermal Limits Analyses," December 1994.

5. NEDO-24229-1, "PBAPS Units 2 and 3 Single-Loop Operation," May 1980.

6. GE Service Information Letter No. 380, "BWR Core Thermal Hydraulic Stability," Revision 1, February 10, 1984.

7. NRC Bulletin 88-07, "Power Oscillations in Boiling Water Reactors (BWRs)," Supplement 1, December 30, 1988.

8. NRC Generic Letter 86-02, "Technical Resolution of Generic Issue B-19 Thermal Hydraulic Stability," January 22, 1986.

5.6.5 CORE OPERATING LIMITS REPORT (COLR)

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

1. The Average Planar Linear Heat Generation Rate for Specification 3.2.1;

2. The Minimum Critical Power Ratio for Specifications 3.2.2 and 3.3.2.1;

3. The Linear Heat Generation Rate for Specification 3.2.3; and

4. The Control Rod Block Instrumentation for Specification 3.3.2.1.

INSERT 16

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. NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel" (latest approved version as specified in the COLR);

2. NEDC-32162P, "Maximum Extended Load Line Limit and ARTS Improvement Program Analyses for Peach Bottom Atomic Power Station Units 2 and 3," Revision 2, March, 1995;

3. PECo-FMS-0001-A, "Steady-State Thermal Hydraulic Analysis of Peach Bottom Units 2 and 3 using the FIBWR Computer Code";

4. PECo-FMS-0002-A, "Method for Calculating Transient Critical Power Ratios for Boiling Water Reactors (RETRAN-TCPPECo)";

5. PECo-FMS-0003-A, "Steady-State Fuel Performance Methods Report";

6. PECo-FMS-0004-A, "Methods for Performing BWR Systems Transient Analysis";

(continued)

TECH SPEC MARKUP

INSERT 16:

5. The Oscillation Power Range Monitor (OPRM) Instrumentation for Specification 3.3.1.1.

PB ECR 99-00015 Rev
Attachment Page 98 of
Dwg
Sht Rev
initials [handwritten initials]

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

7. PECo-FMS-0005-A, "Methods for Performing BWR Steady-State Reactor Physics Analysis"; and

8. PECo-FMS-0006-A, "Methods for Performing BWR Reload Safety Evaluations."

INSERT 17

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

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

5.6.6 Post Accident Monitoring (PAM) Instrumentation Report

When a report is required by Condition B or F of LCO 3.3.3.1, "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.

TECH SPEC MARKUP

INSERT 17:

9. NEDO-32465-A, "BWR Owners' Group Long-Term Stability Detect and Suppress Solutions Licensing Basis Methodology And Reload Applications," August 1996.

3.3 INSTRUMENTATION

3.3.1.1 Reactor Protection System (RPS) Instrumentation

LCO 3.3.1.1 The RPS instrumentation for each Function in Table 3.3.1.1-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.1.1-1.

ACTIONS

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

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more required channels inoperable.	A.1	Place channel in trip.	12 hours
	OR		
	A.2	--------NOTE--------- Not applicable for Functions 2.a, 2.b, 2.c, 2.d, or 2.f. --------------------- Place associated trip system in trip.	12 hours
B. --------NOTE--------- Not applicable for Functions 2.a, 2.b, 2.c, 2.d, or 2.f. --------------------- One or more Functions with one or more required channels inoperable in both trip systems.	B.1	Place channel in one trip system in trip.	6 hours
	OR		
	B.2	Place one trip system in trip.	6 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
H. As required by Required Action D.1 and referenced in Table 3.3.1.1-1.	H.1 Initiate action to fully insert all insertable control rods in core cells containing one or more fuel assemblies.	Immediately
I. As required by Required Action D.1 and referenced in Table 3.3.1.1-1.	I.1 Initiate alternate method to detect and suppress thermal hydraulic instability oscillations.	12 hours
	AND	
	I.2 --------NOTE-------- LCO 3.0.4 is not applicable. -------------------- Restore required channels to OPERABLE.	120 days
J. Required Action and associated Completion Time of Condition I not met.	J.1 Reduce THERMAL POWER to <25% RTP.	4 hours

SURVEILLANCE REQUIREMENTS

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

1. Refer to Table 3.3.1.1-1 to determine which SRs apply for each RPS Function.

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

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.1.1.2	------------------NOTE------------------ Not required to be performed until 12 hours after THERMAL POWER ≥ 25% RTP. --------------------------------------- Verify the absolute difference between the average power range monitor (APRM) channels and the calculated power is ≤ 2% RTP while operating at ≥ 25% RTP.	7 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.9	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.1.1.10	------------------NOTE------------------ Radiation detectors are excluded. -- Perform CHANNEL CALIBRATION.	92 days
SR 3.3.1.1.11	------------------NOTES----------------- 1. For Function 2.a, not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2. 2. For Functions 2.b and 2.f, the CHANNEL FUNCTIONAL TEST includes the recirculation flow input processing, excluding the flow transmitters -- Perform CHANNEL FUNCTIONAL TEST.	184 days
SR 3.3.1.1.12	------------------NOTES----------------- 1. Neutron detectors are excluded. 2. For Function 1, not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2. 3. For Functions 2.b and 2.f, the recirculation flow transmitters that feed the APRMs are included. -- Perform CHANNEL CALIBRATION.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.13	Verify Turbine Stop Valve—Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure—Low Functions are not bypassed when THERMAL POWER is ≥ 30% RTP.	24 months
SR 3.3.1.1.14	Perform CHANNEL FUNCTIONAL TEST.	24 months
SR 3.3.1.1.15	Perform CHANNEL CALIBRATION.	24 months
SR 3.3.1.1.16	Calibrate each radiation detector.	24 months
SR 3.3.1.1.17	Perform LOGIC SYSTEM FUNCTIONAL TEST.	24 months
SR 3.3.1.1.18	Verify the RPS RESPONSE TIME is within limits.	24 months
SR 3.3.1.1.19	Verify OPRM is not bypassed when APRM Simulated Thermal Power is ≥30% and recirculation drive flow is <60%.	24 months

Table 3.3.1.1-1 (page 1 of 3)
Reactor Protection System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	CONDITIONS REFERENCED FROM REQUIRED ACTION D.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Wide Range Neutron Monitors					
a. Period-Short	2	3	G	SR 3.3.1.1.1 SR 3.3.1.1.5 SR 3.3.1.1.12 SR 3.3.1.1.17 SR 3.3.1.1.18	≥ 13 seconds
	5[(a)]	3	H	SR 3.3.1.1.1 SR 3.3.1.1.6 SR 3.3.1.1.12 SR 3.3.1.1.17 SR 3.3.1.1.18	≥ 13 seconds
b. Inop	2	3	G	SR 3.3.1.1.5 SR 3.3.1.1.17	NA
	5[(a)]	3	H	SR 3.3.1.1.6 SR 3.3.1.1.17	NA
2. Average Power Range Monitors					
a. Neutron Flux-High (Setdown)	2	3[(c)]	G	SR 3.3.1.1.1 SR 3.3.1.1.8 SR 3.3.1.1.11 SR 3.3.1.1.12	≤ 15.0% RTP
b. Simulated Thermal Power-High	1	3[(c)]	F	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.8 SR 3.3.1.1.11 SR 3.3.1.1.12	≤ 0.66 W + 64.9% RTP[(b)] and ≤ 118.0% RTP
c. Neutron Flux-High	1	3[(c)]	F	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.8 SR 3.3.1.1.11 SR 3.3.1.1.12	≤ 119.7% RTP
d. Inop	1,2	3[(c)]	G	SR 3.3.1.1.11	NA
e. 2-Out-Of-4 Voter	1,2	2	G	SR 3.3.1.1.1 SR 3.3.1.1.11 SR 3.3.1.1.17 SR 3.3.1.1.18	NA
f. OPRM Upscale	≥25% RTP	3[(c)]	I	SR 3.3.1.1.1 SR 3.3.1.1.8 SR 3.3.1.1.11 SR 3.3.1.1.12 SR 3.3.1.1.19	NA[(d)]

(continued)

(a) With any control rod withdrawn from a core cell containing one or more fuel assemblies.

(b) 0.66 (W - ΔW) + 64.9% RTP when reset for single loop operation per LCO 3.4.1, "Recirculation Loops Operating."

(c) Each APRM channel provides inputs to both trip systems.

(d) See COLR for OPRM period based detection algorithm (PBDA) setpoint limits.

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; and

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

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

APPLICABILITY: MODES 1 and 2.

ACTIONS

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ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Requirements of the LCO not met.	A.1	Satisfy the requirements of the LCO.	24 hours
B. Required Action and associated Completion Time of Condition A not met. <u>OR</u> No recirculation loops in operation.	B.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. $\leq 10.25 \times 10^6$ lbm/hr when operating at $< 71.75 \times 10^6$ lbm/hr; and b. $\leq 5.125 \times 10^6$ lbm/hr when operating at $\geq 71.75 \times 10^6$ lbm/hr.	24 hours

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

1.b. Wide Range Neutron Monitor—Inop (continued)

Six channels of the Wide Range Neutron Monitor—Inop Function, with three channels in each trip system, are required to be OPERABLE to ensure that no single instrument failure will preclude a scram from this Function on a valid signal. Since this Function is not assumed in the safety analysis, there is no Allowable Value for this Function.

This Function is required to be OPERABLE when the Wide Range Neutron Monitor Period-Short Function is required.

Average Power Range Monitor (APRM)

The APRM channels provide the primary indication of neutron flux within the core and respond almost instantaneously to neutron flux increases. The APRM channels receive input signals from the local power range monitors (LPRMs) within the reactor core to provide an indication of the power distribution and local power changes. The APRM channels average these LPRM signals to provide a continuous indication of average reactor power from a few percent to greater than RTP. Each APRM also includes an Oscillation Power Range Monitor (OPRM) Upscale Function which monitors small groups of LPRM signals to detect thermal-hydraulic instabilities.

The APRM System is divided into four APRM channels and four 2-out-of-4 voter channels. Each APRM channel provides inputs to each of four voter channels. The four voter channels are divided into two groups of two each, with each group of two providing inputs to one RPS trip system. The system is designed to allow one APRM channel, but no voter channels, to be bypassed. A trip from any one unbypassed APRM will result in a "half-trip" in all four of the voter channels, but no trip inputs to either RPS trip system. APRM trip Functions 2.a, 2.b, 2.c, and 2.d are voted independently from OPRM Upscale Function 2.f. Therefore, any Function 2.a, 2.b, 2.c, or 2.d trip from any two unbypassed APRM channels will result in a full trip in each of the four voter channels, which in turn results in two trip inputs into each RPS trip system logic channel (A1, A2, B1, and B2), thus resulting in a full scram signal. Similarly, a Function 2.f trip from any two unbypassed APRM channels will result in a full trip from each of the four voter channels. Three of the four APRM channels and all four of the voter channels are required to be OPERABLE to ensure that no single failure will preclude a scram on a valid signal. In addition, to provide adequate coverage of the entire core, consistent with the design bases for the APRM Functions 2.a, 2.b, and 2.c, at least 20 LPRM inputs, with at least three LPRM inputs from each of the four axial levels at which the LPRMs are located, must be operable for each APRM channel, and the number of LPRM inputs that have become inoperable (and bypassed) since the last APRM calibration (SR 3.3.1.1.2) must be less than ten for each APRM channel. For the OPRM Upscale, Function 2.f, LPRMs are assigned to "cells" of 3 or 4 detectors. A minimum of 25 cells, each with a minimum of 2 LPRMs, must be OPERABLE for the OPRM Upscale Function 2.f to be OPERABLE.

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

2.a. Average Power Range Monitor Neutron Flux-High (Setdown) (continued)

For operation at low power (i.e., MODE 2), the Average Power Range Monitor Neutron Flux-High (Setdown)Function is capable of generating a trip signal that prevents fuel damage resulting from abnormal operating transients in this power range. For most operation at low power levels, the Average Power Range Monitor Neutron Flux-High (Setdown) Function will provide a secondary scram to the Wide Range Neutron Monitor Period-Short Function because of the relative setpoints. At higher power levels, it is possible that the Average Power Range Monitor Neutron Flux-High (Setdown) Function will provide the primary trip signal for a corewide increase in power.

No specific safety analyses take direct credit for the Average Power Range Monitor Neutron Flux-High (Setdown) Function. However, this Function indirectly ensures that before the reactor mode switch is placed in the run position, reactor power does not exceed 25% RTP (SL 2.1.1.1) when operating at low reactor pressure and low core flow. Therefore, it indirectly prevents fuel damage during significant reactivity increases with THERMAL POWER < 25% RTP.

The Allowable Value is based on preventing significant increases in power when THERMAL POWER is < 25% RTP.

The Average Power Range Monitor Neutron Flux-High (Setdown) Function must be OPERABLE during MODE 2 when control rods may be withdrawn since the potential for criticality exists. In MODE 1, the Average Power Range Monitor Neutron Flux-High Function provides protection against reactivity transients and the RWM and rod block monitor protect against control rod withdrawal error events.

2.b. Average Power Range Monitor Simulated Thermal Power-High

The Average Power Range Monitor Simulated Thermal Power-High Function monitors average neutron flux to approximate the THERMAL POWER being transferred to the reactor coolant. The APRM neutron flux is electronically filtered with a time constant representative of the fuel heat transfer dynamics to generate a signal proportional to the THERMAL POWER in the reactor. The trip level is varied as a function of recirculation drive flow (i.e., at lower core flows, the setpoint is reduced proportional to the reduction in power experienced as core flow is reduced with a fixed control rod pattern) but is clamped at an upper limit that is always lower than the Average Power Range Monitor Neutron Flux-High Function Allowable Value. A note is included, applicable when the plant is in single recirculation loop operation per LCO 3.4.1, which requires the flow value, used in the Allowable Value equation, be reduced by ΔW. The value of ΔW

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

2.b. Average Power Range Monitor Simulated Thermal Power-High (continued)

is established to conservatively bound the inaccuracy created in the core flow/drive flow correlation due to back flow in the jet pumps associated with the inactive recirculation loop. The allowable value thus maintains thermal margins essentially unchanged from those for two loop operation. The value of ΔW is plant specific and is defined in plant procedures. The allowable value equation for single loop operation is only valid for flows down to W = ΔW; the allowable value does not go below 64.9% RTP. This is acceptable because back flow in the inactive recirculation loop is only evident with drive flows of approximately 35% or greater (Reference 19).

The Average Power Range Monitor Simulated Thermal Power-High Function is not specifically credited in the safety analysis but is intended to provide an additional margin of protection from transient induced fuel damage during operation where recirculation flow is reduced to below the minimum required for rated power operation. The Average Power Range Monitor Simulated Thermal Power-High Function provides protection against transients where THERMAL POWER increases slowly (such as the loss of feedwater heating event) and protects the fuel cladding integrity by ensuring that the MCPR SL is not exceeded. During these events, the THERMAL POWER increase does not significantly lag the neutron flux scram. For rapid neutron flux increase events, the THERMAL POWER lags the neutron flux and the Average Power Range Monitor Neutron Flux-High Function will provide a scram signal before the Average Power Range Monitor Simulated Thermal Power-High Function setpoint is exceeded.

Each APRM channel uses one total drive flow signal representative of total core flow. The total drive flow signal is generated by the flow processing logic, part of the APRM channel, by summing up the flow calculated from two flow transmitter signal inputs, one from each of the two recirculation loop flows. The flow processing logic OPERABILITY is part of the APRM channel OPERABILITY requirements for this Function. The APRM flow processing logic is considered inoperable whenever it cannot deliver a flow signal less than or equal to actual Recirculation flow conditions for all steady state and transient reactor conditions while in Mode 1. Reduced or Downscale flow conditions due to planned maintenance or testing activities during derated plant conditions (i.e. end of cycle coast down) will result in conservative setpoints for the APRM Simulated Thermal Power-High function, thus maintaining that function operable.

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2.d. Average Power Range Monitor—Inop

Three of the four APRM channels are required to be OPERABLE for each of the APRM Functions. This Function (Inop) provides assurance that the minimum number of APRM channels are OPERABLE.

For any APRM channel, any time its mode switch is not in the "Operate" position, an APRM module required to issue a trip is unplugged, or the automatic self-test system detects a critical fault with the APRM channel, an Inop trip is sent to all four voter channels. Inop trips from two or more unbypassed APRM channels result in a trip output from each of the four voter channels to it's associated trip system. This Function was not specifically credited in the accident analysis, but it is retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

There is no Allowable Value for this Function.

This Function is required to be OPERABLE in the MODES where the APRM Functions are required.

2.e. 2-Out-Of-4 Voter

The 2-Out-Of-4 Voter Function provides the interface between the APRM Functions, including the OPRM Upscale Function, and the final RPS trip system logic. As such, it is required to be OPERABLE in the MODES where the APRM Functions are required and is necessary to support the safety analysis applicable to each of those Functions. Therefore, the 2-Out-Of-4 Voter Function needs to be OPERABLE in MODES 1 and 2.

All four voter channels are required to be OPERABLE. Each voter channel includes self-diagnostic functions. If any voter channel detects a critical fault in its own processing, a trip is issued from that voter channel to the associated trip system.

The Two-Out-Of-Four Logic Module includes 2-Out-Of-4 Voter hardware and the APRM Interface hardware. The 2-Out-Of-4 Voter Function 2.e votes APRM Functions 2.a, 2.b, 2.c, and 2.d independently of Function 2.f. This voting is accomplished by the 2-Out-Of-4 Voter hardware in the Two-Out-Of-Four Logic Module. The voter includes separate outputs to RPS for the two independently voted sets of Functions, each of which is redundant (four total outputs). The analysis in Reference 12 took credit for this redundancy in the justification of the 12-hour Completion Time for Condition A., so the voter Function 2.e must be declared inoperable if any of its functionality is inoperable. The voter Function 2.e does not need to be declared inoperable due to any failure affecting only the APRM Interface hardware portion of the Two-Out-Of-Four Logic Module.

There is no Allowable Value for this Function.

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2.f. Oscillation Power Range Monitor (OPRM) Upscale

The OPRM Upscale Function provides compliance with 10 CFR 50, Appendix A, General Design Criteria (GDC) 10 and 12, thereby providing protection from exceeding the fuel MCPR safety limit (SL) due to anticipated thermal-hydraulic power oscillations.

References 14, 15 and 16 describe three algorithms for detecting thermal-hydraulic instability related neutron flux oscillations: the period based detection algorithm, the amplitude based algorithm, and the growth rate algorithm. All three are implemented in the OPRM Upscale Function, but the safety analysis takes credit only for the period based detection algorithm. The remaining algorithms provide defense in depth and additional protection against unanticipated oscillations. OPRM Upscale Function OPERABILITY for Technical Specification purposes is based only on the period based detection algorithm.

The OPRM Upscale Function receives input signals from the local power range monitors (LPRMs) within the reactor core, which are combined into "cells" for evaluation by the OPRM algorithms. Each channel is capable of detecting thermal-hydraulic instabilities, by detecting the related neutron flux oscillations, and issuing a trip signal before the MCPR SL is exceeded. Three of the four channels are required to be OPERABLE.

The OPRM Upscale trip is automatically enabled (bypass removed) when THERMAL POWER is ≥ 30% RTP, as indicated by the APRM Simulated Thermal Power, and reactor core flow is < 60% of rated flow, as indicated by APRM measured recirculation drive flow. This is the operating region where actual thermal-hydraulic instability and related neutron flux oscillations may occur (Reference 18). These setpoints, which are sometimes referred to as the "auto-bypass" setpoints, establish the boundaries of the OPRM Upscale trip enabled region. The APRM Simulated Thermal Power auto-enable setpoint has 1% deadband while the drive flow setpoint has a 2% deadband. The deadband for these setpoints is established so that it increases the enabled region.

The OPRM Upscale Function is required to be OPERABLE when the plant is at ≥ 25% RTP. The 25% RTP level is selected to provide margin in the unlikely event that a reactor power increase transient occurring while the plant is operating below 30% RTP causes a power increase to or

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2.f. Oscillation Power Range Monitor (OPRM) Upscale (continued)

beyond the 30% APRM Simulated Thermal Power OPRM Upscale trip auto-enable setpoint without operator action. This OPERABILITY requirement assures that the OPRM Upscale trip auto-enable function will be OPERABLE when required.

An OPRM Upscale trip is issued from an APRM channel when the period based detection algorithm in that channel detects oscillatory changes in the neutron flux, indicated by the combined signals of the LPRM detectors in a cell, with period confirmations and relative cell amplitude exceeding specified setpoints. One or more cells in a channel exceeding the trip conditions will result in a channel trip. An OPRM Upscale trip is also issued from the channel if either the growth rate or amplitude based algorithms detect oscillatory changes in the neutron flux for one or more cells in that channel.

There are four "sets" of OPRM related setpoints or adjustment parameters: a) OPRM trip auto-enable setpoints for STP (30%) and drive flow (60%); b) period based detection algorithm (PBDA) confirmation count and amplitude setpoints; c) period based detection algorithm tuning parameters; and d) growth rate algorithm (GRA) and amplitude based algorithm (ABA) setpoints.

The first set, the OPRM auto-enable region setpoints, as discussed in the SR 3.3.1.1.19 Bases, are treated as nominal setpoints with no additional margins added. The settings, 30% APRM Simulated Thermal Power and 60% drive flow, are defined (limit values) in and confirmed by SR 3.3.1.1.19. The second set, the OPRM PBDA trip setpoints, are established in accordance with methodologies defined in Reference 16, and are documented in the COLR. There are no allowable values for these setpoints. The third set, the OPRM PBDA "tuning" parameters, are established or adjusted in accordance with and controlled by PBAPS procedures. The fourth set, the GRA and ABA setpoints, in accordance with References 14 and 15, are established as nominal values only, and controlled by PBAPS procedures.

(continued)

BASES

ACTIONS

A.1 and A.2 (continued)

Function's inoperable channel is in one trip system and the Function still maintains RPS trip capability (refer to Required Actions B.1, B.2, and C.1 Bases). If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, the channel or the associated trip system must be placed in the tripped condition per Required Actions A.1 and A.2. Placing the inoperable channel in trip (or the associated trip system in trip) would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue. Alternatively, if it is not desired to place the channel (or trip system) in trip (e.g., as in the case where placing the inoperable channel in trip would result in a full scram), Condition D must be entered and its Required Action taken.

As noted, Action A.2 is not applicable for APRM Functions 2.a, 2.b, 2.c, 2.d, or 2.f. Inoperability of one required APRM channel affects both trip systems. For that condition, Required Action A.1 must be satisfied, and is the only action (other than restoring operability) that will restore capability to accommodate a single failure. Inoperability of more than one required APRM channel of the same trip function results in loss of trip capability and entry into Condition C, as well as entry into Condition A for each channel.

B.1 and B.2

Condition B exists when, for any one or more Functions, at least one required channel is inoperable in each trip system. In this condition, provided at least one channel per trip system is OPERABLE, the RPS still maintains trip capability for that Function, but cannot accommodate a single failure in either trip system.

Required Actions B.1 and B.2 limit the time the RPS scram logic, for any Function, would not accommodate single failure in both trip systems (e.g., one-out-of-one and one-out-of-one arrangement for a typical four channel Function). The reduced reliability of this logic arrangement was not evaluated in References 9, 12 or 13 for the 12 hour Completion Time. Within the 6 hour allowance, the associated Function will have all required channels OPERABLE or in trip (or any combination) in one trip system.

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

Completing one of these Required Actions restores RPS to a reliability level equivalent to that evaluated in References 9, 12 or 13, which justified a 12 hour allowable out of service time as presented in Condition A. The trip system in the more degraded state should be placed in trip or, alternatively, all the inoperable channels in that trip system should be placed in trip (e.g., a trip system with two inoperable channels could be in a more degraded state than a trip system with four inoperable channels if the two inoperable channels are in the same Function while the four inoperable channels are all in different Functions). The decision of which trip system is in the more degraded state should be based on prudent judgment and take into account current plant conditions (i.e., what MODE the plant is in). If this action would result in a scram or RPT, it is permissible to place the other trip system or its inoperable channels in trip.

The 6 hour Completion Time is judged acceptable based on the remaining capability to trip, the diversity of the sensors available to provide the trip signals, the low probability of extensive numbers of inoperabilities affecting all diverse Functions, and the low probability of an event requiring the initiation of a scram.

Alternately, if it is not desired to place the inoperable channels (or one trip system) in trip (e.g., as in the case where placing the inoperable channel or associated trip system in trip would result in a scram, Condition D must be entered and its Required Action taken.

As noted, Condition B is not applicable for APRM Functions 2.a, 2.b, 2.c, 2.d, or 2.f. Inoperability of an APRM channel affects both trip systems and is not associated with a specific trip system as are the APRM 2-Out-Of-4 voter and other non-APRM channels for which Condition B applies. For an inoperable APRM channel, Required Action A.1 must be satisfied, and is the only action (other than restoring operability) that will restore capability to accommodate a single failure. Inoperability of a Function in more than one required APRM channel results in loss of trip capability for that Function and entry into Condition C, as well as entry into Condition A for each channel. Because Condition A and C provide Required Actions that are appropriate for the inoperability of APRM Functions 2.a, 2.b, 2.c, 2.d or 2.f, and these functions are not associated with specific trip systems as are the APRM 2-Out-Of-4 voter and other non-APRM channels, Condition B does not apply.

(continued)

BASES

ACTIONS (continued)

E.1, F.1, G.1, and J.1

If the channel(s) is not restored to OPERABLE status or placed in trip (or the associated trip system placed in trip) within the allowed Completion Time, the plant must be placed in a MODE or other specified condition in which the LCO does not apply. The allowed Completion Times are reasonable, based on operating experience, to reach the specified condition from full power conditions in an orderly manner and without challenging plant systems. In addition, the Completion Time of Required Actions E.1 and J.1 are consistent with the Completion Time provided in LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)."

H.1

If the channel(s) is not restored to OPERABLE status or placed in trip (or the associated trip system placed in trip) within the allowed Completion Time, the plant must be placed in a MODE or other specified condition in which the LCO does not apply. This is done by immediately initiating action to fully insert all insertable control rods in core cells containing one or more fuel assemblies. Control rods in core cells containing no fuel assemblies do not affect the reactivity of the core and are, therefore, not required to be inserted. Action must continue until all insertable control rods in core cells containing one or more fuel assemblies are fully inserted.

I.1

If OPRM Upscale trip capability is not maintained, Condition I exists. References 12 and 13 justified use of alternate methods to detect and suppress oscillations for a limited period of time. The alternate methods are procedurally established consistent with the guidelines identified in Reference 17 requiring manual operator action to scram the plant if certain predefined events occur. The 12-hour allowed Completion Time for Required Action I.1 is based on engineering judgment to allow orderly transition to the alternate methods while limiting the period of time during which no automatic or alternate detect and suppress trip capability is formally in place. Based on the small probability of an instability event occurring at all, the 12 hours is judged to be reasonable.

(continued)

BASES

ACTIONS (continued)

I.2

The alternate method to detect and suppress oscillations implemented in accordance with I.1 was evaluated (References 12 and 13) based on use up to 120 days only. The evaluation, based on engineering judgment, concluded that the likelihood of an instability event that could not be adequately handled by the alternate methods during this 120-day period was negligibly small. The 120-day period is intended to be an outside limit to allow for the case where design changes or extensive analysis might be required to understand or correct some unanticipated characteristic of the instability detection algorithms or equipment. This action is not intended and was not evaluated as a routine alternative to returning failed or inoperable equipment to OPERABLE status. Correction of routine equipment failure or inoperability is expected to normally be accomplished within the completion times allowed for Actions for Condition A.

A note is provided to indicate that LCO 3.0.4 is not applicable. The intent of that note is to allow plant start-up while within the 120-day completion time for action I.2. The primary purpose of this exclusion is to allow an orderly completion of design and verification activities, in the event of a required design change, without undue impact on plant operation.

SURVEILLANCE REQUIREMENTS

As noted at the beginning of the SRs, the SRs for each RPS instrumentation Function are located in the SRs column of Table 3.3.1.1-1.

The Surveillances are modified by a Note to indicate that when a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed for up to 6 hours, provided the associated Function maintains RPS 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 reliability analysis (Refs. 9, 12 & 13) assumption of the average time required to perform channel Surveillance. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that the RPS will trip when necessary.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.9 and SR 3.3.1.1.14 (continued)

In addition, Function 5 and 7 instruments are not accessible while the unit is operating at power due to high radiation and the installed indication instrumentation does not provide accurate indication of the trip setting. For the Function 9 channels, verification that the trip settings are less than or equal to the specified Allowable Value during the CHANNEL FUNCTIONAL TEST is not required since the instruments are not accessible while the unit is operating at power due to high radiation and the installed indication instrumentation does not provided accurate indication of the trip setting. Waiver of these verifications for the above functions is considered acceptable since the magnitude of drift assumed in the setpoint calculation is based on a 24 month calibration interval. The 92 day Frequency of SR 3.3.1.1.9 is based on the reliability analysis of Reference 9.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components will pass the Surveillance when performed at the 24 month Frequency.

SR 3.3.1.1.10, SR 3.3.1.1.12, SR 3.3.1.1.15, and SR 3.3.1.1.16

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies that 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 current plant specific setpoint methodology.

As noted for SR 3.3.1.1.10, radiation detectors are excluded from CHANNEL CALIBRATION due to ALARA reasons (when the plant is operating, the radiation detectors are generally in a high radiation area; the steam tunnel). This exclusion is acceptable because the radiation detectors are passive devices, with minimal drift. To complete the radiation CHANNEL CALIBRATION, SR 3.3.1.1.16 requires that the radiation detectors be calibrated on a once per 24 months Frequency.

The once per 92 days Frequency of SR 3.3.1.1.10 is conservative with respect to the magnitude of equipment drift assumed in the setpoint analysis. The Frequency of SR 3.3.1.1.16 is based upon the assumption of a 24-month calibration interval used in the determination of the equipment drift in the setpoint analysis.

As noted for SR 3.3.1.1.12, neutron detectors are excluded from CHANNEL CALIBRATION because they are passive devices, with minimal drift, and because of the difficulty of simulating a meaningful signal. Changes in

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.10, SR 3.3.1.1.12, SR 3.3.1.1.15, and SR 3.3.1.1.16 (continued)

neutron detector sensitivity are compensated for by performing the 7 day calorimetric calibration (SR 3.3.1.1.2) and the 1000 MWD/T LPRM calibration against the TIPs (SR 3.3.1.1.8).

A second note is provided for SR 3.3.1.1.12 that allows the WRNM SR to be performed within 12 hours of entering MODE 2 from MODE 1. Testing of the MODE 2 WRNM Functions cannot be performed in MODE 1 without utilizing jumpers, lifted leads or movable links. This Note allows entry into MODE 2 from MODE 1, if the 24 month Frequency is not met per SR 3.0.2. Twelve hours is based on operating experience and in consideration of providing a reasonable time in which to complete the SR.

A third note is provided for SR 3.3.1.1.12 that includes in the SR the recirculation flow (drive flow) transmitters, which supply the flow signal to the APRMs. The APRM Simulated Thermal Power-High Function (Function 2.b) and the OPRM Upscale Function (Function 2.f), both require a valid drive flow signal. The APRM Simulated Thermal Power-High Function uses drive flow to vary the trip setpoint. The OPRM Upscale Function uses drive flow to automatically enable or bypass the OPRM Upscale trip output to RPS. A CHANNEL CALIBRATION of the APRM drive flow signal requires both calibrating the drive flow transmitters and establishing a valid drive flow / core flow relationship. The drive flow /core flow relationship is established once per refuel cycle, while operating at or near rated power and flow conditions. This method of correlating core flow and drive flow is consistent with GE recommendations. Changes throughout the cycle in the drive flow / core flow relationship due to the changing thermal hydraulic operating conditions of the core are accounted for in the margins included in the bases or analyses used to establish the setpoints for the APRM Simulated Thermal Power-High Function and the OPRM Upscale Function.

The Frequencies of SR 3.3.1.1.12 and SR 3.3.1.1.15 are based upon the assumption of a 24-month calibration interval used in the determination of the equipment drift in the setpoint analysis.

SR 3.3.1.1.11

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.11 (continued)

intended function. For the APRM Functions, this test supplements the automatic self-test functions that operate continuously in the APRM and voter channels. The APRM CHANNEL FUNCTIONAL TEST covers the APRM channels (including recirculation flow processing - applicable to Function 2.b and the auto-enable portion of Function 2.f only), the 2-Out-Of 4 voter channels, and the interface connections into the RPS trip systems from the voter channels. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. The 184 day Frequency of SR 3.3.1.1.11 is based on the reliability analyses of References 12 and 13. (NOTE: The actual voting logic of the 2-Out-Of-4 Voter Function is tested as part of SR 3.3.1.1.17. The actual auto-enable setpoints for the OPRM Upscale trip are confirmed by SR 3.3.1.1.19.)

A Note is provided for Function 2.a that requires this SR to be performed within 12 hours of entering MODE 2 from MODE 1. Testing of the MODE 2 APRM Function cannot be performed in MODE 1 without utilizing jumpers or lifted leads. This Note allows entry into MODE 2 from MODE 1 if the associated Frequency is not met per SR 3.0.2.

A second Note is provided for Function 2.b that clarifies that the CHANNEL FUNCTIONAL TEST for Function 2.b includes testing of the recirculation flow processing electronics, excluding the flow transmitters.

SR 3.3.1.1.13

This SR ensures that scrams initiated from the Turbine Stop Valve—Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure—Low Functions will not be inadvertently bypassed when THERMAL POWER is ≥ 30% RTP. This involves calibration of the bypass channels. Adequate margins for the instrument setpoint methodologies are incorporated into the Allowable Value (≤ 29.4% RTP which is equivalent to ≤ 138.4 psig as measured from turbine first stage pressure) and the actual setpoint. Because main turbine bypass flow can affect this setpoint nonconservatively (THERMAL POWER is derived from turbine first stage pressure), the main turbine bypass valves must remain closed during the calibration at THERMAL POWER ≥ 30% RTP to ensure that the calibration is valid.

If any bypass channel's setpoint is nonconservative (i.e., the Functions are bypassed at ≥ 30% RTP, either due to open main turbine bypass valve(s) or other reasons), then the

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.13 (continued)

affected Turbine Stop Valve—Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure—Low Functions are considered inoperable. Alternatively, the bypass channel can be placed in the conservative condition (nonbypass). If placed in the nonbypass condition, this SR is met and the channel is considered OPERABLE.

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

SR 3.3.1.1.17

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required trip logic for a specific channel. The functional testing of control rods (LCO 3.1.3), and SDV vent and drain valves (LCO 3.1.8), overlaps this Surveillance to provide complete testing of the assumed safety function.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components will pass the Surveillance when performed at the 24 month Frequency.

The LOGIC SYSTEM FUNCTIONAL TEST for APRM Function 2.e simulates APRM and OPRM trip conditions at the 2-Out-Of-4 voter channel inputs to check all combinations of two tripped inputs to the 2-Out-Of-4 logic in the voter channels and APRM related redundant RPS relays.

SR 3.3.1.1.18

This SR ensures that the individual channel response times are maintained less than or equal to the original design value. The RPS RESPONSE TIME acceptance criterion is included in Reference 11.

RPS RESPONSE TIME tests are conducted on a 24 month Frequency. The 24 month Frequency is consistent with the PBAPS refueling cycle and is based upon plant operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.19

This surveillance involves confirming the OPRM Upscale trip auto-enable setpoints. The auto-enable setpoint values are considered to be nominal values as discussed in Reference 18. This surveillance ensures that the OPRM Upscale trip is enabled (not bypassed) for the correct values of APRM Simulated Thermal Power and recirculation drive flow. Other surveillances ensure that the APRM Simulated Thermal Power and recirculation drive flow properly correlate with THERMAL POWER (SR 3.3.1.1.2) and core flow (SR 3.3.1.1.12), respectively.

If any auto-enable setpoint is nonconservative (i.e., the OPRM Upscale trip is bypassed when APRM Simulated Thermal Power ≥30% and recirculation drive flow < 60%), then the affected channel is considered inoperable for the OPRM Upscale Function. Alternatively, the OPRM Upscale trip auto-enable setpoint(s) may be adjusted to place the channel in a conservative condition (not bypassed). If the OPRM Upscale trip is placed in the not-bypassed condition, this SR is met and the channel is considered OPERABLE.

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

REFERENCES

1. UFSAR, Section 7.2.
2. UFSAR, Chapter 14.
3. NEDO-32368, "Nuclear Measurement Analysis and Control Wide Range Neutron Monitoring System Licensing Report for Peach Bottom Atomic Power Station, Units 2 and 3," November 1994.
4. NEDC-32183P, "Power Rerate Safety Analysis Report for Peach Bottom 2 & 3," dated May 1993.
5. UFSAR, Section 14.6.2.
6. UFSAR, Section 14.5.4.
7. UFSAR, Section 14.5.1.
8. P. Check (NRC) letter to G. Lainas (NRC), "BWR Scram Discharge System Safety Evaluation," December 1, 1980.
9. NEDO-30851-P-A , "Technical Specification Improvement Analyses for BWR Reactor Protection System," March 1988.

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BASES (continued)

REFERENCES (continued)

10. MDE-87-0485-1, "Technical Specification Improvement Analysis for the Reactor Protection System for Peach Bottom Atomic Power Station Units 2 and 3," October 1987.

11. UFSAR, Section 7.2.3.9.

12. NEDC-32410P-A, "Nuclear Measurement Analysis and Control Power Range Neutron Monitor (NUMAC PRNM) Retrofit Plus Option III Stability Trip Function", October 1995.

13. NEDC-32410P Supplement 1, "Nuclear Measurement Analysis and Control Power Range Neutron Monitor (NUMAC PRNM) Retrofit Plus Option III Stability Trip Function, Supplement 1", November 1997.

14. NEDO-31960-A, "BWR Owners' Group Long-Term Stability Solutions Licensing Methodology," November 1995.

15. NEDO-31960-A, Supplement 1, "BWR Owners' Group Long-Term Stability Solutions Licensing Methodology," November 1995.

16. NEDO-32465-A, "BWR Owners' Group Long-Term Stability Detect and Suppress Solutions Licensing Basis Methodology And Reload Applications," August 1996.

17. Letter, L. A. England (BWROG) to M. J. Virgilio, "BWR Owners' Group Guidelines for Stability Interim Corrective Action," June 6, 1994.

18. BWROG Letter 96113, K. P. Donovan (BWROG) to L. E. Phillips (NRC), "Guidelines for Stability Option III `Enable Region' (TAC M92882)," September 17, 1996.

19. NEDO-24229-1, "Peach Bottom Atomic Power Station Units 2 and 3 Single-Loop Operation," May 1980.

BASES

APPLICABLE SAFETY ANALYSES (continued)

Plant specific LOCA and average power range monitor/rod block monitor Technical Specification/maximum extended load line limit analyses have been performed assuming only one operating recirculation loop. These analyses demonstrate 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 (Refs. 2, 3, and 4).

The transient analyses of Chapter 14 of the UFSAR have also been performed for single recirculation loop operation (Ref. 5) 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 (RPS) average power range monitor (APRM) instrument setpoints is also required to account for the different relationships between recirculation drive flow and reactor core flow. The MCPR limits and APLHGR limits (power-dependent APLHGR multipliers, $MAPFAC_p$, and flow-dependent APLHGR multipliers, $MAPFAC_f$) for single loop operation are specified in the COLR. The APRM Simulated Thermal Power-High Allowable Value is in LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation."

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BASES

APPLICABLE SAFETY ANALYSES (continued)

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

LCO

Two recirculation loops are normally required to be in operation with their flows matched within the limits specified in SR 3.4.1.1 to ensure that during a LOCA caused by a break of the piping of one recirculation loop the

(continued)

BASES

LCO (continued)

assumptions of the LOCA analysis are satisfied. Alternatively, with only one recirculation loop in operation, modifications to the required APLHGR limits (power- and flow-dependent APLHGR multipliers, $MAPFAC_p$ and $MAPFAC_f$, respectively of LCO 3.2.1, "AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)"), MCPR limits (LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)") and APRM Simulated Thermal Power-High Allowable Value (LCO 3.3.1.1) must be applied to allow continued operation consistent with the assumptions of Reference 5.

The LCO is modified by a Note which allows up to 12 hours before having to put in effect the required modifications to required limits after a change in the reactor operating conditions from two recirculation loops operating to single recirculation loop operation. If the required limits are not in compliance with the applicable requirements at the end of this period, the associated equipment must be declared inoperable or the limits "not satisfied," and the ACTIONS required by nonconformance with the applicable specifications implemented. This time is provided due to the need to stabilize operation with one recirculation loop, including the procedural steps necessary to limit flow in the operating loop, and the complexity and detail required to fully implement and confirm the required limit modifications.

APPLICABILITY

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

(continued)

BASES

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BASES

ACTIONS (continued)

A.1

With the requirements of the LCO not met for reasons other than no recirculation loops in operation, the recirculation loops must be restored to operation with matched flows 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. The loop with the lower flow must be considered not in operation. 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 operating limits and RPS setpoints, operation with only one recirculation loop would satisfy the requirements of the LCO and the initial conditions of the accident sequence.

The 24 hour Completion Time is based on the low probability of an accident occurring during this time period, on a reasonable time to complete the Required Action, and on frequent core monitoring by operators allowing abrupt changes in core flow conditions to be quickly detected.

(continued)

BASES

ACTIONS

A.1 (continued)

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 pump speeds to re-establish forward flow or by tripping the pump.

B.1

With no recirculation loops in operation or the Required Action and associated Completion Time of Condition A not met, the plant must 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.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.4.1.1

This SR ensures the recirculation loops are within the allowable limits for mismatch. At low core flow (i.e., < 71.75 X 10^6 lbm/hr), the MCPR requirements provide larger margins to the fuel cladding integrity Safety Limit such that the potential adverse effect of early boiling transition during a LOCA is reduced. A larger flow mismatch can therefore be allowed when core flow is < 71.75 X 10^6 lbm/hr. 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 core flow. (Rated core flow is 102.5 X 10^6 lbm/hr. The first limit is based on mismatch ≤ 10% of rated core flow when operating at < 70% of rated core flow. The second limit is based on mismatch ≤ 5% of rated core flow when operating at ≥ 70% of rated core flow.) If the flow mismatch exceeds the specified limits, the loop with the lower flow is considered not in operation. The 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 Surveillance 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

REFERENCES

1. UFSAR, Section 14.6.3.
2. NEDC-32163P, "PBAPS Units 2 and 3 SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis," January 1993.
3. NEDC-32162P, "Maximum Extended Load Line Limit and ARTS Improvement Program Analyses for Peach Bottom Atomic Power Station Unit 2 and 3," Revision 1, February 1993.
4. NEDC-32428P, "Peach Bottom Atomic Power Station Unit 2 Cycle 11 ARTS Thermal Limits Analyses," December 1994.
5. NEDO-24229-1, "PBAPS Units 2 and 3 Single-Loop Operation," May 1980.

5.6 Reporting Requirements (continued)

5.6.5 CORE OPERATING LIMITS REPORT (COLR)

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

1. The Average Planar Linear Heat Generation Rate for Specification 3.2.1;

2. The Minimum Critical Power Ratio for Specifications 3.2.2 and 3.3.2.1;

3. The Linear Heat Generation Rate for Specification 3.2.3; and

4. The Control Rod Block Instrumentation for Specification 3.3.2.1.

5. The Oscillation Power Range Monitor (OPRM) Instrumentation for Specification 3.3.1.1.

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. NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel" (latest approved version as specified in the COLR);

2. NEDC-32162P, "Maximum Extended Load Line Limit and ARTS Improvement Program Analyses for Peach Bottom Atomic Power Station Units 2 and 3," Revision 2, March, 1995;

3. PECo-FMS-0001-A, "Steady-State Thermal Hydraulic Analysis of Peach Bottom Units 2 and 3 using the FIBWR Computer Code";

4. PECo-FMS-0002-A, "Method for Calculating Transient Critical Power Ratios for Boiling Water Reactors (RETRAN-TCPPECo)";

5. PECo-FMS-0003-A, "Steady-State Fuel Performance Methods Report";

6. PECo-FMS-0004-A, "Methods for Performing BWR Systems Transient Analysis";

(continued)

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

7. PECo-FMS-0005-A, "Methods for Performing BWR Steady-State Reactor Physics Analysis"; and

8. PECo-FMS-0006-A, "Methods for Performing BWR Reload Safety Evaluations."

9. NEDO-32465-A, "BWR Owners' Group Long-Term Stability Detect and Suppress Solutions Licensing Basis Methodology And Reload Applications," August 1996.

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

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

5.6.6 Post Accident Monitoring (PAM) Instrumentation Report

When a report is required by Condition B or F of LCO 3.3.3.1, "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.

TECH SPEC MARKUP
for
Stability (PRNM) OPRM
Trip Activation MOD
at
PEACH BOTTOM UNIT 3

3.3 INSTRUMENTATION

3.3.1.1 Reactor Protection System (RPS) Instrumentation

LCO 3.3.1.1 The RPS instrumentation for each Function in Table 3.3.1.1-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.1.1-1.

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required channels inoperable.	A.1 Place channel in trip. OR A.2 --------NOTE-------- Not applicable for Functions 2.a, 2.b, 2.c, ~~or~~ 2.d, or 2.f. ------------------------ Place associated trip system in trip.	12 hours 12 hours
B. ---------NOTE--------- Not applicable for Functions 2.a, 2.b, 2.c, ~~or~~ 2.d, or 2.f. ------------------------ One or more Functions with one or more required channels inoperable in both trip systems.	B.1 Place channel in one trip system in trip. OR B.2 Place one trip system in trip.	6 hours 6 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
H. As required by Required Action D.1 and referenced in Table 3.3.1.1-1.	H.1 Initiate action to fully insert all insertable control rods in core cells containing one or more fuel assemblies.	Immediately

INSERT 1

SURVEILLANCE REQUIREMENTS

-----NOTES-----

1. Refer to Table 3.3.1.1-1 to determine which SRs apply for each RPS Function.
2. When a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed for up to 6 hours provided the associated Function maintains RPS trip capability.

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.1.1.2	-----NOTE----- Not required to be performed until 12 hours after THERMAL POWER $\geq$ 25% RTP. ----- Verify the absolute difference between the average power range monitor (APRM) channels and the calculated power is $\leq$ 2% RTP while operating at $\geq$ 25% RTP.	7 days

(continued)

TECH SPEC MARKUP

INSERT 1:

I. As required by Required Action D.1 and referenced in Table 3.3.1.1-1.	I.1 Initiate alternate method to detect and suppress thermal hydraulic instability oscillations.	12 hours
	AND	
	I.2 ----------------NOTE----------------- LCO 3.0.4 is not applicable. --- Restore required channels to OPERABLE.	120 days
J. Required Action and associated Completion Time of Condition I not met.	J.1 Reduce THERMAL POWER to <25% RTP.	4 hours

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SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.1.9	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.1.1.10	------NOTE------ Radiation detectors are excluded. ------------ Perform CHANNEL CALIBRATION.	92 days
SR 3.3.1.1.11	------NOTES------ 1. For Function 2.a, not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2. 2. For Function(s) 2.b (and 2.f), the CHANNEL FUNCTIONAL TEST includes the recirculation flow input processing, excluding the flow transmitters. ------------ Perform CHANNEL FUNCTIONAL TEST.	184 days
SR 3.3.1.1.12	------NOTES------ 1. Neutron detectors are excluded. 2. For Function 1, not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2. 3. For Function(s) 2.b (and 2.f), the recirculation flow transmitter(s) that feed the APRMs are included. ------------ Perform CHANNEL CALIBRATION.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.13	Verify Turbine Stop Valve—Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure—Low Functions are not bypassed when THERMAL POWER is ≥ 30% RTP.	24 months
SR 3.3.1.1.14	Perform CHANNEL FUNCTIONAL TEST.	24 months
SR 3.3.1.1.15	Perform CHANNEL CALIBRATION.	24 months
SR 3.3.1.1.16	Calibrate each radiation detector.	24 months
SR 3.3.1.1.17	Perform LOGIC SYSTEM FUNCTIONAL TEST.	24 months
SR 3.3.1.1.18	Verify the RPS RESPONSE TIME is within limits.	24 months

INSERT 2

TECH SPEC MARKUP

INSERT 2:

SR 3.3.1.1.19	Verify OPRM is not bypassed when APRM Simulated Thermal Power is ≥ 30% and recirculation drive flow is < 60%.	24 months

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Table 3.3.1.1-1 (page 1 of 3)
Reactor Protection System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	CONDITIONS REFERENCED FROM REQUIRED ACTION D.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Wide Range Neutron Monitors					
a. Period-Short	2	3	G	SR 3.3.1.1.1 SR 3.3.1.1.5 SR 3.3.1.1.12 SR 3.3.1.1.17 SR 3.3.1.1.18	≥ 13 seconds
	5(a)	3	H	SR 3.3.1.1.1 SR 3.3.1.1.6 SR 3.3.1.1.12 SR 3.3.1.1.17 SR 3.3.1.1.18	≥ 13 seconds
b. Inop	2	3	G	SR 3.3.1.1.5 SR 3.3.1.1.17	NA
	5(a)	3	H	SR 3.3.1.1.6 SR 3.3.1.1.17	NA
2. Average Power Range Monitors					
a. Neutron Flux-High (Setdown)	2	3(c)	G	SR 3.3.1.1.1 SR 3.3.1.1.8 SR 3.3.1.1.11 SR 3.3.1.1.12	≤ 15.0% RTP
b. Simulated Thermal Power-High	1	3(c)	F	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.8 SR 3.3.1.1.11 SR 3.3.1.1.12	≤ 0.66 W + 64.9% RTP(b) and ≤ 118.0% RTP
c. Neutron Flux-High	1	3(c)	F	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.8 SR 3.3.1.1.11 SR 3.3.1.1.12	≤ 119.7% RTP
d. Inop	1,2	3(c)	G	SR 3.3.1.1.11	NA
e. 2-Out-Of-4 Voter	1,2	2	G	SR 3.3.1.1.1 SR 3.3.1.1.11 SR 3.3.1.1.17 SR 3.3.1.1.18	NA

INSERT 3 →

(continued)

(a) With any control rod withdrawn from a core cell containing one or more fuel assemblies.

(b) ~~0.66 W + 64.9% - 0.66 ΔW~~ [0.66(W - ΔW) + 64.9%] RTP when reset for single loop operation per LCO 3.4.1, "Recirculation Loops Operating."

(c) Each APRM channel provides inputs to both trip systems.

INSERT 3A →

TECH SPEC MARKUP

INSERT 3:

f.	OPRM Upscale	≥ 25% RTP	3[c]	I	SR 3.3.1.1.1 SR 3.3.1.1.8 SR 3.3.1.1.11 SR 3.3.1.1.12 SR 3.3.1.1.19	NA[d]

INSERT 3A:

(d) See COLR for OPRM period based detection algorithm (PBDA) setpoint limits.

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. ~~with core flow as a function of THERMAL POWER in the "Unrestricted" Region of Figure 3.4.1-1.~~

OR

One recirculation loop shall be in operation with ~~core flow as a function of THERMAL POWER in the "Unrestricted" Region of Figure 3.4.1-1 and 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; and

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

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

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or two recirculation loops in operation with core flow as a function of THERMAL POWER in the "Restricted" Region of Figure 3.4.1-1.	A.1 Verify APRM and LPRM neutron flux noise levels are ≤ 4% and ≤ 3 times baseline noise levels.	1 hour AND Once per 8 hours thereafter AND 1 hour after completion of any THERMAL POWER increase ≥ 5% RTP
B. Required Action and associated Completion Time of Condition A not met.	B.1 Restore APRM and LPRM neutron flux noise levels to ≤ 4% and ≤ 3 times baseline noise levels.	2 hours
C. One recirculation loop in operation with core flow ≤ 39% of rated core flow and THERMAL POWER in the "Restricted" Region of Figure 3.4.1-1.	C.1 Reduce THERMAL POWER to the "Unrestricted" Region of Figure 3.4.1-1. OR C.2 Increase core flow to > 39% of rated core flow.	4 hours 4 hours

(continued)

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ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ~~D.~~ Requirements of the LCO not met ~~for reasons other than Conditions A, B, C, and F~~.	A.1 ~~D.1~~ Satisfy the requirements of the LCO.	24 hours
B. ~~E.~~ Required Action and associated Completion Time of Condition ~~B, C, or D~~ A not met.	B.1 ~~E.1~~ Be in MODE 3.	12 hours
OR C. ~~F.~~ No recirculation loops in operation.	~~F.1 Initiate action to reduce THERMAL POWER to the "Unrestricted" Region of Figure 3.4.1-1.~~	~~Immediately~~
	~~AND~~	
	~~F.2~~ C.1 Be in MODE 3.	6 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. $\leq 10.25 \times 10^6$ lbm/hr when operating at $< 71.75 \times 10^6$ lbm/hr; and b. $\leq 5.125 \times 10^6$ lbm/hr when operating at $\geq 71.75 \times 10^6$ lbm/hr.	24 hours
SR 3.4.1.2	Verify core flow as a function of THERMAL POWER is in the "Unrestricted" Region of Figure 3.4.1-1.	24 hours

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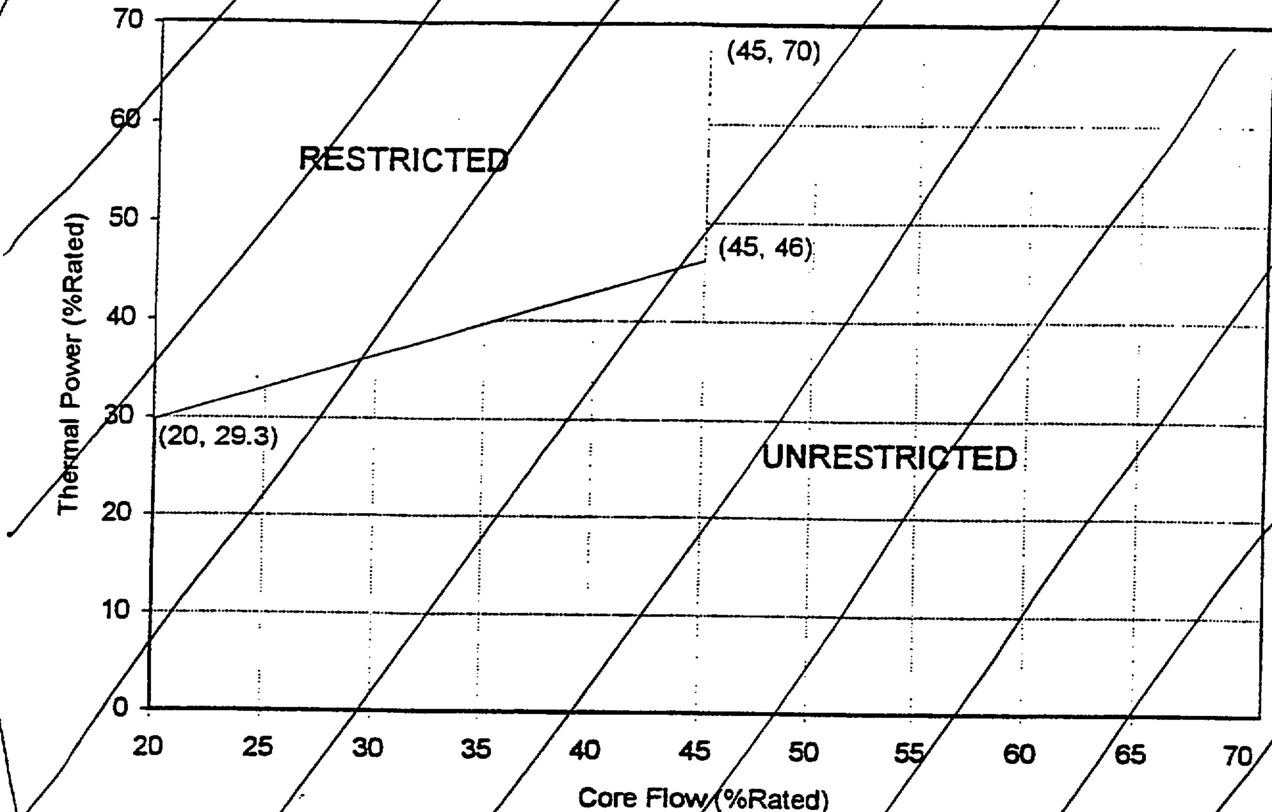

Figure 3.4.1-1 (page 1 of 1)

THERMAL POWER VERSUS CORE FLOW
STABILITY REGIONS

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

1.b. Wide Range Neutron Monitor — Inop (continued)

Six channels of the Wide Range Neutron Monitor — Inop Function, with three channels in each trip system, are required to be OPERABLE to ensure that no single instrument failure will preclude a scram from this Function on a valid signal. Since this Function is not assumed in the safety analysis, there is no Allowable Value for this Function.

This Function is required to be OPERABLE when the Wide Range Neutron Monitor Period-Short Function is required.

Average Power Range Monitor (APRM)

The APRM channels provide the primary indication of neutron flux within the core and respond almost instantaneously to neutron flux increases. The APRM channels receive input signals from the local power range monitors (LPRMs) within the reactor core to provide an indication of the power distribution and local power changes. The APRM channels average these LPRM signals to provide a continuous indication of average reactor power from a few percent to greater than RTP. ← INSERT 4

The APRM System is divided into four APRM channels and four 2-out-of-4 voter channels. Each APRM channel provides inputs to each of the four voter channels. The four voter channels are divided into two groups of two each, with each group of two providing inputs to one RPS trip system. The system is designed to allow one APRM channel, but no voter channels, to be bypassed. (INSERT 5) A trip from any one unbypassed APRM will result in a "half-trip" in all four of the voter channels, but no trip inputs to either RPS trip system. A trip from any two unbypassed APRM channels will result in a full trip in each of the four voter channels, which in turn results in two trip inputs into each RPS trip system, thus resulting in a full scram signal. (INSERT 6) (INSERT 7) Three of the four APRM channels and all four of the voter channels are required to be OPERABLE to ensure that no single failure will preclude a scram on a valid signal. In addition, to provide adequate coverage of the entire core, consistent with the design bases for the APRM ~~functions~~, (INSERT 8) at least 20 LPRM inputs, with at least three LPRM inputs from each of the four axial levels at which the LPRMs are located, must be operable for each APRM channel, and the number of LPRM inputs that have become inoperable (and bypassed) since the last APRM calibration (SR 3.3.1.1.2) must be less than ten for each APRM channel. (INSERT 9)

(continued)

TECH SPEC MARKUP

INSERT 4:

Each APRM also includes an Oscillation Power Range Monitor (OPRM) Upscale Function which monitors small groups of LPRM signals to detect thermal-hydraulic instabilities.

INSERT 5:

APRM trip Functions 2.a, 2.b, 2.c, and 2.d are voted independently from OPRM Upscale Function 2.f. Therefore, any Function 2.a, 2.b, 2.c, or 2.d

INSERT 6:

logic channel (A1, A2, B1, and B2)

INSERT 7:

Similarly, a Function 2.f trip from any two unbypassed APRM channels will result in a full trip from each of the four voter channels.

INSERT 8:

Functions 2.a, 2.b, and 2.c

INSERT 9:

For the OPRM Upscale, Function 2.f, LPRMs are assigned to "cells" of 3 or 4 detectors. A minimum of 25 cells, each with a minimum of 2 LPRMs, must be OPERABLE for the OPRM Upscale Function 2.f to be OPERABLE.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

2.a. Average Power Range Monitor Neutron Flux-High (Setdown) (continued)

For operation at low power (i.e., MODE 2), the Average Power Range Monitor Neutron Flux-High (Setdown) Function is capable of generating a trip signal that prevents fuel damage resulting from abnormal operating transients in this power range. For most operation at low power levels, the Average Power Range Monitor Neutron Flux-High (Setdown) Function will provide a secondary scram to the Wide Range Neutron Monitor Period-Short Function because of the relative setpoints. At higher power levels, it is possible that the Average Power Range Monitor Neutron Flux-High (Setdown) Function will provide the primary trip signal for a corewide increase in power.

No specific safety analyses take direct credit for the Average Power Range Monitor Neutron Flux-High (Setdown) Function. However, this Function indirectly ensures that before the reactor mode switch is placed in the run position, reactor power does not exceed 25% RTP (SL 2.1.1.1) when operating at low reactor pressure and low core flow. Therefore, it indirectly prevents fuel damage during significant reactivity increases with THERMAL POWER < 25% RTP.

The Allowable Value is based on preventing significant increases in power when THERMAL POWER is < 25% RTP.

The Average Power Range Monitor Neutron Flux-High (Setdown) Function must be OPERABLE during MODE 2 when control rods may be withdrawn since the potential for criticality exists. In MODE 1, the Average Power Range Monitor Neutron Flux-High Function provides protection against reactivity transients and the RWM and rod block monitor protect against control rod withdrawal error events.

2.b. Average Power Range Monitor Simulated Thermal Power-High

The Average Power Range Monitor Simulated Thermal Power-High Function monitors average neutron flux to approximate the THERMAL POWER being transferred to the reactor coolant. The APRM neutron flux is electronically filtered with a time constant representative of the fuel heat transfer dynamics to generate a signal proportional to the THERMAL POWER in the reactor. The trip level is varied as a function of recirculation drive flow (i.e., at lower core flows, the setpoint is reduced proportional to the reduction in power experienced as core flow is reduced with a fixed control rod pattern) but is clamped at an upper limit that is always lower than the Average Power Range Monitor Neutron Flux-High Function Allowable Value.

INSERT 9a

(continued)

TECH SPEC MARKUP

INSERT 9a:

A note is included, applicable when the plant is in single recirculation loop operation per LCO 3.4.1, which requires the flow value, used in the Allowable Value equation, be reduced by ΔW. The value of ΔW is established to conservatively bound the inaccuracy created in the core flow/drive flow correlation due to back flow in the jet pumps associated with the inactive recirculation loop. The allowable value thus maintains thermal margins essentially unchanged from those for two loop operation. The value of ΔW is plant specific and is defined in plant procedures. The allowable value equation for single loop operation is only valid for flows down to $W = \Delta W$; the allowable value does not go below 64.9% RTP. This is acceptable because back flow in the inactive recirculation loop is only evident with drive flows of approximately 35% or greater (Reference 19).

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2.d. Average Power Range Monitor - Inop

Three of the four APRM channels are required to be OPERABLE for each of the APRM Functions. This Function (Inop) provides assurance that the minimum number of APRM channels are OPERABLE.

For any APRM channel, any time its mode switch is not in the "Operate" position, an APRM module required to issue a trip is unplugged, or the automatic self-test system detects a critical fault with the APRM channel, an Inop trip is sent to all four voter channels. Inop trips from two or more ~~non-bypassed~~ unbypassed APRM channels result in a trip output from each of the four voter channels to it's associated trip system. This Function was not specifically credited in the accident analysis, but it is retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

There is no Allowable Value for this Function.

This Function is required to be OPERABLE in the MODES where the APRM Functions are required.

2.e. 2-Out-Of-4 Voter

The 2-Out-Of-4 Voter Function provides the interface between the APRM Functions, [INSERT 10] and the final RPS trip system logic. As such, it is required to be OPERABLE in the MODES where the APRM Functions are required and is necessary to support the safety analysis applicable to each of those Functions. Therefore, the 2-Out-Of-4 Voter Function needs to be OPERABLE in MODES 1 and 2.

All four voter channels are required to be OPERABLE. Each voter channel includes self-diagnostic functions. If any voter channel detects a critical fault in its own processing, a trip is issued from that voter channel to the associated trip system.

[INSERT 11] ¶

There is no Allowable Value for this Function.

[INSERT 12]

(continued)

TECH SPEC MARKUP

INSERT 10:

, including the OPRM Upscale Function,

INSERT 11:

The Two-Out-Of-Four Logic Module includes 2-Out-Of-4 Voter hardware and the APRM Interface hardware. The 2-Out-Of-4 Voter Function 2.e votes APRM Functions 2.a, 2.b, 2.c, and 2.d independently of Function 2.f. This voting is accomplished by the 2-Out-Of-4 Voter hardware in the Two-Out-Of-Four Logic Module. The voter includes separate outputs to RPS for the two independently voted sets of Functions, each of which is redundant (four total outputs). The analysis in Reference 12 took credit for this redundancy in the justification of the 12-hour Completion Time for Condition A., so the voter Function 2.e must be declared inoperable if any of its functionality is inoperable. The voter Function 2.e does not need to be declared inoperable due to any failure affecting only the APRM Interface hardware portion of the Two-Out-Of-Four Logic Module.

TECH SPEC MARKUP

INSERT 12:

2.f. Oscillation Power Range Monitor (OPRM) Upscale

The OPRM Upscale Function provides compliance with 10 CFR 50, Appendix A, General Design Criteria (GDC) 10 and 12, thereby providing protection from exceeding the fuel MCPR safety limit (SL) due to anticipated thermal-hydraulic power oscillations.

References 14, 15 and 16 describe three algorithms for detecting thermal-hydraulic instability related neutron flux oscillations: the period based detection algorithm, the amplitude based algorithm, and the growth rate algorithm. All three are implemented in the OPRM Upscale Function, but the safety analysis takes credit only for the period based detection algorithm. The remaining algorithms provide defense in depth and additional protection against unanticipated oscillations. OPRM Upscale Function OPERABILITY for Technical Specification purposes is based only on the period based detection algorithm.

The OPRM Upscale Function receives input signals from the local power range monitors (LPRMs) within the reactor core, which are combined into "cells" for evaluation by the OPRM algorithms. Each channel is capable of detecting thermal-hydraulic instabilities, by detecting the related neutron flux oscillations, and issuing a trip signal before the MCPR SL is exceeded. Three of the four channels are required to be OPERABLE.

The OPRM Upscale trip is automatically enabled (bypass removed) when THERMAL POWER is ≥ 30% RTP, as indicated by the APRM Simulated Thermal Power, and reactor core flow is < 60% of rated flow, as indicated by APRM measured recirculation drive flow. This is the operating region where actual thermal-hydraulic instability and related neutron flux oscillations may occur (Reference 18). These setpoints, which are sometimes referred to as the "auto-bypass" setpoints, establish the boundaries of the OPRM Upscale trip enabled region. The APRM Simulated Thermal Power auto-enable setpoint has 1% deadband while the drive flow setpoint has a 2% deadband. The deadband for these setpoints is established so that it increases the enabled region.

The OPRM Upscale Function is required to be OPERABLE when the plant is at ≥ 25% RTP. The 25% RTP level is selected to provide margin in the unlikely event that a reactor power increase transient occurring while the plant is operating below 30% RTP causes a power increase to or beyond the 30% APRM Simulated Thermal Power OPRM Upscale trip auto-enable setpoint without operator action. This OPERABILITY requirement assures that the OPRM Upscale trip auto-enable function will be OPERABLE when required.

An OPRM Upscale trip is issued from an APRM channel when the period based detection algorithm in that channel detects oscillatory changes in the neutron flux, indicated by the combined signals of the LPRM detectors in a cell, with period confirmations and relative cell amplitude exceeding specified setpoints. One or more cells in a channel exceeding the trip conditions will result in a channel trip. An OPRM Upscale trip is also issued from the channel if either the growth rate or amplitude based algorithms detect oscillatory changes in the neutron flux for one or more cells in that channel.

There are four "sets" of OPRM related setpoints or adjustment parameters: a) OPRM trip auto-enable setpoints for STP (30%) and drive flow (60%); b) period based detection algorithm (PBDA) confirmation count and amplitude setpoints; c) period based detection algorithm tuning parameters; and d) growth rate algorithm (GRA) and amplitude based algorithm (ABA) setpoints.

The first set, the OPRM auto-enable region setpoints, as discussed in the SR 3.3.1.1.19 Bases, are treated as nominal setpoints with no additional margins added. The settings, 30% APRM Simulated Thermal Power and 60% drive flow, are defined (limit values) in and confirmed by SR 3.3.1.1.19. The second set, the OPRM PBDA trip setpoints, are established in accordance with methodologies defined in Reference 16, and are documented in the COLR. There are no allowable values for these setpoints. The third set, the OPRM PBDA "tuning" parameters, are established or adjusted in accordance with and controlled by PBAPS procedures. The forth set, the GRA and ABA setpoints, in accordance with References 14 and 15, are established as nominal values only, and controlled by PBAPS procedures.

BASES

ACTIONS

A.1 and A.2 (continued)

Function's inoperable channel is in one trip system and the Function still maintains RPS trip capability (refer to Required Actions B.1, B.2, and C.1 Bases). If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, the channel or the associated trip system must be placed in the tripped condition per Required Actions A.1 and A.2. Placing the inoperable channel in trip (or the associated trip system in trip) would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue. Alternatively, if it is not desired to place the channel (or trip system) in trip (e.g., as in the case where placing the inoperable channel in trip would result in a full scram), Condition D must be entered and its Required Action taken.

As noted, Action A.2 is not applicable for APRM Functions 2.a, 2.b, 2.c, ~~and 2.d.~~ 2.d, or 2.f. Inoperability of one required APRM channel affects both trip systems. For that condition, Required Action A.1 must be satisfied, and is the only action (other than restoring operability) that will restore capability to accommodate a single failure. Inoperability of more than one required APRM channel of the same trip function results in loss of trip capability and entry into Condition C, as well as entery into Condition A for each channel.

B.1 and B.2

Condition B exists when, for any one or more Functions, at least one required channel is inoperable in each trip system. In this condition, provided at least one channel per trip system is OPERABLE, the RPS still maintains trip capability for that Function, but cannot accommodate a single failure in either trip system.

Required Actions B.1 and B.2 limit the time the RPS scram logic, for any Function, would not accommodate single failure in both trip systems (e.g., one-out-of-one and one-out-of-one arrangement for a typical four channel Function). The reduced reliability of this logic arrangement was not evaluated in References 9, 12 or 13 for the 12 hour Completion Time. Within the 6 hour allowance, the associated Function will have all required channels OPERABLE or in trip (or any combination) in one trip system.

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

Completing one of these Required Actions restores RPS to a reliability level equivalent to that evaluated in References 9, 12 or 13, which justified a 12 hour allowable out of service time as presented in Condition A. The trip system in the more degraded state should be placed in trip or, alternatively, all the inoperable channels in that trip system should be placed in trip (e.g., a trip system with two inoperable channels could be in a more degraded state than a trip system with four inoperable channels if the two inoperable channels are in the same Function while the four inoperable channels are all in different Functions). The decision of which trip system is in the more degraded state should be based on prudent judgment and take into account current plant conditions (i.e., what MODE the plant is in). If this action would result in a scram or RPT, it is permissible to place the other trip system or its inoperable channels in trip.

The 6 hour Completion Time is judged acceptable based on the remaining capability to trip, the diversity of the sensors available to provide the trip signals, the low probability of extensive numbers of inoperabilities affecting all diverse Functions, and the low probability of an event requiring the initiation of a scram.

Alternately, if it is not desired to place the inoperable channels (or one trip system) in trip (e.g., as in the case where placing the inoperable channel or associated trip system in trip would result in a scram, Condition D must be entered and its Required Action taken.

As noted, Condition B is not applicable for APRM Functions 2.a, 2.b, 2.c, ~~and 2.d.~~ 2.d, or 2.f. Inoperability of an APRM channel affects both trip systems and is not associated with a specific trip system as are the APRM 2-Out-Of-4 voter and other non-APRM channels for which Condition B applies. For an inoperable APRM channel, Required Action A.1 must be satisfied, and is the only action (other than restoring operability) that will restore capability to accommodate a single failure. Inoperability of ~~[illegible]~~ a Function in more than one required APRM channel results in loss of trip capability for that Function and entry into Condition C, as well as entry into Condition A for each channel. Because Condition A and C provide Required Actions that are appropriate for the inoperability of APRM Functions 2.a, 2.b, 2.c, ~~and 2.d,~~ 2.d, or 2.f, and these functions are not associated with specific trip systems as are the APRM 2-Out-Of-4 voter and other non-APRM channels, Condition B does not apply.

(continued)

BASES

ACTIONS (continued)

E.1, F.1, and G.1, and J.1

If the channel(s) is not restored to OPERABLE status or placed in trip (or the associated trip system placed in trip) within the allowed Completion Time, the plant must be placed in a MODE or other specified condition in which the LCO does not apply. The allowed Completion Times are reasonable, based on operating experience, to reach the specified condition from full power conditions in an orderly manner and without challenging plant systems. In addition, the Completion Time of Required Actions E.1 are is consistent with the Completion Time provided in LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)." AND J.1

H.1

If the channel(s) is not restored to OPERABLE status or placed in trip (or the associated trip system placed in trip) within the allowed Completion Time, the plant must be placed in a MODE or other specified condition in which the LCO does not apply. This is done by immediately initiating action to fully insert all insertable control rods in core cells containing one or more fuel assemblies. Control rods in core cells containing no fuel assemblies do not affect the reactivity of the core and are, therefore, not required to be inserted. Action must continue until all insertable control rods in core cells containing one or more fuel assemblies are fully inserted.

Insert 13

SURVEILLANCE REQUIREMENTS

As noted at the beginning of the SRs, the SRs for each RPS instrumentation Function are located in the SRs column of Table 3.3.1.1-1.

The Surveillances are modified by a Note to indicate that when a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed for up to 6 hours, provided the associated Function maintains RPS 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 reliability analysis (Refs. 9, 12 & 13) assumption of the average time required to perform channel Surveillance. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that the RPS will trip when necessary.

(continued)

TECH SPEC MARKUP

INSERT 13:

I.1

If OPRM Upscale trip capability is not maintained, Condition I exists. References 12 and 13 justified use of alternate methods to detect and suppress oscillations for a limited period of time. The alternate methods are procedurally established consistent with the guidelines identified in Reference 17 requiring manual operator action to scram the plant if certain predefined events occur. The 12-hour allowed Completion Time for Required Action I.1 is based on engineering judgment to allow orderly transition to the alternate methods while limiting the period of time during which no automatic or alternate detect and suppress trip capability is formally in place. Based on the small probability of an instability event occurring at all, the 12 hours is judged to be reasonable.

I.2

The alternate method to detect and suppress oscillations implemented in accordance with I.1 was evaluated (References 12 and 13) based on use up to 120 days only. The evaluation, based on engineering judgment, concluded that the likelihood of an instability event that could not be adequately handled by the alternate methods during this 120-day period was negligibly small. The 120-day period is intended to be an outside limit to allow for the case where design changes or extensive analysis might be required to understand or correct some unanticipated characteristic of the instability detection algorithms or equipment. This action is not intended and was not evaluated as a routine alternative to returning failed or inoperable equipment to OPERABLE status. Correction of routine equipment failure or inoperability is expected to be normally be accomplished within the completion times allowed for Actions for Condition A.

A note is provided to indicate that LCO 3.0.4 is not applicable. The intent of that note is to allow plant start-up while within the 120-day completion time for action I.2. The primary purpose of this exclusion is to allow an orderly completion of design and verification activities, in the event of a required design change, without undue impact on plant operation.

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.9 and SR 3.3.1.1.14 (continued)

In addition, Function 5 and 7 instruments are not accessible while the unit is operating at power due to high radiation and the installed indication instrumentation does not provide accurate indication of the trip setting. For the Function 9 channels, verification that the trip settings are less than or equal to the specified Allowable Value during the CHANNEL FUNCTIONAL TEST is not required since the instruments are not accessible while the unit is operating at power due to high radiation and the installed indication instrumentation does not provided accurate indication of the trip setting. Waiver of these verifications for the above functions is considered acceptable since the magnitude of drift assumed in the setpoint calculation is based on a 24 month calibration interval. The 92 day Frequency of SR 3.3.1.1.9 is based on the reliability analysis of Reference 9.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components will pass the Surveillance when performed at the 24 month Frequency.

SR 3.3.1.1.10, SR 3.3.1.1.12, SR 3.3.1.1.15, and SR 3.3.1.1.16

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies that 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 current plant specific setpoint methodology. ~~SR 3.3.1.1.16, however, is only a calibration of the radiation detectors using a standard radiation source.~~

INSERT 13a →

As noted for SR 3.3.1.1.12, neutron detectors are excluded from CHANNEL CALIBRATION because they are passive devices, with minimal drift, and because of the difficulty of simulating a meaningful signal. Changes in

(continued)

TECH SPEC MARKUP

INSERT 13a:

As noted for SR 3.3.1.1.10, radiation detectors are excluded from CHANNEL CALIBRATION due to ALARA reasons (when the plant is operating, the radiation detectors are generally in a high radiation area; the steam tunnel). This exclusion is acceptable because the radiation detectors are passive devices, with minimal drift. To complete the radiation CHANNEL CALIBRATION, SR 3.3.1.1.16 requires that the radiation detectors be calibrated on a once per 24 months Frequency.

The once per 92 days Frequency of SR 3.3.1.1.10 is conservative with respect to the magnitude of equipment drift assumed in the setpoint analysis. The Frequency of SR 3.3.1.1.16 is based upon the assumption of a 24-month calibration interval used in the determination of the equipment drift in the setpoint analysis.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.10, SR 3.3.1.1.12, SR 3.3.1.1.15, and SR 3.3.1.1.16 (continued)

neutron detector sensitivity are compensated for by performing the 7 day calorimetric calibration (SR 3.3.1.1.2) and the 1000 MWD/T LPRM calibration against the TIPs (SR 3.3.1.1.8). A second note is provided for SR 3.3.1.1.12 that allows the WRNM SR to be performed within 12 hours of entering MODE 2 from MODE 1. Testing of the MODE 2 WRNM Functions cannot be performed in MODE 1 without utilizing jumpers, lifted leads or movable links. This Note allows entry into MODE 2 from MODE 1, if the 24 month Frequency is not met per SR 3.0.2. Twelve hours is based on operating experience and in consideration of providing a reasonable time in which to complete the SR. For the APRM Simulated Thermal Power-High Function, SR 3.3.1.1.12 also includes calibrating the associated recirculation loop flow channel. A third note is provided for SR 3.3.1.1.12 to include the recirculation flow transmitters that feed the APRMs as applied to Function 2.b. The Average Power Range Monitor Simulated Thermal Power-High Function uses the recirculation loop drive flows to vary the trip setpoint. This SR ensures that the recirculation flow transmitters that supply the recirculation flow signal to the APRMs respond to the measured recirculation flow within the necessary range and accuracy by use of a standard pressure source.

INSERT ¶ break

As noted for SR 3.3.1.1.10, radiation detectors are excluded from CHANNEL CALIBRATION due to ALARA reasons (when the plant is operating, the radiation detectors are generally in a high radiation area; the steam tunnel). This exclusion is acceptable because the radiation detectors are passive devices, with minimal drift. The radiation detectors are calibrated in accordance with SR 3.3.1.1.16 on a 24 month Frequency.

The 92 day Frequency of SR 3.3.1.1.10 is conservative with respect to the magnitude of equipment drift assumed in the setpoint analysis. The Frequencies of SR 3.3.1.1.12, SR 3.3.1.1.15 and SR 3.3.1.1.16 are based upon the assumption of a 24 month calibration interval in the determination of the magnitude of equipment drift in the applicable setpoint analysis.

INSERT 13b

SR 3.3.1.1.11

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the

(continued)

TECH SPEC MARKUP

INSERT 13b:

A third note is provided for SR 3.3.1.1.12 that includes in the SR the recirculation flow (drive flow) transmitters, which supply the flow signal to the APRMs. The APRM Simulated Thermal Power-High Function (Function 2.b) and the OPRM Upscale Function (Function 2.f), both require a valid drive flow signal. The APRM Simulated Thermal Power-High Function uses drive flow to vary the trip setpoint. The OPRM Upscale Function uses drive flow to automatically enable or bypass the OPRM Upscale trip output to RPS. A CHANNEL CALIBRATION of the APRM drive flow signal requires both calibrating the drive flow transmitters and establishing a valid drive flow / core flow relationship. The drive flow / core flow relationship is established once per refuel cycle, while operating at or near rated power and flow conditions. This method of correlating core flow and drive flow is consistent with GE recommendations. Changes throughout the cycle in the drive flow / core flow relationship due to the changing thermal hydraulic operating conditions of the core are accounted for in the margins included in the bases or analyses used to establish the setpoints for the APRM Simulated Thermal Power-High Function and the OPRM Upscale Function.

The Frequencies of SR 3.3.1.1.12 and SR 3.3.1.1.15 are based upon the assumption of a 24-month calibration interval used in the determination of the equipment drift in the setpoint analysis.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.11 (continued)

intended function. For the APRM Functions, this test supplements the automatic self-test functions that operate continuously in the APRM and voter channels. The APRM CHANNEL FUNCTIONAL TEST covers the APRM channels (including recirculation flow processing - applicable to Function 2.b only), the 2-Out-Of 4 voter channels, and the interface connections into the RPS trip systems from the voter channels. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. The 184 day Frequency of SR 3.3.1.1.11 is based on the reliability analyses of References 12 and 13. (NOTE: The actual voting logic of the 2-Out-Of-4 Voter Function is tested as part of SR 3.3.1.1.17.)

INSERT 13c

INSERT 13d

A Note is provided for Function 2.a that requires this SR to be performed within 12 hours of entering MODE 2 from MODE 1. Testing of the MODE 2 APRM Function cannot be performed in MODE 1 without utilizing jumpers or lifted leads. This Note allows entry into MODE 2 from MODE 1 if the associated Frequency is not met per SR 3.0.2.

A second Note is provided for Function 2.b that clarifies that the CHANNEL FUNCTIONAL TEST for Function 2.b includes testing of the recirculation flow processing electronics, excluding the flow transmitters.

SR 3.3.1.1.13

This SR ensures that scrams initiated from the Turbine Stop Valve—Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure—Low Functions will not be inadvertently bypassed when THERMAL POWER is ≥ 30% RTP. This involves calibration of the bypass channels. Adequate margins for the instrument setpoint methodologies are incorporated into the Allowable Value (≤ 29.4% RTP which is equivalent to ≤ 138.4 psig as measured from turbine first stage pressure) and the actual setpoint. Because main turbine bypass flow can affect this setpoint nonconservatively (THERMAL POWER is derived from turbine first stage pressure), the main turbine bypass valves must remain closed during the calibration at THERMAL POWER ≥ 30% RTP to ensure that the calibration is valid.

If any bypass channel's setpoint is nonconservative (i.e., the Functions are bypassed at ≥ 30% RTP, either due to open main turbine bypass valve(s) or other reasons), then the

(continued)

TECH SPEC MARKUP

INSERT 13c:

and the auto-enable portion of Function 2.f

INSERT 13d:

The actual auto-enable setpoints for the OPRM Upscale trip are confirmed by SR 3.3.1.1.19.

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SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.13 (continued)

affected Turbine Stop Valve—Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure—Low Functions are considered inoperable. Alternatively, the bypass channel can be placed in the conservative condition (nonbypass). If placed in the nonbypass condition, this SR is met and the channel is considered OPERABLE.

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

SR 3.3.1.1.17

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required trip logic for a specific channel. The functional testing of control rods (LCO 3.1.3), and SDV vent and drain valves (LCO 3.1.8), overlaps this Surveillance to provide complete testing of the assumed safety function.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components will pass the Surveillance when performed at the 24 month Frequency.

The LOGIC SYSTEM FUNCTIONAL TEST for APRM Function 2.e simulates APRM [and OPRM] trip conditions at the 2-Out-Of-4 voter channel inputs to check all combinations of two tripped inputs to the 2-Out-Of-4 logic in the voter channels and APRM related redundant RPS relays.

SR 3.3.1.1.18

This SR ensures that the individual channel response times are maintained less than or equal to the original design value. The RPS RESPONSE TIME acceptance criterion is included in Reference 11.

RPS RESPONSE TIME tests are conducted on a 24 month Frequency. The 24 month Frequency is consistent with the PBAPS refueling cycle and is based upon plant operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences.

INSERT 14

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TECH SPEC MARKUP

INSERT 14:

SR 3.3.1.1.19

This surveillance involves confirming the OPRM Upscale trip auto-enable setpoints. The auto-enable setpoint values are considered to be nominal values as discussed in Reference 18. This surveillance ensures that the OPRM Upscale trip is enabled (not bypassed) for the correct values of APRM Simulated Thermal Power and recirculation drive flow. Other surveillances ensure that the APRM Simulated Thermal Power and recirculation drive flow properly correlate with THERMAL POWER (SR 3.3.1.1.2) and core flow (SR 3.3.1.1.12), respectively.

If any auto-enable setpoint is nonconservative (i.e., the OPRM Upscale trip is bypassed when APRM Simulated Thermal Power ≥ 30% and recirculation drive flow < 60%), then the affected channel is considered inoperable for the OPRM Upscale Function. Alternatively, the OPRM Upscale trip auto-enable setpoint(s) may be adjusted to place the channel in a conservative condition (not bypassed). If the OPRM Upscale trip is placed in the not-bypassed condition, this SR is met and the channel is considered OPERABLE.

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

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REFERENCES

1. UFSAR, Section 7.2.
2. UFSAR, Chapter 14.
3. NEDO-32368, "Nuclear Measurement Analysis and Control Wide Range Neutron Monitoring System Licensing Report for Peach Bottom Atomic Power Station, Units 2 and 3," November 1994.
4. NEDC-32183P, "Power Rerate Safety Analysis Report for Peach Bottom 2 & 3," dated May 1993.
5. UFSAR, Section 14.6.2.
6. UFSAR, Section 14.5.4.
7. UFSAR, Section 14.5.1.
8. P. Check (NRC) letter to G. Lainas (NRC), "BWR Scram Discharge System Safety Evaluation," December 1, 1980.
9. NEDO-30851-P-A , "Technical Specification Improvement Analyses for BWR Reactor Protection System," March 1988.
10. MDE-87-0485-1, "Technical Specification Improvement Analysis for the Reactor Protection System for Peach Bottom Atomic Power Station Units 2 and 3," October 1987.
11. UFSAR, Section 7.2.3.9.
12. NEDC-32410P-A, "Nuclear Measurement Analysis and Control Power Range Neutron Monitor (NUMAC PRNM) Retrofit Plus Option III Stability Trip Function", ~~March~~ October 1995.
13. NEDC-32410P Supplement 1, "Nuclear Measurement Analysis and Control Power Range Neutron Monitor (NUMAC PRNM) Retrofit Plus Option III Stability Trip Function, Supplement 1", November 1997.

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14. NEDO-31960-A, "BWR Owners' Group Long-Term Stability Solutions Licensing Methodology," November 1995.

15. NEDO-31960-A, Supplement 1, "BWR Owners' Group Long-Term Stability Solutions Licensing Methodology," November 1995.

16. NEDO-32465-A, "BWR Owners' Group Long-Term Stability Detect and Suppress Solutions Licensing Basis Methodology And Reload Applications," August 1996.

17. Letter, L. A. England (BWROG) to M. J. Virgilio, "BWR Owners' Group Guidelines for Stability Interim Corrective Action", June 6, 1994.

18. BWROG Letter 96113, K. P. Donovan (BWROG) to L. E. Phillips (NRC), "Guidelines for Stability Option III 'Enable Region' (TAC M92882)," September 17, 1996.

19. NEDO-24229-1, "Peach Bottom Atomic Power Station Units 2 and 3 Single-Loop Operation," May 1980.

BASES

APPLICABLE SAFETY ANALYSES (continued)

Plant specific LOCA and average power range monitor/rod block monitor Technical Specification/maximum extended load line limit analyses have been performed assuming only one operating recirculation loop. These analyses demonstrate 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 (Refs. 2, 3, and 4).

The transient analyses of Chapter 14 of the UFSAR have also been performed for single recirculation loop operation (Ref. 5) 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 (RPS) average power range monitor (APRM) instrument setpoints is also required to account for the different relationships between recirculation drive flow and reactor core flow. The MCPR limits and APLHGR limits (power-dependent APLHGR multipliers, $MAPFAC_P$, and flow-dependent APLHGR multipliers, $MAPFAC_F$) for single loop operation are specified in the COLR. The APRM Simulated Thermal Power-High Allowable Value is in LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation."

Safety analyses performed for UFSAR Chapter 14 implicitly assume core conditions are stable. However, at the high power/low flow corner of the power/flow map, an increased probability for limit cycle oscillations exists (Ref. 6) depending on combinations of operating conditions (e.g., power shape, bundle power, and bundle flow). Generic evaluations indicate that when regional power oscillations become detectable on the APRMs, the safety margin may be insufficient under some operating conditions to ensure actions taken to respond to the APRMs signals would prevent violation of the MCPR Safety Limit (Ref. 7). NRC Generic Letter 86-02 (Ref. 8) addressed stability calculation methodology and stated that due to uncertainties, 10 CFR 50, Appendix A, General Design Criteria (GDC) 10 and 12 could not be met using analytic procedures on a BWR 4 design. However, Reference 8 concluded that operating limitations which provide for the detection (by monitoring neutron flux noise levels) and suppression of flux oscillations in operating regions of potential instability consistent with

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APPLICABLE SAFETY ANALYSES (continued)

the recommendations of Reference 6 are acceptable to demonstrate compliance with GDC 10 and 12. The NRC concluded that regions of potential instability could occur at calculated decay ratios of 0.8 or greater by the General Electric methodology.

Stability tests at operating BWRs were reviewed to determine a generic region of the power/flow map in which surveillance of neutron flux noise levels should be performed. A conservative decay ratio was chosen as the basis for determining the generic region for surveillance to account for the plant to plant variability of decay ratio with core and fuel designs. This decay ratio also helps ensure sufficient margin to an instability occurrence is maintained. The generic region ("Restricted" Region of Figure 3.4.1-1) has been determined to be bounded by the 80% rod line and the 45% core flow line. This conforms to Reference 6 recommendations. Operation is permitted in the "Restricted" Region when two recirculation loops are in operation provided neutron flux noise levels are verified to be within limits. Operation is permitted in the "Restricted" Region when only one recirculation loop is in operation provided core flow is > 39% of rated core flow and neutron flux levels are verified to be within limits. Single recirculation loop operation in the "Restricted" Region with core flow ≤ 39% of rated core flow shall be avoided due to the increased potential for thermal hydraulic instability in this condition. The "Unrestricted" Region of Figure 3.4.1-1 is the area of the power/flow map where unrestricted operation (with respect to thermal hydraulic stability concerns) is allowed, and includes any area not shown as the "Restricted" Region of the figure. The full power/flow map is not shown in Figure 3.4.1-1 to enhance the readability of the bounds of the "Restricted" Region. Operation outside the bounds of Figure 3.4.1-1 is governed by plant operating procedures.

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

LCO

Two recirculation loops are normally required to be in operation with their flows matched within the limits specified in SR 3.4.1.1 to ensure that during a LOCA caused by a break of the piping of one recirculation loop the

(continued)

BASES

LCO

assumptions of the LOCA analysis are satisfied. In addition, the core flow expressed as a function of THERMAL POWER must be in the "Unrestricted" Region of Figure 3.4.1-1, "THERMAL POWER Versus Core Flow Stability Regions." Alternatively, with only one recirculation loop in operation, modifications to the required APLHGR limits (power- and flow-dependent APLHGR multipliers, $MAPFAC_P$ and $MAPFAC_F$, respectively of LCO 3.2.1, "AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)"), MCPR limits (LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)") and APRM Simulated Thermal Power-High Allowable Value (LCO 3.3.1.1) must be applied to allow continued operation consistent with the assumptions of References 5 and 6.

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

APPLICABILITY

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

(continued)

BASES

ACTIONS

A.1

With one or two recirculation loops in operation with core flow as a function of THERMAL POWER in the "Restricted" Region of Figure 3.4.1-1, the plant is operating in a region where the potential for thermal hydraulic instability exists. In order to assure sufficient margin is provided for operator response to detect and suppress potential limit cycle oscillations, APRM and local power range monitor

(LPRM) neutron flux noise levels must be periodically monitored and verified to be ≤ 4% and ≤ 3 times baseline noise levels. Detector levels A and C of one LPRM string per core quadrant plus detectors A and C of one LPRM string in the center of the core shall be monitored. A minimum of three APRMs shall also be monitored. The Completion Times of this verification (within 1 hour and once per 8 hours thereafter and within 1 hour after completion of any THERMAL POWER increase ≥ 5% RATED THERMAL POWER) are acceptable for ensuring potential limit cycle oscillations are detected to allow operator response to suppress the oscillation. These Completion Times were developed considering the operator's inherent knowledge of reactor status and sensitivity to potential thermal hydraulic instabilities when operating in this condition.

B.1

With the Required Action and associated Completion Time of Condition A not met, sufficient margin may not be available for operator response to suppress potential limit cycle oscillations since APRM or LPRM neutron flux noise levels may be > 4% and > 3 times baseline noise levels. As a result, action must be immediately initiated to restore noise levels to within required limits. The 2 hour Completion Time for restoring APRM and LPRM neutron flux noise levels to within required limits is acceptable because it minimizes risk while allowing time for restoration before subjecting the plant to transients associated with shutdown.

(continued)

BASES

ACTIONS (continued)

C.1 and C.2

With one recirculation loop in operation with core flow ≤ 39% of rated core flow and THERMAL POWER in the "Restricted" Region of Figure 3.4.1-1, an increased potential for thermal hydraulic instability exists. As a result, immediate action should be initiated to reduce THERMAL POWER to the "Unrestricted" Region of Figure 3.4.1-1 or increase core flow to > 39% of rated core flow. The

4 hour Completion Time provides a reasonable amount of time to complete the Required Action and is considered acceptable based on the frequent core monitoring by the operators (Required Action A.1) allowing potential limit cycle oscillations to be quickly detected.

A.1 D.1

With the requirements of the LCO not met for reasons other than Conditions A, B, C, and F NO RECIRCULATION LOOPS IN OPERATION the recirculation loops must be restored to operation with matched flows 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. The loop with the lower flow must be considered not in operation. (However, the flow rate of both loops shall be used for the purposes of determining if the THERMAL POWER and core flow combination is in the Unrestricted Region of Figure 3.4.1-1.) 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 operating limits and RPS setpoints, operation with only one recirculation loop would satisfy the requirements of the LCO and the initial conditions of the accident sequence.

The 24 hour Completion Time is based on the low probability of an accident occurring during this time period, on a reasonable time to complete the Required Action, and on frequent core monitoring by operators allowing abrupt changes in core flow conditions to be quickly detected.

(continued)

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BASES

ACTIONS (A.1) ~~D.1~~ (continued)

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 pump speeds to re-establish forward flow or by tripping the pump.

(B.1) ~~E.1~~ (A)

With ~~any~~ [no recirculation loops in operation or the] ~~The~~ Required Action and associated Completion Time of Condition ~~B, C, or D~~ not met, the plant must 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.

~~(C.1) F.1~~

~~With no recirculation loops in operation, the plant must be brought to a MODE in which the LCO does not apply. Action must be initiated immediately to reduce THERMAL POWER to be within the "Unrestricted" Region of Figure 3.4.1-1 to assure thermal hydraulic stability concerns are addressed. The plant is then required to be placed in MODE 3 in 6 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 is reasonable to reach MODE 3 considering the potential for thermal hydraulic instability in this condition.~~

~~INSERT 1B~~

(continued)

\BASES

SURVEILLANCE REQUIREMENTS

SR 3.4.1.1

This SR ensures the recirculation loops are within the allowable limits for mismatch. At low core flow (i.e., < 71.75 X 10^6 lbm/hr), the MCPR requirements provide larger margins to the fuel cladding integrity Safety Limit such that the potential adverse effect of early boiling transition during a LOCA is reduced. A larger flow mismatch can therefore be allowed when core flow is < 71.75 X 10^6 lbm/hr. 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 core flow. (Rated core flow is 102.5 X 10^6 lbm/hr. The first limit is based on mismatch ≤ 10% of rated core flow when operating at < 70% of rated core flow. The second limit is based on mismatch ≤ 5% of rated core flow when operating at ≥ 70% of rated core flow.) If the flow mismatch exceeds the specified limits, the loop with the lower flow is considered not in operation. (However, for the purposes of performing SR 3.4.1.2, the flow rate of both loops shall be used.) The 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 Surveillance 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.

SR 3.4.1.2

This SR ensures the reactor THERMAL POWER and core flow are within appropriate parameter limits to prevent uncontrolled power oscillations. At low recirculation flows and high reactor power, the reactor exhibits increased susceptibility to thermal hydraulic instability. Figure 3.4.1-1 is based on guidance provided in Reference 6, which is used to respond to operation in these conditions. The 24 hour Frequency is based on operating experience and the operators' inherent knowledge of reactor status, including significant changes in THERMAL POWER and core flow.

(continued)

REFERENCES

1. UFSAR, Section 14.6.3.

2. NEDC-32163P, "PBAPS Units 2 and 3 SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis," January 1993.

3. NEDC-32162P, "Maximum Extended Load Line Limit and ARTS Improvement Program Analyses for Peach Bottom Atomic Power Station Unit 2 and 3," Revision 1, February 1993.

4. NEDC-32427P, "Peach Bottom Atomic Power Station Unit 3 Cycle 10 ARTS Thermal Limits Analyses," December 1994.

5. NEDO-24229-1, "PBAPS Units 2 and 3 Single-Loop Operation," May 1980.

6. GE Service Information Letter No. 380, "BWR Core Thermal Hydraulic Stability," Revision 1, February 10, 1984.

7. NRC Bulletin 88-07, "Power Oscillations in Boiling Water Reactors (BWRs)," Supplement 1, December 30, 1988.

8. NRC Generic Letter 86-02, "Technical Resolution of Generic Issue B-19 Thermal Hydraulic Stability," January 22, 1986.

5.6 Reporting Requirements (continued)

5.6.5 CORE OPERATING LIMITS REPORT (COLR)

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

1. The Average Planar Linear Heat Generation Rate for Specification 3.2.1;

2. The Minimum Critical Power Ratio for Specifications 3.2.2 and 3.3.2.1;

3. The Linear Heat Generation Rate for Specification 3.2.3; and

INSERT 16

4. The Control Rod Block Instrumentation for Specification 3.3.2.1.

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. NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel" (latest approved version as specified in the COLR);

2. NEDC-32162P, "Maximum Extended Load Line Limit and ARTS Improvement Program Analyses for Peach Bottom Atomic Power Station Units 2 and 3," Revision 2, March, 1995;

3. PECo-FMS-0001-A, "Steady-State Thermal Hydraulic Analysis of Peach Bottom Units 2 and 3 using the FIBWR Computer Code";

4. PECo-FMS-0002-A, "Method for Calculating Transient Critical Power Ratios for Boiling Water Reactors (RETRAN-TCPPECo)";

5. PECo-FMS-0003-A, "Steady-State Fuel Performance Methods Report";

6. PECo-FMS-0004-A, "Methods for Performing BWR Systems Transient Analysis";

(continued)

TECH SPEC MARKUP

INSERT 16:

5. The Oscillation Power Range Monitor (OPRM) Instrumentation for Specification 3.3.1.1.

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5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

7. PECo-FMS-0005-A, "Methods for Performing BWR Steady-State Reactor Physics Analysis"; and

INSERT 17

8. PECo-FMS-0006-A, "Methods for Performing BWR Reload Safety Evaluations."

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

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

5.6.6 Post Accident Monitoring (PAM) Instrumentation Report

When a report is required by Condition B or F of LCO 3.3.3.1, "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.

TECH SPEC MARKUP

INSERT 17:

9. NEDO-32465-A, "BWR Owners' Group Long-Term Stability Detect and Suppress Solutions Licensing Basis Methodology And Reload Applications," August 1996.

3.3 INSTRUMENTATION

3.3.1.1 Reactor Protection System (RPS) Instrumentation

LCO 3.3.1.1 The RPS instrumentation for each Function in Table 3.3.1.1-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.1.1-1.

ACTIONS

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

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more required channels inoperable.	A.1	Place channel in trip.	12 hours
	OR		
	A.2	--------NOTE--------- Not applicable for Functions 2.a, 2.b, 2.c, 2.d, or 2.f. --------------------- Place associated trip system in trip.	12 hours
B. ---------NOTE--------- Not applicable for Functions 2.a, 2.b, 2.c, 2.d, or 2.f. --------------------- One or more Functions with one or more required channels inoperable in both trip systems.	B.1	Place channel in one trip system in trip.	6 hours
	OR		
	B.2	Place one trip system in trip.	6 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
H. As required by Required Action D.1 and referenced in Table 3.3.1.1-1.	H.1	Initiate action to fully insert all insertable control rods in core cells containing one or more fuel assemblies.	Immediately
I. As required by Required Action D.1 and referenced in Table 3.3.1.1-1.	I.1	Initiate alternate method to detect and suppress thermal hydraulic instability oscillations.	12 hours
	AND		
	I.2	--------NOTE-------- LCO 3.0.4 is not applicable. -------------------- Restore required channels to OPERABLE.	120 days
J. Required Action and associated Completion Time of Condition I not met.	J.1	Reduce THERMAL POWER to <25% RTP.	4 hours

(continued)

SURVEILLANCE REQUIREMENTS

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

1. Refer to Table 3.3.1.1-1 to determine which SRs apply for each RPS Function.

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

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.1.1.2	-----------------NOTE----------------- Not required to be performed until 12 hours after THERMAL POWER ≥ 25% RTP. --------------------------------------- Verify the absolute difference between the average power range monitor (APRM) channels and the calculated power is ≤ 2% RTP while operating at ≥ 25% RTP.	7 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.9	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.1.1.10	-----NOTE----- Radiation detectors are excluded. ---------- Perform CHANNEL CALIBRATION.	92 days
SR 3.3.1.1.11	-----NOTES----- 1. For Function 2.a, not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2. 2. For Functions 2.b and 2.f, the CHANNEL FUNCTIONAL TEST includes the recirculation flow input processing, excluding the flow transmitters. ---------- Perform CHANNEL FUNCTIONAL TEST.	184 days
SR 3.3.1.1.12	-----NOTES----- 1. Neutron detectors are excluded. 2. For Function 1, not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2. 3. For Functions 2.b and 2.f, the recirculation flow transmitters that feed the APRMs are included. ---------- Perform CHANNEL CALIBRATION.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.13	Verify Turbine Stop Valve—Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure—Low Functions are not bypassed when THERMAL POWER is ≥ 30% RTP.	24 months
SR 3.3.1.1.14	Perform CHANNEL FUNCTIONAL TEST.	24 months
SR 3.3.1.1.15	Perform CHANNEL CALIBRATION.	24 months
SR 3.3.1.1.16	Calibrate each radiation detector.	24 months
SR 3.3.1.1.17	Perform LOGIC SYSTEM FUNCTIONAL TEST.	24 months
SR 3.3.1.1.18	Verify the RPS RESPONSE TIME is within limits.	24 months
SR 3.3.1.1.19	Verify OPRM is not bypassed when APRM Simulated Thermal Power is ≥30% and recirculation drive flow is <60%.	24 months

Table 3.3.1.1-1 (page 1 of 3)
Reactor Protection System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	CONDITIONS REFERENCED FROM REQUIRED ACTION D.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Wide Range Neutron Monitors					
a. Period-Short	2	3	G	SR 3.3.1.1.1 SR 3.3.1.1.5 SR 3.3.1.1.12 SR 3.3.1.1.17 SR 3.3.1.1.18	≥ 13 seconds
	5[(a)]	3	H	SR 3.3.1.1.1 SR 3.3.1.1.6 SR 3.3.1.1.12 SR 3.3.1.1.17 SR 3.3.1.1.18	≥ 13 seconds
b. Inop	2	3	G	SR 3.3.1.1.5 SR 3.3.1.1.17	NA
	5[(a)]	3	H	SR 3.3.1.1.6 SR 3.3.1.1.17	NA
2. Average Power Range Monitors					
a. Neutron Flux-High (Setdown)	2	3[(c)]	G	SR 3.3.1.1.1 SR 3.3.1.1.8 SR 3.3.1.1.11 SR 3.3.1.1.12	≤ 15.0% RTP
b. Simulated Thermal Power-High	1	3[(c)]	F	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.8 SR 3.3.1.1.11 SR 3.3.1.1.12	≤ 0.66 W + 64.9% RTP[(b)] and ≤ 118.0% RTP
c. Neutron Flux-High	1	3[(c)]	F	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.8 SR 3.3.1.1.11 SR 3.3.1.1.12	≤ 119.7% RTP
d. Inop	1,2	3[(c)]	G	SR 3.3.1.1.11	NA
e. 2-Out-Of-4 Voter	1,2	2	G	SR 3.3.1.1.1 SR 3.3.1.1.11 SR 3.3.1.1.17 SR 3.3.1.1.18	NA
f. OPRM Upscale	≥25% RTP	3[(c)]	I	SR 3.3.1.1.1 SR 3.3.1.1.8 SR 3.3.1.1.11 SR 3.3.1.1.12 SR 3.3.1.1.19	NA[(d)]

(continued)

(a) With any control rod withdrawn from a core cell containing one or more fuel assemblies.

(b) 0.66 (W - ΔW) + 64.9% RTP when reset for single loop operation per LCO 3.4.1, "Recirculation Loops Operating."

(c) Each APRM channel provides inputs to both trip systems.

(d) See COLR for OPRM period based detection algorithm (PBDA) setpoint limits.

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; and

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

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

APPLICABILITY: MODES 1 and 2.

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ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Requirements of the LCO not met.	A.1	Satisfy the requirements of the LCO.	24 hours
B. Required Action and associated Completion Time of Condition A not met. OR No recirculation loops in operation.	B.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. $\leq 10.25 \times 10^6$ lbm/hr when operating at $< 71.75 \times 10^6$ lbm/hr; and b. $\leq 5.125 \times 10^6$ lbm/hr when operating at $\geq 71.75 \times 10^6$ lbm/hr.	24 hours

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

1.b. Wide Range Neutron Monitor—Inop (continued)

Six channels of the Wide Range Neutron Monitor—Inop Function, with three channels in each trip system, are required to be OPERABLE to ensure that no single instrument failure will preclude a scram from this Function on a valid signal. Since this Function is not assumed in the safety analysis, there is no Allowable Value for this Function.

This Function is required to be OPERABLE when the Wide Range Neutron Monitor Period-Short Function is required.

Average Power Range Monitor (APRM)

The APRM channels provide the primary indication of neutron flux within the core and respond almost instantaneously to neutron flux increases. The APRM channels receive input signals from the local power range monitors (LPRMs) within the reactor core to provide an indication of the power distribution and local power changes. The APRM channels average these LPRM signals to provide a continuous indication of average reactor power from a few percent to greater than RTP. Each APRM also includes an Oscillation Power Range Monitor (OPRM) Upscale Function which monitors small groups of LPRM signals to detect thermal-hydraulic instabilities.

The APRM System is divided into four APRM channels and four 2-out-of-4 voter channels. Each APRM channel provides inputs to each of the four voter channels. The four voter channels are divided into two groups of two each, with each group of two providing inputs to one RPS trip system. The system is designed to allow one APRM channel, but no voter channels, to be bypassed. A trip from any one unbypassed APRM will result in a "half-trip" in all four of the voter channels, but no trip inputs to either RPS trip system. APRM trip Functions 2.a, 2.b, 2.c, and 2.d are voted independently from OPRM Upscale Function 2.f. Therefore, any Function 2.a, 2.b, 2.c, or 2.d trip from any two unbypassed APRM channels will result in a full trip in each of the four voter channels, which in turn results in two trip inputs into each RPS trip system logic channel (A1, A2, B1, and B2), thus resulting in a full scram signal. Similarly, a Function 2.f trip from any two unbypassed APRM channels will result in a full trip from each of the four voter channels. Three of the four APRM channels and all four of the voter channels are required to be OPERABLE to ensure that no single failure will preclude a scram on a valid signal. In addition, to provide adequate coverage of the entire core, consistent with the design bases for the APRM Functions 2.a, 2.b, and 2.c, at least 20 LPRM inputs, with at least three LPRM inputs from each of the four axial levels at which the LPRMs are located, must be operable for each APRM channel, and the number of LPRM inputs that have become inoperable (and bypassed) since the last APRM calibration (SR 3.3.1.1.2) must be less than ten for each APRM channel. For the OPRM Upscale, Function 2.f, LPRMs are assigned to “cells” of 3 or 4 detectors. A minimum of 25 cells, each with a minimum of 2 LPRMs, must be OPERABLE for the OPRM Upscale Function 2.f to be OPERABLE.

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

2.a. Average Power Range Monitor Neutron Flux-High (Setdown) (continued)

For operation at low power (i.e., MODE 2), the Average Power Range Monitor Neutron Flux-High (Setdown) Function is capable of generating a trip signal that prevents fuel damage resulting from abnormal operating transients in this power range. For most operation at low power levels, the Average Power Range Monitor Neutron Flux-High (Setdown) Function will provide a secondary scram to the Wide Range Neutron Monitor Period-Short Function because of the relative setpoints. At higher power levels, it is possible that the Average Power Range Monitor Neutron Flux-High (Setdown) Function will provide the primary trip signal for a corewide increase in power.

No specific safety analyses take direct credit for the Average Power Range Monitor Neutron Flux-High (Setdown) Function. However, this Function indirectly ensures that before the reactor mode switch is placed in the run position, reactor power does not exceed 25% RTP (SL 2.1.1.1) when operating at low reactor pressure and low core flow. Therefore, it indirectly prevents fuel damage during significant reactivity increases with THERMAL POWER < 25% RTP.

The Allowable Value is based on preventing significant increases in power when THERMAL POWER is < 25% RTP.

The Average Power Range Monitor Neutron Flux-High (Setdown) Function must be OPERABLE during MODE 2 when control rods may be withdrawn since the potential for criticality exists. In MODE 1, the Average Power Range Monitor Neutron Flux-High Function provides protection against reactivity transients and the RWM and rod block monitor protect against control rod withdrawal error events.

2.b. Average Power Range Monitor Simulated Thermal Power-High

The Average Power Range Monitor Simulated Thermal Power-High Function monitors average neutron flux to approximate the THERMAL POWER being transferred to the reactor coolant. The APRM neutron flux is electronically filtered with a time constant representative of the fuel heat transfer dynamics to generate a signal proportional to the THERMAL POWER in the reactor. The trip level is varied as a function of recirculation drive flow (i.e., at lower core flows, the setpoint is reduced proportional to the reduction in power experienced as core flow is reduced with a fixed control rod pattern) but is clamped at an upper limit that is always lower than the Average Power Range Monitor Neutron Flux-High Function Allowable Value. A note is included, applicable when the plant is in single recirculation loop operation per LCO 3.4.1, which requires the flow value, used in the Allowable Value equation, be reduced by ΔW. The value of ΔW

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

2.b. Average Power Range Monitor Simulated Thermal Power-High (continued)

is established to conservatively bound the inaccuracy created in the core flow/drive flow correlation due to back flow in the jet pumps associated with the inactive recirculation loop. The allowable value thus maintains thermal margins essentially unchanged from those for two loop operation. The value of ΔW is plant specific and is defined in plant procedures. The allowable value equation for single loop operation is only valid for flows down to $W = \Delta W$; the allowable value does not go below 64.9% RTP. This is acceptable because back flow in the inactive recirculation loop is only evident with drive flows of approximately 35% or greater (Reference 19).

The Average Power Range Monitor Simulated Thermal Power-High Function is not specifically credited in the safety analysis but is intended to provide an additional margin of protection from transient induced fuel damage during operation where recirculation flow is reduced to below the minimum required for rated power operation. The Average Power Range Monitor Simulated Thermal Power-High Function provides protection against transients where THERMAL POWER increases slowly (such as the loss of feedwater heating event) and protects the fuel cladding integrity by ensuring that the MCPR SL is not exceeded. During these events, the THERMAL POWER increase does not significantly lag the neutron flux scram. For rapid neutron flux increase events, the THERMAL POWER lags the neutron flux and the Average Power Range Monitor Neutron Flux-High Function will provide a scram signal before the Average Power Range Monitor Simulated Thermal Power-High Function setpoint is exceeded.

Each APRM channel uses one total drive flow signal representative of total core flow. The total drive flow signal is generated by the flow processing logic, part of the APRM channel, by summing up the flow calculated from two flow transmitter signal inputs, one from each of the two recirculation loop flows. The flow processing logic OPERABILITY is part of the APRM channel OPERABILITY requirements for this Function. The APRM flow processing logic is considered inoperable whenever it cannot deliver a flow signal less than or equal to actual Recirculation flow conditions for all steady state and transient reactor conditions while in Mode 1. Reduced or Downscale flow conditions due to planned maintenance or testing activities during derated plant conditions (i.e. end of cycle coast down) will result in conservative setpoints for the APRM Simulated Thermal Power-High function, thus maintaining that function operable.

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2.d. Average Power Range Monitor—Inop

Three of the four APRM channels are required to be OPERABLE for each of the APRM Functions. This Function (Inop) provides assurance that the minimum number of APRM channels are OPERABLE.

For any APRM channel, any time its mode switch is not in the "Operate" position, an APRM module required to issue a trip is unplugged, or the automatic self-test system detects a critical fault with the APRM channel, an Inop trip is sent to all four voter channels. Inop trips from two or more unbypassed APRM channels result in a trip output from each of the four voter channels to it's associated trip system. This Function was not specifically credited in the accident analysis, but it is retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

There is no Allowable Value for this Function.

This Function is required to be OPERABLE in the MODES where the APRM Functions are required.

2.e. 2-Out-Of-4 Voter

The 2-Out-Of-4 Voter Function provides the interface between the APRM Functions, including the OPRM Upscale Function, and the final RPS trip system logic. As such, it is required to be OPERABLE in the MODES where the APRM Functions are required and is necessary to support the safety analysis applicable to each of those Functions. Therefore, the 2-Out-Of-4 Voter Function needs to be OPERABLE in MODES 1 and 2.

All four voter channels are required to be OPERABLE. Each voter channel includes self-diagnostic functions. If any voter channel detects a critical fault in its own processing, a trip is issued from that voter channel to the associated trip system.

The Two-Out-Of-Four Logic Module includes 2-Out-Of-4 Voter hardware and the APRM Interface hardware. The 2-Out-Of-4 Voter Function 2.e votes APRM Functions 2.a, 2.b, 2.c, and 2.d independently of Function 2.f. This voting is accomplished by the 2-Out-Of-4 Voter hardware in the Two-Out-Of-Four Logic Module. The voter includes separate outputs to RPS for the two independently voted sets of Functions, each of which is redundant (four total outputs). The analysis in Reference 12 took credit for this redundancy in the justification of the 12-hour Completion Time for Condition A., so the voter Function 2.e must be declared inoperable if any of its functionality is inoperable. The voter Function 2.e does not need to be declared inoperable due to any failure affecting only the APRM Interface hardware portion of the Two-Out-Of-Four Logic Module.

There is no Allowable Value for this Function.

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2.f. Oscillation Power Range Monitor (OPRM) Upscale

The OPRM Upscale Function provides compliance with 10 CFR 50, Appendix A, General Design Criteria (GDC) 10 and 12, thereby providing protection from exceeding the fuel MCPR safety limit (SL) due to anticipated thermal-hydraulic power oscillations.

References 14, 15 and 16 describe three algorithms for detecting thermal-hydraulic instability related neutron flux oscillations: the period based detection algorithm, the amplitude based algorithm, and the growth rate algorithm. All three are implemented in the OPRM Upscale Function, but the safety analysis takes credit only for the period based detection algorithm. The remaining algorithms provide defense in depth and additional protection against unanticipated oscillations. OPRM Upscale Function OPERABILITY for Technical Specification purposes is based only on the period based detection algorithm.

The OPRM Upscale Function receives input signals from the local power range monitors (LPRMs) within the reactor core, which are combined into "cells" for evaluation by the OPRM algorithms. Each channel is capable of detecting thermal-hydraulic instabilities, by detecting the related neutron flux oscillations, and issuing a trip signal before the MCPR SL is exceeded. Three of the four channels are required to be OPERABLE.

The OPRM Upscale trip is automatically enabled (bypass removed) when THERMAL POWER is ≥ 30% RTP, as indicated by the APRM Simulated Thermal Power, and reactor core flow is < 60% of rated flow, as indicated by APRM measured recirculation drive flow. This is the operating region where actual thermal-hydraulic instability and related neutron flux oscillations may occur (Reference 18). These setpoints, which are sometimes referred to as the "auto-bypass" setpoints, establish the boundaries of the OPRM Upscale trip enabled region. The APRM Simulated Thermal Power auto-enable setpoint has 1% deadband while the drive flow setpoint has a 2% deadband. The deadband for these setpoints is established so that it increases the enabled region.

The OPRM Upscale Function is required to be OPERABLE when the plant is at ≥ 25% RTP. The 25% RTP level is selected to provide margin in the unlikely event that a reactor power increase transient occurring while the plant is operating below 30% RTP causes a power increase to or

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2.f. Oscillation Power Range Monitor (OPRM) Upscale (continued)

beyond the 30% APRM Simulated Thermal Power OPRM Upscale trip auto-enable setpoint without operator action. This OPERABILITY requirement assures that the OPRM Upscale trip auto-enable function will be OPERABLE when required.

An OPRM Upscale trip is issued from an APRM channel when the period based detection algorithm in that channel detects oscillatory changes in the neutron flux, indicated by the combined signals of the LPRM detectors in a cell, with period confirmations and relative cell amplitude exceeding specified setpoints. One or more cells in a channel exceeding the trip conditions will result in a channel trip. An OPRM Upscale trip is also issued from the channel if either the growth rate or amplitude based algorithms detect oscillatory changes in the neutron flux for one or more cells in that channel.

There are four "sets" of OPRM related setpoints or adjustment parameters: a) OPRM trip auto-enable setpoints for STP (30%) and drive flow (60%); b) period based detection algorithm (PBDA) confirmation count and amplitude setpoints; c) period based detection algorithm tuning parameters; and d) growth rate algorithm (GRA) and amplitude based algorithm (ABA) setpoints.

The first set, the OPRM auto-enable region setpoints, as discussed in the SR 3.3.1.1.19 Bases, are treated as nominal setpoints with no additional margins added. The settings, 30%o APRM Simulated Thermal Power and 60% drive flow, are defined (limit values) in and confirmed by SR 3.3.1.1.19. The second set, the OPRM PBDA trip setpoints, are established in accordance with methodologies defined in Reference 16, and are documented in the COLR. There are no allowable values for these setpoints. The third set, the OPRM PBDA "tuning" parameters, are established or adjusted in accordance with and controlled by PBAPS procedures. The fourth set, the GRA and ABA setpoints, in accordance with References 14 and 15, are established as nominal values only, and controlled by PBAPS procedures.

(continued)

BASES

ACTIONS

A.1 and A.2 (continued)

Function's inoperable channel is in one trip system and the Function still maintains RPS trip capability (refer to Required Actions B.1, B.2, and C.1 Bases). If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, the channel or the associated trip system must be placed in the tripped condition per Required Actions A.1 and A.2. Placing the inoperable channel in trip (or the associated trip system in trip) would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue. Alternatively, if it is not desired to place the channel (or trip system) in trip (e.g., as in the case where placing the inoperable channel in trip would result in a full scram), Condition D must be entered and its Required Action taken.

As noted, Action A.2 is not applicable for APRM Functions 2.a, 2.b, 2.c, 2.d, or 2.f. Inoperability of one required APRM channel affects both trip systems. For that condition, Required Action A.1 must be satisfied, and is the only action (other than restoring operability) that will restore capability to accommodate a single failure. Inoperability of more than one required APRM channel of the same trip function results in loss of trip capability and entry into Condition C, as well as entery into Condition A for each channel.

B.1 and B.2

Condition B exists when, for any one or more Functions, at least one required channel is inoperable in each trip system. In this condition, provided at least one channel per trip system is OPERABLE, the RPS still maintains trip capability for that Function, but cannot accommodate a single failure in either trip system.

Required Actions B.1 and B.2 limit the time the RPS scram logic, for any Function, would not accommodate single failure in both trip systems (e.g., one-out-of-one and one-out-of-one arrangement for a typical four channel Function). The reduced reliability of this logic arrangement was not evaluated in References 9, 12 or 13 for the 12 hour Completion Time. Within the 6 hour allowance, the associated Function will have all required channels OPERABLE or in trip (or any combination) in one trip system.

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

Completing one of these Required Actions restores RPS to a reliability level equivalent to that evaluated in References 9, 12 or 13, which justified a 12 hour allowable out of service time as presented in Condition A. The trip system in the more degraded state should be placed in trip or, alternatively, all the inoperable channels in that trip system should be placed in trip (e.g., a trip system with two inoperable channels could be in a more degraded state than a trip system with four inoperable channels if the two inoperable channels are in the same Function while the four inoperable channels are all in different Functions). The decision of which trip system is in the more degraded state should be based on prudent judgment and take into account current plant conditions (i.e., what MODE the plant is in). If this action would result in a scram or RPT, it is permissible to place the other trip system or its inoperable channels in trip.

The 6 hour Completion Time is judged acceptable based on the remaining capability to trip, the diversity of the sensors available to provide the trip signals, the low probability of extensive numbers of inoperabilities affecting all diverse Functions, and the low probability of an event requiring the initiation of a scram.

Alternately, if it is not desired to place the inoperable channels (or one trip system) in trip (e.g., as in the case where placing the inoperable channel or associated trip system in trip would result in a scram, Condition D must be entered and its Required Action taken.

As noted, Condition B is not applicable for APRM Functions 2.a, 2.b, 2.c, 2.d, or 2.f. Inoperability of an APRM channel affects both trip systems and is not associated with a specific trip system as are the APRM 2-Out-Of-4 voter and other non-APRM channels for which Condition B applies. For an inoperable APRM channel, Required Action A.1 must be satisfied, and is the only action (other than restoring operability) that will restore capability to accommodate a single failure. Inoperability of a Function in more than one required APRM channel results in loss of trip capability for that Function and entry into Condition C, as well as entry into Condition A for each channel. Because Condition A and C provide Required Actions that are appropriate for the inoperability of APRM Functions 2.a, 2.b, 2.c, 2.d, or 2.f, and these functions are not associated with specific trip systems as are the APRM 2-Out-Of-4 voter and other non-APRM channels, Condition B does not apply.

(continued)

BASES

ACTIONS (continued)

E.1, F.1, G.1, and J.1

If the channel(s) is not restored to OPERABLE status or placed in trip (or the associated trip system placed in trip) within the allowed Completion Time, the plant must be placed in a MODE or other specified condition in which the LCO does not apply. The allowed Completion Times are reasonable, based on operating experience, to reach the specified condition from full power conditions in an orderly manner and without challenging plant systems. In addition, the Completion Time of Required Actions E.1 and J.1 are consistent with the Completion Time provided in LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)."

H.1

If the channel(s) is not restored to OPERABLE status or placed in trip (or the associated trip system placed in trip) within the allowed Completion Time, the plant must be placed in a MODE or other specified condition in which the LCO does not apply. This is done by immediately initiating action to fully insert all insertable control rods in core cells containing one or more fuel assemblies. Control rods in core cells containing no fuel assemblies do not affect the reactivity of the core and are, therefore, not required to be inserted. Action must continue until all insertable control rods in core cells containing one or more fuel assemblies are fully inserted.

I.1

If OPRM Upscale trip capability is not maintained, Condition I exists. References 12 and 13 justified use of alternate methods to detect and suppress oscillations for a limited period of time. The alternate methods are procedurally established consistent with the guidelines identified in Reference 17 requiring manual operator action to scram the plant if certain predefined events occur. The 12-hour allowed Completion Time for Required Action I.1 is based on engineering judgment to allow orderly transition to the alternate methods while limiting the period of time during which no automatic or alternate detect and suppress trip capability is formally in place. Based on the small probability of an instability event occurring at all, the 12 hours is judged to be reasonable.

(continued)

BASES

ACTIONS (continued)

I.2

The alternate method to detect and suppress oscillations implemented in accordance with I.1 was evaluated (References 12 and 13) based on use up to 120 days only. The evaluation, based on engineering judgment, concluded that the likelihood of an instability event that could not be adequately handled by the alternate methods during this 120-day period was negligibly small. The 120-day period is intended to be an outside limit to allow for the case where design changes or extensive analysis might be required to understand or correct some unanticipated characteristic of the instability detection algorithms or equipment. This action is not intended and was not evaluated as a routine alternative to returning failed or inoperable equipment to OPERABLE status. Correction of routine equipment failure or inoperability is expected to normally be accomplished within the completion times allowed for Actions for Condition A.

A note is provided to indicate that LCO 3.0.4 is not applicable. The intent of that note is to allow plant start-up while within the 120-day completion time for action I.2. The primary purpose of this exclusion is to allow an orderly completion of design and verification activities, in the event of a required design change, without undue impact on plant operation.

SURVEILLANCE REQUIREMENTS

As noted at the beginning of the SRs, the SRs for each RPS instrumentation Function are located in the SRs column of Table 3.3.1.1-1.

The Surveillances are modified by a Note to indicate that when a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed for up to 6 hours, provided the associated Function maintains RPS 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 reliability analysis (Refs. 9, 12 & 13) assumption of the average time required to perform channel Surveillance. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that the RPS will trip when necessary.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.9 and SR 3.3.1.1.14 (continued)

In addition, Function 5 and 7 instruments are not accessible while the unit is operating at power due to high radiation and the installed indication instrumentation does not provide accurate indication of the trip setting. For the Function 9 channels, verification that the trip settings are less than or equal to the specified Allowable Value during the CHANNEL FUNCTIONAL TEST is not required since the instruments are not accessible while the unit is operating at power due to high radiation and the installed indication instrumentation does not provided accurate indication of the trip setting. Waiver of these verifications for the above functions is considered acceptable since the magnitude of drift assumed in the setpoint calculation is based on a 24 month calibration interval. The 92 day Frequency of SR 3.3.1.1.9 is based on the reliability analysis of Reference 9.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components will pass the Surveillance when performed at the 24 month Frequency.

SR 3.3.1.1.10, SR 3.3.1.1.12, SR 3.3.1.1.15, and SR 3.3.1.1.16

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies that 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 current plant specific setpoint methodology.

As noted for SR 3.3.1.1.10, radiation detectors are excluded from CHANNEL CALIBRATION due to ALARA reasons (when the plant is operating, the radiation detectors are generally in a high radiation area; the steam tunnel). This exclusion is acceptable because the radiation detectors are passive devices, with minimal drift. To complete the radiation CHANNEL CALIBRATION, SR 3.3.1.1.16 requires that the radiation detectors be calibrated on a once per 24 months Frequency.

The once per 92 days Frequency of SR 3.3.1.1.10 is conservative with respect to the magnitude of equipment drift assumed in the setpoint analysis. The Frequency of SR 3.3.1.1.16 is based upon the assumption of a 24-month calibration interval used in the determination of the equipment drift in the setpoint analysis.

As noted for SR 3.3.1.1.12, neutron detectors are excluded from CHANNEL CALIBRATION because they are passive devices, with minimal drift, and because of the difficulty of simulating a meaningful signal. Changes in

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.10, SR 3.3.1.1.12, SR 3.3.1.1.15, and SR 3.3.1.1.16 (continued)

neutron detector sensitivity are compensated for by performing the 7 day calorimetric calibration (SR 3.3.1.1.2) and the 1000 MWD/T LPRM calibration against the TIPs (SR 3.3.1.1.8).

A second note is provided for SR 3.3.1.1.12 that allows the WRNM SR to be performed within 12 hours of entering MODE 2 from MODE 1. Testing of the MODE 2 WRNM Functions cannot be performed in MODE 1 without utilizing jumpers, lifted leads or movable links. This Note allows entry into MODE 2 from MODE 1, if the 24 month Frequency is not met per SR 3.0.2. Twelve hours is based on operating experience and in consideration of providing a reasonable time in which to complete the SR.

A third note is provided for SR 3.3.1.1.12 that includes in the SR the recirculation flow (drive flow) transmitters, which supply the flow signal to the APRMs. The APRM Simulated Thermal Power-High Function (Function 2.b) and the OPRM Upscale Function (Function 2.f), both require a valid drive flow signal. The APRM Simulated Thermal Power-High Function uses drive flow to vary the trip setpoint. The OPRM Upscale Function uses drive flow to automatically enable or bypass the OPRM Upscale trip output to RPS. A CHANNEL CALIBRATION of the APRM drive flow signal requires both calibrating the drive flow transmitters and establishing a valid drive flow / core flow relationship. The drive flow /core flow relationship is established once per refuel cycle, while operating at or near rated power and flow conditions. This method of correlating core flow and drive flow is consistent with GE recommendations. Changes throughout the cycle in the drive flow / core flow relationship due to the changing thermal hydraulic operating conditions of the core are accounted for in the margins included in the bases or analyses used to establish the setpoints for the APRM Simulated Thermal Power-High Function and the OPRM Upscale Function.

The Frequencies of SR 3.3.1.1.12 and SR 3.3.1.1.15 are based upon the assumption of a 24-month calibration interval used in the determination of the equipment drift in the setpoint analysis.

SR 3.3.1.1.11

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.11 (continued)

intended function. For the APRM Functions, this test supplements the automatic self-test functions that operate continuously in the APRM and voter channels. The APRM CHANNEL FUNCTIONAL TEST covers the APRM channels (including recirculation flow processing - applicable to Function 2.b and the auto-enable portion of Function 2.f only), the 2-Out-Of 4 voter channels, and the interface connections into the RPS trip systems from the voter channels. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. The 184 day Frequency of SR 3.3.1.1.11 is based on the reliability analyses of References 12 and 13. (NOTE: The actual voting logic of the 2-Out-Of-4 Voter Function is tested as part of SR 3.3.1.1.17. The actual auto-enable setpoints for the OPRM Upscale trip are confirmed by SR 3.3.1.1.19.)

A Note is provided for Function 2.a that requires this SR to be performed within 12 hours of entering MODE 2 from MODE 1. Testing of the MODE 2 APRM Function cannot be performed in MODE 1 without utilizing jumpers or lifted leads. This Note allows entry into MODE 2 from MODE 1 if the associated Frequency is not met per SR 3.0.2.

A second Note is provided for Function 2.b that clarifies that the CHANNEL FUNCTIONAL TEST for Function 2.b includes testing of the recirculation flow processing electronics, excluding the flow transmitters.

SR 3.3.1.1.13

This SR ensures that scrams initiated from the Turbine Stop Valve—Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure—Low Functions will not be inadvertently bypassed when THERMAL POWER is ≥ 30% RTP. This involves calibration of the bypass channels. Adequate margins for the instrument setpoint methodologies are incorporated into the Allowable Value (≤ 29.4% RTP which is equivalent to ≤ 138.4 psig as measured from turbine first stage pressure) and the actual setpoint. Because main turbine bypass flow can affect this setpoint nonconservatively (THERMAL POWER is derived from turbine first stage pressure), the main turbine bypass valves must remain closed during the calibration at THERMAL POWER ≥ 30% RTP to ensure that the calibration is valid.

If any bypass channel's setpoint is nonconservative (i.e., the Functions are bypassed at ≥ 30% RTP, either due to open main turbine bypass valve(s) or other reasons), then the

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.13 (continued)

affected Turbine Stop Valve—Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure—Low Functions are considered inoperable. Alternatively, the bypass channel can be placed in the conservative condition (nonbypass). If placed in the nonbypass condition, this SR is met and the channel is considered OPERABLE.

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

SR 3.3.1.1.17

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required trip logic for a specific channel. The functional testing of control rods (LCO 3.1.3), and SDV vent and drain valves (LCO 3.1.8), overlaps this Surveillance to provide complete testing of the assumed safety function.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components will pass the Surveillance when performed at the 24 month Frequency.

The LOGIC SYSTEM FUNCTIONAL TEST for APRM Function 2.e simulates APRM and OPRM trip conditions at the 2-Out-Of-4 voter channel inputs to check all combinations of two tripped inputs to the 2-Out-Of-4 logic in the voter channels and APRM related redundant RPS relays.

SR 3.3.1.1.18

This SR ensures that the individual channel response times are maintained less than or equal to the original design value. The RPS RESPONSE TIME acceptance criterion is included in Reference 11.

RPS RESPONSE TIME tests are conducted on a 24 month Frequency. The 24 month Frequency is consistent with the PBAPS refueling cycle and is based upon plant operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.19

This surveillance involves confirming the OPRM Upscale trip auto-enable setpoints. The auto-enable setpoint values are considered to be nominal values as discussed in Reference 18. This surveillance ensures that the OPRM Upscale trip is enabled (not bypassed) for the correct values of APRM Simulated Thermal Power and recirculation drive flow. Other surveillances ensure that the APRM Simulated Thermal Power and recirculation drive flow properly correlate with THERMAL POWER (SR 3.3.1.1.2) and core flow (SR 3.3.1.1.12), respectively.

If any auto-enable setpoint is nonconservative (i.e., the OPRM Upscale trip is bypassed when APRM Simulated Thermal Power ≥30% and recirculation drive flow < 60%), then the affected channel is considered inoperable for the OPRM Upscale Function. Alternatively, the OPRM Upscale trip auto-enable setpoint(s) may be adjusted to place the channel in a conservative condition (not bypassed). If the OPRM Upscale trip is placed in the not-bypassed condition, this SR is met and the channel is considered OPERABLE.

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

REFERENCES

1. UFSAR, Section 7.2.
2. UFSAR, Chapter 14.
3. NEDO-32368, "Nuclear Measurement Analysis and Control Wide Range Neutron Monitoring System Licensing Report for Peach Bottom Atomic Power Station, Units 2 and 3," November 1994.
4. NEDC-32183P, "Power Rerate Safety Analysis Report for Peach Bottom 2 & 3," dated May 1993.
5. UFSAR, Section 14.6.2.
6. UFSAR, Section 14.5.4.
7. UFSAR, Section 14.5.1.
8. P. Check (NRC) letter to G. Lainas (NRC), "BWR Scram Discharge System Safety Evaluation," December 1, 1980.
9. NEDO-30851-P-A , "Technical Specification Improvement Analyses for BWR Reactor Protection System," March 1988.

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BASES (continued)

REFERENCES (continued)

10. MDE-87-0485-1, "Technical Specification Improvement Analysis for the Reactor Protection System for Peach Bottom Atomic Power Station Units 2 and 3," October 1987.

11. UFSAR, Section 7.2.3.9.

12. NEDC-32410P-A, "Nuclear Measurement Analysis and Control Power Range Neutron Monitor (NUMAC PRNM) Retrofit Plus Option III Stability Trip Function", October 1995.

13. NEDC-32410P Supplement 1, "Nuclear Measurement Analysis and Control Power Range Neutron Monitor (NUMAC PRNM) Retrofit Plus Option III Stability Trip Function, Supplement 1", November 1997.

14. NEDO-31960-A, "BWR Owners' Group Long-Term Stability Solutions Licensing Methodology," November 1995.

15. NEDO-31960-A, Supplement 1, "BWR Owners' Group Long-Term Stability Solutions Licensing Methodology," November 1995.

16. NEDO-32465-A, "BWR Owners' Group Long-Term Stability Detect and Suppress Solutions Licensing Basis Methodology And Reload Applications," August 1996.

17. Letter, L. A. England (BWROG) to M. J. Virgilio, "BWR Owners' Group Guidelines for Stability Interim Corrective Action," June 6, 1994.

18. BWROG Letter 96113, K. P. Donovan (BWROG) to L. E. Phillips (NRC), "Guidelines for Stability Option III `Enable Region' (TAC M92882)," September 17, 1996.

19. NEDO-24229-1, "Peach Bottom Atomic Power Station Units 2 and 3 Single-Loop Operation," May 1980.

BASES

APPLICABLE SAFETY ANALYSES (continued)

Plant specific LOCA and average power range monitor/rod block monitor Technical Specification/maximum extended load line limit analyses have been performed assuming only one operating recirculation loop. These analyses demonstrate 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 (Refs. 2, 3, and 4).

The transient analyses of Chapter 14 of the UFSAR have also been performed for single recirculation loop operation (Ref. 5) 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 (RPS) average power range monitor (APRM) instrument setpoints is also required to account for the different relationships between recirculation drive flow and reactor core flow. The MCPR limits and APLHGR limits (power-dependent APLHGR multipliers, $MAPFAC_p$, and flow-dependent APLHGR multipliers, $MAPFAC_f$) for single loop operation are specified in the COLR. The APRM Simulated Thermal Power-High Allowable Value is in LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation."

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BASES

APPLICABLE SAFETY ANALYSES (continued)

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

LCO

Two recirculation loops are normally required to be in operation with their flows matched within the limits specified in SR 3.4.1.1 to ensure that during a LOCA caused by a break of the piping of one recirculation loop the

(continued)

BASES

LCO	assumptions of the LOCA analysis are satisfied. Alternatively, with only one recirculation loop in operation, modifications to the required APLHGR limits (power- and flow-dependent APLHGR multipliers, $MAPFAC_p$ and $MAPFAC_f$, respectively of LCO 3.2.1, "AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)"), MCPR limits (LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)") and APRM Simulated Thermal Power-High Allowable Value (LCO 3.3.1.1) must be applied to allow continued operation consistent with the assumptions of Reference 5. The LCO is modified by a Note which allows up to 12 hours before having to put in effect the required modifications to required limits after a change in the reactor operating conditions from two recirculation loops operating to single recirculation loop operation. If the required limits are not in compliance with the applicable requirements at the end of this period, the associated equipment must be declared inoperable or the limits "not satisfied," and the ACTIONS required by nonconformance with the applicable specifications implemented. This time is provided due to the need to stabilize operation with one recirculation loop, including the procedural steps necessary to limit flow in the operating loop, and the complexity and detail required to fully implement and confirm the required limit modifications.
APPLICABILITY	In MODES 1 and 2, requirements for operation of the Reactor Coolant Recirculation System are necessary since there is considerable energy in the reactor core and the limiting 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.

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BASES

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BASES

ACTIONS (continued)

A.1

With the requirements of the LCO not met for reasons other than no recirculation loops in operation, the recirculation loops must be restored to operation with matched flows 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. The loop with the lower flow must be considered not in operation. 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 operating limits and RPS setpoints, operation with only one recirculation loop would satisfy the requirements of the LCO and the initial conditions of the accident sequence.

The 24 hour Completion Time is based on the low probability of an accident occurring during this time period, on a reasonable time to complete the Required Action, and on frequent core monitoring by operators allowing abrupt changes in core flow conditions to be quickly detected.

(continued)

BASES

ACTIONS

A.1 (continued)

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 pump speeds to re-establish forward flow or by tripping the pump.

B.1

With no recirculation loops in operation or the Required Action and associated Completion Time of Condition A not met, the plant must 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.

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.4.1.1

This SR ensures the recirculation loops are within the allowable limits for mismatch. At low core flow (i.e., < 71.75 X 10^6 lbm/hr), the MCPR requirements provide larger margins to the fuel cladding integrity Safety Limit such that the potential adverse effect of early boiling transition during a LOCA is reduced. A larger flow mismatch can therefore be allowed when core flow is < 71.75 X 10^6 lbm/hr. 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 core flow. (Rated core flow is 102.5 X 10^6 lbm/hr. The first limit is based on mismatch ≤ 10% of rated core flow when operating at < 70% of rated core flow. The second limit is based on mismatch ≤ 5% of rated core flow when operating at ≥ 70% of rated core flow.) If the flow mismatch exceeds the specified limits, the loop with the lower flow is considered not in operation. The 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 Surveillance 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

REFERENCES

1. UFSAR, Section 14.6.3.

2. NEDC-32163P, "PBAPS Units 2 and 3 SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis," January 1993.

3. NEDC-32162P, "Maximum Extended Load Line Limit and ARTS Improvement Program Analyses for Peach Bottom Atomic Power Station Unit 2 and 3," Revision 1, February 1993.

4. NEDC-32427P, "Peach Bottom Atomic Power Station Unit 3 Cycle 10 ARTS Thermal Limits Analyses," December 1994.

5. NEDO-24229-1, "PBAPS Units 2 and 3 Single-Loop Operation," May 1980.

5.6 Reporting Requirements (continued)

5.6.5 CORE OPERATING LIMITS REPORT (COLR)

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

1. The Average Planar Linear Heat Generation Rate for Specification 3.2.1;

2. The Minimum Critical Power Ratio for Specifications 3.2.2 and 3.3.2.1;

3. The Linear Heat Generation Rate for Specification 3.2.3; and

4. The Control Rod Block Instrumentation for Specification 3.3.2.1.

5. The Oscillation Power Range Monitor (OPRM) Instrumentation for Specification 3.3.1.1.

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. NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel" (latest approved version as specified in the COLR);

2. NEDC-32162P, "Maximum Extended Load Line Limit and ARTS Improvement Program Analyses for Peach Bottom Atomic Power Station Units 2 and 3," Revision 2, March, 1995;

3. PECo-FMS-0001-A, "Steady-State Thermal Hydraulic Analysis of Peach Bottom Units 2 and 3 using the FIBWR Computer Code";

4. PECo-FMS-0002-A, "Method for Calculating Transient Critical Power Ratios for Boiling Water Reactors (RETRAN-TCPPECo)";

5. PECo-FMS-0003-A, "Steady-State Fuel Performance Methods Report";

6. PECo-FMS-0004-A, "Methods for Performing BWR Systems Transient Analysis";

(continued)

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

7. PECo-FMS-0005-A, "Methods for Performing BWR Steady-State Reactor Physics Analysis"; and

8. PECo-FMS-0006-A, "Methods for Performing BWR Reload Safety Evaluations."

9. NEDO-32465-A, “BWR Owners’ Group Long-Term Stability Detect and Suppress Solutions Licensing Basis Methodology And Reload Applications,” August 1996.

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

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

5.6.6 Post Accident Monitoring (PAM) Instrumentation Report

When a report is required by Condition B or F of LCO 3.3.3.1, "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.

ATTACHMENT 3

PEACH BOTTOM ATOMIC POWER STATION
UNITS 2 and 3

DOCKET NOS. 50-277
50-278

LICENSE NOS. DPR-44
DPR-56

License Change Application ECR No. 99-00015

Activation of the Trip Outputs of the Oscillation Power Range Monitor Portion of the Power Range Neutron Monitoring System

PLANT SPECIFIC RESPONSES REQUIRED BY NUMAC PRNM RETROFIT PLUS OPTION III STABILITY TRIP FUNCTION TOPICAL REPORT (NEDC-32410P-A) Phase 2 OPRM Trip Activation/Deletion of ICAs

The section numbers and Utility Actions Required listed below are from the NUMAC PRNM Retrofit Plus Option III Stability Trip Function Topical Report NEDC-32410P-A including Supplement 1. The section numbers shown are only the "OPRM unique" ones. All other items were addressed in the earlier submittal covering the overall PRNM installation. At that time, the OPRM trip was not being activated, so OPRM specific responses were deferred.

Section	Utility Action Required	Response
7.6	Impact on UFSAR The plant-specific action required for FSAR updates will vary between plants. In all cases, however, existing FSAR documents should be reviewed to identify areas that have descriptions specific to the current PRNM using the general guidance of Sections 7.2 through 7.5 of the PRNM LTR to identify potential areas impacted. The utility should include in the *plant-specific licensing submittal* a statement of the plans for updating the plant FSAR for the PRNM project.	Applicable sections of the UFSAR related to PRNM were reviewed and appropriate revisions of those sections prepared and approved as part of the normal design process in support of the PRNM modification (previously reviewed and approved by the NRC). In support of activation of the OPRM functions as part of the normal PBAPS modification process, the UFSAR will be reviewed with appropriate additions and any needed revisions identified. Following implementation of the design modification, and closure of the design package, the UFSAR revisions will be submitted to the NRC and included in the updated UFSAR as part of the routine UFSAR update submittal.
8.3.6.1	APRM-Related RPS Trip Functions - Setpoints Add to or delete from the appropriate document any changed RPS setpoint information. If ARTS is being implemented concurrently with the PRNM modification, either include the related Tech Spec submittal information with the PRNM information in the plant-specific submittal, or reference the ARTS submittal in the PRNM submittal. In the *plant-specific licensing submittal,* identify what changes, if any, are being implemented and identify the basis or method used for the calculation of setpoints and where the setpoint information or changes will be recorded.	The Technical Specification Table 3.3.1.1-1 and the Bases description for the APRM Simulated Thermal Power -- High function were updated as part of the original Tech Spec changes for the PBAPS PRNM implementation. Note (b) to Table 3.3.1.1-1, which shows an offset term of "0.66ΔW" for single loop operation (SLO), was updated to reflect the APRM Simulated Thermal Power setpoints. However, neither the NUMAC PRNM LTR nor the PBAPS specific implementation addressed the flow offset required (ΔW). No change related to SLO is required for the OPRM Upscale Function implementation, but based on experience with the PRNM at PBAPS, the SLO equation in Table 3.3.1.1-1 note (b) has been rearranged to the form "0.66 (W-ΔW) + 64.9%". This arrangement is mathematically equivalent to the current presentation of the equation, but more effectively presents both the intent of the adjustment (offset the flow) and the way the adjustment is actually accomplished in the PRNM equipment. The ΔW offset for SLO is only required for drive flows above about 35% for PBAPS, but for simplicity of implementation, is applied for flows down to W=ΔW. For drive flows below ΔW, the equation is

Section	Utility Action Required	Response
		"clamped" at the offset value. Since the Tech Spec Bases does not currently address this subject, a short description of the single loop operation adjustment (ΔW) and the limits of application has been added to the Bases discussion for Function 2.b. See the PBAPS Tech Spec and Bases markup for the specific changes. See response for Section 8.4.6.1 for a discussion of OPRM setpoints.
8.4.1.4	OPRM-Related RPS Trip Functions - Functions <u>Covered by Tech Specs</u> Add the OPRM Upscale function as an "APRM function" in the RPS Instrumentation "function" table. Also add the related surveillance requirements and, if applicable, the related setpoint, and the related descriptions in the bases sections. Perform analysis necessary to establish setpoints for the OPRM Upscale trip. Add discussions related to the OPRM function in the Bases for the APRM Inop and 2-out-of-4 Voter functions. NOTE: The markups in Appendix H of Supplement 1 to the PRNM LTR show the OPRM Upscale as an APRM sub-function. However, individual plants may determine that for their particular situation, addition of the OPRM to the RPS Instrumentation table separate from the APRM, or as a separate Tech Spec, better meets their needs. In those cases, the basis elements of the Tech Spec as shown in this Supplement would remain, but the specific implementation would be different.	An OPRM Upscale trip function has been added to the PBAPS Tech Spec as an "APRM function" (Function 2.f) consistent with Appendix H to the PRNM LTR. However, a footnote "(d)" has been added to document that the PBDA setpoints are defined in the COLR. Additions to the Tech Spec Bases for Function 2.f have also been incorporated consistent with the PRNM LTR but with some rewording to more clearly present the information, and with additions to more completely address OPRM related setpoints and adjustable parameters. Unrelated to OPRM, the Function 2.b Bases discussion has been amended to include discussion of the SLO flow adjustment. The PRNM LTR Supplement 1 included some additional wording for Function 2.e (voter) to address independent voting of the OPRM and APRM signals. The corresponding PBAPS Bases additions for Function 2.e are modified somewhat from those shown in the LTR, Supplement 1. These modifications are conservative in that they delete any discussion of a "partially OPERABLE" Voter Function. These changes are made for simplicity based on the conclusion that the added alternatives discussed in the LTR are complicated to evaluate, and are very unlikely to ever be applied. The modified Bases text does include some added discussion (not included in the LTR) of the hardware that implements the voter function. The added wording clarifies that operability of parts of the hardware that are not related to the voter function do not need to be considered in determining operability of the voter function. See the PBAPS Tech Spec and Bases markup for the specific changes.

Section	Utility Action Required	Response
8.4.2.4	OPRM-Related RPS Trip Functions - Minimum Number of Operable OPRM Channels For the OPRM functions added (Section 8.4.1), include in the OPRM Tech Spec a "minimum operable channels" requirement for three OPRM channels, shared by both trip systems. Add the same action statements as for the APRM Neutron Flux - High function for OPRM Upscale function. In addition, add a new action statement for OPRM Upscale function unavailable per Paragraph 8.4.2.2 of the PRNM LTR. Revise the Bases section as needed to add descriptions of the 4-OPRM system with 2-out-of-4 output Voter channels (2 per RPS Trip System), and allowed one OPRM bypass total.	A minimum operable channels requirement of three, shared by both trip systems, has been included in the Tech Spec for the OPRM Upscale trip function (Function 2.f). This addition, as well as addition of action statements and Bases descriptions, is consistent with the PRNM LTR and LTR Supplement 1. However, to make the Required Action statements more consistent with the intent of the LTR, a note has been added to Required Action I.2 stating that LCO 3.0.4 is not applicable. Although the exception to LCO 3.0.4 is not included in the PRNM LTR Supplement 1, it is consistent with the intent of Required Action I.2. Inclusion of Action I.2 is intended to allow orderly identification and implementation of a resolution plan for an unanticipated design problem with the OPRM logic without undue impact on normal plant operation. The LCO 3.0.4 exception does not eliminate the requirement to restore the OPRM Upscale function to OPERABLE status within a 120-day period. The exception does, however, allow the plant to start up with the alternate detect and suppress provision of Action I.1 in effect during the 120-day period. The Bases discussion of Required Action I.2 has also been modified from the LTR proposed text to reflect the inclusion of the Note regarding LCO 3.0.4 and to cite the PRNM LTR Supplement 1 as a reference (Ref. 13). See the PBAPS Tech Spec and Bases markup for the specific changes.
8.4.3.4	OPRM-Related RPS Trip Functions - Applicable Modes of Operation Add the requirement for operation of the OPRM Upscale function in Mode 1 (RUN) when Thermal Power is ≥ 25% RTP, and add Bases descriptions as required.	A Modes of Operation requirement of Mode 1 ≥25% RTP, consistent with the PRNM LTR Supplement 1, has been included in the Tech Spec along with associated Bases descriptions. The specific wording included in the Function 2.f Bases discussion for Modes of Operation has been modified somewhat from the LTR proposed text for improved clarity of the intent. See the PBAPS Tech Spec and Bases markup for the specific changes.
8.4.4.1.4	OPRM-Related RPS Trip Functions - Channel Check Add once per 12 hour or once per day Channel Check or Instrument Check requirements for the OPRM Upscale	A Channel Check requirement of once per 12 hours has been included for the OPRM Upscale function, consistent with the PRNM LTR Supplement 1. See the PBAPS Tech Spec markup for the specific

Section	Utility Action Required	Response
	function.	changes.
8.4.4.2.4	OPRM-Related RPS Trip Functions - Channel Functional Test Add Channel Functional Test requirements with a requirement for a test frequency of every 184 days (6 months), including the 2-out-of-4 Voter function. Add a "confirm auto-enable region" surveillance on a once per outage basis up to 24 month intervals.	A "confirm auto-enable region" surveillance requirement, SR 3.3.1.1.19, has been added to require confirmation that the OPRM Upscale trip output auto-enable (not bypassed) setpoints remain correct. The SR Bases wording is similar to that in the LTR, but the wording has been modified and Reference 18 added to clarify that the setpoints are nominal values. References to two related SRs have also been added. The discussion of the use of APRM Simulated Thermal Power and drive flow for the setpoints (vs. Thermal Power and core flow) has been omitted from the SR 3.3.1.1.19 Bases because that same information is presented in the newly added OPRM Upscale (Function 2.f) Bases discussion. Use of the term "rated drive flow" has been omitted from the SR wording to avoid potential confusion at PBAPS where the terminology "rated recirculation drive flow" is not commonly used. These changes have no effect on the actual SR as originally defined in the PRNM LTRs since the intent of the SR, to require reconfirmation of the setpoints in the APRM hardware, remains unchanged from the LTR. A Channel Functional Test requirement with a test frequency of every 184 days (SR 3.3.1.1.11) has been added for the OPRM Upscale consistent with the PRNM LTR, Supplement 1. The SR 3.3.1.1.11 is already applied to the 2-Out-Of 4 voter channels. The original PBAPS PRNM modification also included a second note to SR 3.3.1.1.11 (not included in the PRNM LTR) to clarify that the SR also applied to the flow input function, except the transmitters. That note has been modified to also include the OPRM Upscale Function 2.f. No change is shown in the PRNM LTR Supplement 1 for the Channel Functional Test (SR 3.3.1.1.11) Bases to cover the OPRM Upscale Function. The Bases discussion for SR 3.3.1.1.11 has been modified slightly to clarify that the recirculation flow is used for the auto-enable of the OPRM Upscale trip as well as for the APRM STP Upscale trip. See the PBAPS Tech Spec and Bases markup for the specific changes.

Section	Utility Action Required	Response
8.4.4.3.4	OPRM-Related RPS Trip Functions - Channel Calibration Add calibration interval requirement of every 24 months for the OPRM Upscale function. Revise Bases text as required.	A Channel Calibration requirement for the OPRM Upscale function has been added consistent with the PRNM LTR Supplement 1, but also with some additional changes not included in the LTRs as discussed below. The original PRNM modification added a third note to SR 3.3.1.1.12 and revised the SR 3.3.1.1.12 Bases to address APRM, and to clarify that SR 3.3.1.1.12 includes calibrating the associated recirculation loop flow channel. The original requirement was intended to assure that the drive flow used by the APRM Simulated Thermal Power flow biased trip was properly calibrated. The PRNM LTR, Supplement 1 does not identify any additional changes to the Bases for OPRM Upscale Channel Calibration requirements. However, reviews of the Bases wording as part of the OPRM implementation identified two aspects that should be clarified: 1) the wording should recognize that drive flow is also used as an input to the OPRM Upscale trip auto-enable function, and 2) the "calibrating the recirculation loop flow channel" needed to include the drive flow / core flow correlation. Therefore, as part of the OPRM Upscale Function addition, the SR 3.3.1.1.12 Bases discussion has been modified to include discussion of the OPRM Upscale auto-enable function, and to expand the discussion of the scope of calibrating the drive flow channel. The third note to SR 3.3.1.1.12 has also been modified to include Function 2.f. Since the PBAPS Bases groups discussion of SR 3.3.1.1.12 with other CHANNEL CALIBRATION SRs (SRs 3.3.1.1.10, 15 & 16), some of the text has been rearranged for better flow. These changes do not affect the content or scope of any of the other SRs (SR 3.3.1.1.10, 15 & 16). See the PBAPS Tech Spec and Bases markup for the specific changes.
8.4.4.4.4	OPRM-Related RPS Trip Functions - Response Time Testing Modify as necessary the response time testing procedure for the 2-out-of-4 Voter function to include the Voter OPRM output solid-state relays as part	The PBAPS response time testing related to the 2-Out-Of-4 Voter Function tests from the PRNM panel terminals to the RPS relays. This interface is unchanged by addition of the OPRM Upscale Function because the OPRM Upscale trip outputs are connected electrically in series with the other APRM trip outputs to the RPS. Therefore, no change is

Section	Utility Action Required	Response
	of the response time tests, alternating testing of the Voter OPRM output with the Voter APRM output.	required to the Tech Spec or Bases for response time testing. ***NOTE***: Since the response time test (SR 3.3.1.1.18) will be current at the time of the OPRM Upscale Function activation, and since no response time sensitive equipment is affected by the OPRM Upscale Function activation, it is not necessary to re-perform SR 3.3.1.1.18 prior to declaring the OPRM Upscale Function OPERABLE.
8.4.5.4	OPRM-Related RPS Trip Functions - Logic System Functional Testing (LSFT) Add requirement for LSFT every refueling cycle, 18 or 24 months at the utility's option based on which best fits plant scheduling.	The LSFT (SR 3.3.1.1.17) for the OPRM function is, the same as for the APRM, a test of the 2-Out-Of-4 voter only. Consistent with the PRNM LTR Supplement 1, the only change required to implement the OPRM "LSFT" is the addition of "and OPRM" in the Tech Spec Bases and revision of the related plant procedures to include testing of the OPRM Upscale trip outputs from the 2-out-of-4 voter. The procedure changes will be made as part of the normal modification process. See the PBAPS Tech Spec Bases markup for the specific changes. ***Position on Compliance With TS SR 3.3.1.1.17 for the OPRM Function*** It is PBAPS' position that performance of SR 3.3.1.1.17 relative to the OPRM Upscale voting function within the 2-Out-Of-4 Voter channel can be considered met via acceptance testing performed at the factory, in-plant functional testing of the hardware, and internal self testing performed by the hardware. The next subsequent performance of this LSFT for the OPRM Upscale function will be during the first refueling outage following activation of the OPRM Upscale trip output. Justification for this position is included following this table.
8.4.6.1	OPRM-Related RPS Trip Functions - Setpoints Add setpoint information to the appropriate document and identify in the plant-specific submittal the basis or method used for the calculation and where the setpoint information will be recorded.	There are four "sets" of OPRM related setpoints and adjustable parameters: a) OPRM trip auto-enable (not bypassed) setpoints for STP and drive flow; b) period based detection algorithm (PBDA) confirmation count and amplitude setpoints; c) period based detection algorithm tuning parameters; and d) growth rate algorithm (GRA) and amplitude based algorithm (ABA) setpoints. The first set, the setpoints for the "auto-enable" region for OPRM, as discussed in the Bases discussion of the new SR 3.3.1.1.19, will be treated as

Section	Utility Action Required	Response
		nominal setpoints with no additional margins added. The deadband for these setpoints is established so that it increases the enabled region. The settings, 30% APRM Simulated Thermal Power and 60% drive flow, are defined (limit values) in the Tech Spec SR 3.3.1.1.19. The second set, the PBDA trip setpoints, will be established in accordance with the BWROG LTR 32465-A methodology, previously reviewed and approved by the NRC, and will be documented in the COLR. Table 3.3.1.1 has been modified to add a footnote "(d)" to document that the PBDA setpoints are defined in the COLR. The third set, the PBDA "tuning" parameter values, are established in accordance with and controlled by PBAPS procedures, within the limits established in the BWROG LTRs, or as documented in this submittal. The forth set, the GRA and ABA setpoints, consistent with the BWROG submittals, are established as nominal values only, and controlled by PBAPS procedures only. See the PBAPS Tech Spec Bases markup for the specific changes. To document the handling of OPRM setpoints, the specific wording in the PBAPS Tech Spec Bases markup has been expanded and modified somewhat from that shown in the PRNM LTR Supplement 1.
None	<u>Recirculation Loops Operating</u> LCO 3.4.1 currently requires operation in the "Unrestricted" Region of the power flow map. This restriction and associated required actions were implemented as part of the Interim Corrective Actions in response to NRC Generic Letter 86-02.	Concurrent with activation of the OPRM Upscale trip function, LCO 3.4.1, its associated actions and surveillance requirements, and the related Bases are being revised to delete requirements related to the restricted region of operation. The implementation of the automatic OPRM Upscale trip function eliminates the need for the ICAs and the related administrative requirements implemented in LCO 3.4.1. The other LCO conditions limiting operation with mismatched flows or in single loop operation are retained. Action statements have been modified to delete Actions required only to support the ICAs. The current action statements related to the "no recirculation loops in operation" condition (current Condition F) are structured to support the ICAs. However, that Condition must still be addressed. Therefore, a new Condition B is established combining the current

Section	Utility Action Required	Response
		Condition F and Condition E (required actions not completed) as "OR". The Required Action for both is to be in Mode 3 within the required time. The Completion Time for the new Required Action B.1 will be 12 hours, the same as previously allowed for Required Action E.1, but increased from the previously allowed 6 hours for Required Action F.2. With the added protection of the automatic OPRM Upscale trip to detect potential instabilities, this change is judged reasonable in that it allows more time for an orderly plant shutdown. This change makes the PBAPS Tech Spec Completion Time for this Required Action consistent with the Improved Standard Tech Specs. The Tech Spec Bases have been modified consistent with these Tech Spec changes. See the PBAPS Tech Spec and Bases markup for the specific changes.
None	Core Operating Limits Report Reporting requirements 5.6.5 does not currently address the OPRM.	Requirements have been added to 5.6.5a to include the OPRM setpoints in the COLR, and in 5.6.5b to identify the BWROG LTR as the basis. See the PBAPS Tech Spec markup for the specific changes.
9.1.3	Utility Quality Assurance Program As part of the *plant-specific licensing submittal*, the utility should document the established program that is applicable to the project modification. The submittal should also document for the project what scope is being performed by the utility and what scope is being supplied by others. For scope supplied by others, document the utility actions taken or planned to define or establish requirements for the project, to assure those requirements are compatible with the plant-specific configuration. Actions taken or planned by the utility to assure compatibility of the GE quality program with the utility program should also be documented. Utility planned level of participation in the overall V&V process for the project should be documented, along with utility plans for software configuration	The activation of the OPRM trip is accomplished by removing hardware jumpers in the panel. There are no required firmware changes.

Section	Utility Action Required	Response
	management and provision to support any required changes after delivery should be documented.	

Justification for considering SR 3.3.1.1.17 - Logic System Functional Test - as being satisfactorily met for the OPRM Upscale voting function of the 2-Out-Of-4 Voter channel

SR 3.3.1.1.17 is normally performed during an outage because the method for performing the SR creates a full RPS trip (scram). PBAPS plans to activate the OPRM Upscale trip output on line during full power operation, so the normal method of performing SR 3.3.1.1.17 can not be used. PBAPS has evaluated alternative methods for performing the SR on-line. One alternative requires careful coordination of actions in multiple channels, with a very limited time available. For this alternative, any minor error or delay in the sequence of actions, which would normally have no adverse consequences, will lead to an unintentional scram. A second alternative has been identified that carries a smaller risk of inadvertent scram, but requires disconnecting multiple fiberoptic cables within the cabinet, an action that would normally not be required, and creates a significantly increased risk of causing equipment damage or equipment inoperability.

Since the only identified alternatives for performing the SR while at power carry significant risk of causing problems, PBAPS has evaluated the overall testing that has been and will be performed for the equipment performing the OPRM Upscale function. Based on that evaluation, PBAPS has determined that the intent of the LSFT for the OPRM Upscale testing will be met and that this SR will not need to be performed until the next refuel outage following trip activation. The basis for this conclusion is as follows.

The primary purpose of the SR is to reconfirm that the 2-out-of-4 voting logic is still functioning correctly. As stated in the PRNM LTR, the test of the voting logic in the LSFT SR is redundant to an automatic self-test function that repetitively injects test signals for all combinations of inputs to confirm that the voting logic continues to function correctly. Failures detected by the self-test function are reported via the associated APRM channel to the operator. The PRNM LTR states that the LSFT SR provides "overlap" between the automatic self-test of the voting logic and the voter output test provided by the Channel Functional test SR, which will be performed at the time of OPRM Upscale trip activation. At Peach Bottom's request, GE has re-evaluated the final hardware design and confirmed that the Channel Functional test SR and the automatic self-test of the voting logic provide full overlap, so the LSFT is not required for coverage. GE further clarified that the primary reason for the PRNM LTR recommended LSFT coverage of the voting logic was to provide "defense-in-depth" due to the lack of operational experience with the new equipment. Since the time the PRNM LTR was approved, the same voter hardware used at PBAPS has been installed at 10 BWRs, with over 20 plant-years of operation without any identified failures of the voting logic.

Peach Bottom performed the equivalent of the LSFT for the OPRM Upscale function during the factory acceptance test (FAT) prior to installation for both Units. The normal LSFT SR was performed for the APRM High/Inop voting logic after installation of the PRNM equipment prior to start-up for the current cycle. No voting logic problems were found during these tests.

Based on (1) the determination that the LSFT provides no additional hardware test coverage beyond that provided by the automatic self-test and the Channel Functional test SR to be performed at the time of trip activation, (2) the completion of an equivalent OPRM LSFT test during the FAT and the normal LSFT on the APRM High/Inop voting logic without detected problems, and (3) the extensive operating experience at other BWR plants without voting logic failures, Peach Bottom has concluded that TS SR 3.3.1.1.17, as it applies to the OPRM Upscale function of the 2-Out-Of-4 Voter channel, has already been satisfied and need not be performed until the next refueling outage following OPRM Upscale function trip activation.

OPRM Corner Frequency, Period Tolerance, and Maximum Period Discussion, Proposed Setpoint Range Revisions, and Associated Justifications

Background

LTR NEDO-32465-A, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications" describes the licensing basis methodology for the Option III long term stability solution. The licensing basis for this solution is the period based algorithm (PBA) which relies on the fact that OPRM "cells", composed of closely spaced local power range monitors (LPRMs), can be used to distinguish between thermal-hydraulic instabilities and stable reactor operation. During normal, steady state reactor operation, LPRM signals are comprised of a broad range of frequencies that are typically present in a boiling water reactor (BWR). These LPRM signals become more coherent displaying a characteristic frequency in the 0.3 to 0.7 Hertz (Hz) range with the onset of thermal-hydraulic instability. The PBA uses the difference in LPRM signal coherence to detect instabilities. The coherence persists when signals from closely spaced LPRMs are combined in OPRM cells.

Specifically, the OPRM combines signals from LPRMs assigned to the OPRM cell and determines each successive pair of OPRM cell maxima and minima. If the maxima/minima occur at a frequency in the range of 0.3 to 0.7 Hz, the base period is set. If the subsequent maxima/minima occur within a specified tolerance band of the base period, the oscillation is considered to be a single period confirmation. Subsequent maxima/minima which fall within the specified base period tolerance range cause the PBA continuous period confirmation (CPC) counter to be incremented by one. This process continues until a maxima/minima is found to be outside the specified base period tolerance range, at which time the CPC counter is reset to zero. The last CPC count prior to resetting is termed the maximum continuous period confirmation (MCPC) count.

The CPC for each OPRM cell is evaluated simultaneously. During normal plant operation with large stability margin, non-zero CPC count values are expected due to the random nature of normal core neutron-flux noise. As shown in the data in Tables 1, 2, 3 and 4, the largest frequency of occurrence is a MCPC of 1, with rapidly decreasing frequency of occurrence of higher MCPC counts. The OPRM tuning process, the results of which are discussed in the paragraphs that follow, is intended to optimize the setting values of various OPRM tuning parameters so that the PBA is sufficiently sensitive to detect actual core oscillations while not unnecessarily tripping on normal core neutron-flux noise. The data in Tables 1, 2, 3 and 4 shown shaded applies to the final settings selected.

LTR NEDO-32465-A (Section 3.4.1) describes the acceptable range of values for two OPRM parameters, period tolerance and corner frequency. Both of these parameters can be independently adjusted to tune the OPRM to each plant's unique LPRM noise characteristics. Within the ranges defined for these parameters, the OPRM will provide sufficient CPCs to detect thermal-hydraulic instabilities prior to reaching the PBA amplitude trip setpoint. The ranges presented in NEDO-32465-A were based upon testing the PBA using data taken with analog LPRM signals from several different plants. Data was taken at a 50-millisecond sample rate during stable and unstable reactor operation. A range for each OPRM setpoint value was defined to ensure that the OPRM is sensitive enough to detect an instability as it develops at low amplitudes while allowing utilities the flexibility to adjust the OPRM response to their plant's noise characteristics during steady-state operation. The adjustments to account for noise characteristics are necessary to avoid spurious alarms and reactor scrams. Normal operational LPRM

signals are viewed by the OPRM as a distribution of MCPCs. The OPRM is tuned based on the MCPC distribution under plant operating conditions that have significant stability margin (i.e., near or at rated conditions). Based upon tuning criteria proposed by GE, the PBAPS OPRM tuning setpoints as discussed below provide more than adequate sensitivity.

PBAPS Specific Information

Based on OPRM data collected during the "monitoring period" following PRNM installation at PBAPS, it is apparent that the OPRM is too sensitive when the least sensitive setpoints defined in Table 3-1 of LTR NEDO-32465-A are used (i.e., period tolerance of 100 milliseconds and corner frequency of 2.5 Hz). However, the OPRM design of the PRNM system allows the OPRM period tolerance and corner frequency to be set to less sensitive values than those defined in the LTR, i.e., the hardware allows values from 50 to 300 millisecond and 1.0 to 3.0 Hz, respectively, compared to 100 to 300 millisecond and 1.0 to 2.5 Hz, respectively, in the LTR. PBAPS testing indicates that the OPRM more closely meets the GE tuning criteria under normal operating conditions if a period tolerance of 50 milliseconds and corner frequency of 3.0 Hz are allowed to be utilized. The 3.0 Hz/50 millisecond tuning settings are established based on data obtained at rated plant conditions per established GE procedures. The data collected during low power as part of initial plant start-up indicated slightly more sensitive settings might be acceptable, however, subsequent data collection at rated conditions indicate the 3.0 Hz/50 millisecond settings produce data in closer agreement with optimum OPRM tuning criteria established by GE.

The following factors contribute to the OPRM function being more sensitive than originally anticipated for the PBAPS installation:

1) The plant data used to develop the OPRM detection algorithm had a sample interval of 50 milliseconds. The PBAPS PRNM provides LPRM data to the OPRM algorithm every 25 milliseconds. This increased sampling rate tends to increase OPRM sensitivity.

2) PBAPS noise characteristics differ from those of the reference plants used to test the detection algorithm. Specifically, the PRNM system has improved accuracy, noise immunity, and LPRM signal filtering. The additional LPRM filtering tends to increase OPRM sensitivity, thus producing higher MCPC counts when the plant is operating with a large stability margin.

The maximum oscillation period (T_{max}) is the largest expected period that the OPRM would sense if a reactor instability was present. The minimum oscillation period (T_{min}) is the smallest expected period that the OPRM would sense if a reactor instability was present. For example, if the time between successive LPRM signal maxima/minima is greater than T_{max}, or less than T_{min} , the oscillation is not indicative of an anticipated reactor instability. LTR NEDO-32465-A (Section 4.3.2.4) states that studies of actual instability events indicate that the expected period is approximately 1.8 to 2.0 seconds (0.5 to 0.56 Hz), but that it is desirable to consider a wider band of oscillation frequencies between 0.3 Hz (T_{max} = 3.3 seconds) and 0.7 Hz (T_{min} , = 1.4 seconds). The OPRM design allows T_{max} to be set in the range of 3.0 to 5.0 seconds (0.33 to 0.2 Hz). A review of the online test data indicates that setting T_{max} at its lower design limit of 3.0 seconds (frequency of 0.33 Hz) may help to avoid spurious OPRM alarms and trips. Based on LTR NEDO-32465-A (Figure 4-5), allowing T_{max} to be set down to 3.0 seconds does not significantly alter the probability of detecting core instability. Based on that information, PBAPS OPRM tuning procedures will allow T_{max} settings down to the hardware limit of 3.0 seconds to reduce the risk of spurious OPRM alarms and trips.

Conclusion

The OPRM is fully expected to produce enough MCPCs to exceed the alarm and trip setpoints if a thermal-hydraulic instability should occur. Allowing PBAPS to use the full range of tuning parameters allowed by the OPRM design, including the allowance to set the corner frequency up to the limiting value of 3.0 Hz, the period tolerance down to the limiting value of 50 milliseconds, and the maximum period down to the limiting value of 3.0 seconds, provides acceptable OPRM sensitivity based on the foregoing discussions. These setpoint values are slightly outside the ranges described in LTR NEDO-32465-A, which were based on data from a few plants with different power monitoring system designs. However, the values are consistent with the original definition of the PBA in NEDO-31960-A, Supplement 1. The proposed tuning setpoint range changes provide margin to spurious alarms and trips during stable reactor operation and do not compromise the ability of the OPRM to detect instabilities and initiate an automatic reactor scram prior to violating the minimum critical power ratio (MCPR) safety limit for anticipated reactor instabilities.

Table 1 Unit 3

PBAPS Unit 3 OPRM Tuning Data, Confirmation Counts vs. Tuning Settings
24% Power / 40 M# Flow/33 Operable Cells

OPRM Channel	Corner Freq (Hz)/ Period Tol. (ms)	1	2	3	4	5	6	7	8	9	10
1	3.0 Hz / 50 ms	(2)	171	7	0	0	0	0	0	0	0
1	3.0 Hz / 100 ms	(2)	236	16	1	0	0	0	0	0	0
1	2.5 Hz / 100 ms	(2)	93	6	0	0	0	0	0	0	0
1	2.0 Hz / 100 ms	(2)	16	1	0	0	0	0	0	0	0
1	2.0 Hz / 150 ms	(2)	48	9	3	1	0	0	0	0	0
2	3.0 Hz / 50 ms	(2)	311	22	5	1	0	0	0	0	0
2	3.0 Hz / 100 ms	(2)	323	17	3	0	0	0	0	0	0
2	3.0 Hz / 100 ms	(2)	377	17	1	0	0	0	0	0	0
3	3.0 Hz / 50 ms	(2)	174	9	1	0	0	0	0	0	0
3	3.0 Hz / 100 ms	(2)	249	10	4	0	0	0	0	0	0
3	2.5 Hz / 100 ms	(2)	98	5	0	0	0	0	0	0	0
3	2.0 Hz / 100 ms	(2)	15	1	0	0	0	0	0	0	0
3	2.0 Hz / 150 ms	(2)	37	6	1	0	1	0	0	0	0
4	3.0 Hz / 50 ms	(2)	199	8	0	0	0	0	0	0	0
4	3.0 Hz / 100 ms	(2)	242	27	3	0	0	0	0	0	0
4	2.5 Hz / 100 ms	(2)	126	11	1	0	0	0	0	0	0
4	2.0 Hz / 100 ms	(2)	67	4	2	1	0	0	0	0	0
4	2.0 Hz / 50 ms	(2)	54	8	2	0	0	0	0	0	0

(1) All data taken with: T_{min} = 1.40; T_{max} = 3.00; recording time of 10 minutes.

(2) Count significantly larger than for "2". Value not recorded.

Table 2 Unit 3

PBAPS Unit 3 OPRM Tuning Data, Confirmation Counts vs. Tuning Settings
99.8% Power / 98.5 M# Flow/33 Operable Cells

OPRM Channel	Corner Freq (Hz)/ Period Tol. (ms)	1	2	3	4	5	6	7	8	9	10
1	2.0 Hz / 100 ms	4050	1452	159	86	9	4	1	0	0	0
1	2.5 Hz / 100 ms	3810	1047	119	21	3	2	0	0	0	0
1	2.5 Hz / 50 ms	4067	989	81	21	1	0	0	0	0	0
1	3.0 Hz / 100 ms	2780	853	93	22	2	0	0	0	0	0
1	3.0 Hz / 50 ms	3436	640	51	11	2	0	0	0	0	0
1	3.0 Hz / 50 ms	3232	606	26	1	1	0	0	0	0	0
2	3.0 Hz / 50 ms	3332	692	49	18	1	1	0	0	0	0
2	3.0 Hz / 50 ms	3596	576	35	3	0	0	0	0	0	0
2	3.0 Hz / 50 ms	3470	709	58	11	1	0	0	0	0	0
2	3.0 Hz / 50 ms	3168	630	48	9	0	0	0	0	0	0
3	2.0 Hz / 100 ms	4218	1493	174	70	9	3	0	1	0	0
3	2.5 Hz / 100 ms	3779	1141	122	20	5	0	0	0	0	0
3	2.5 Hz / 50 ms	4165	909	72	9	2	0	0	0	0	0
3	3.0 Hz / 100 ms	2777	875	79	7	2	0	0	0	0	0
3	3.0 Hz / 50 ms	3297	635	63	7	0	0	0	0	0	0
3	3.0 Hz / 50 ms	3291	609	13	1	0	0	0	0	0	0
4	3.0 Hz / 100 ms	3077	942	89	27	3	0	0	0	1	0
4	3.0 Hz / 50 ms	3495	670	49	4	0	0	0	0	0	0
4	3.0 Hz / 50 ms	3517	755	52	6	0	0	0	0	0	0
4	3.0 Hz / 50 ms	3300	614	60	9	0	0	0	0	0	0

(1) All data taken with: $T_{min} = 1.40$; $T_{max} = 3.00$; recording time of 10 minutes.

Table 3 Unit 2

PBAPS Unit 2 OPRM Tuning Data, Confirmation Counts vs. Tuning Settings
100% Power / 96% Flow/33 Operable Cells

OPRM Channel	Corner Freq (Hz)/ Period Tol. (ms)	1	2	3	4	5	6	7	8	9	10
1	3.0 Hz / 150 ms	3517	1266	232	82	16	11	2	0	0	0
1	3.0 Hz / 100 ms	4082	1062	129	31	7	2	0	0	0	0
1	3.0 Hz / 50 ms	4197	869	61	17	1	0	0	0	0	0
1	3.0 Hz / 50 ms	4595	945	105	13	7	0	0	0	0	0
2	3.0 Hz / 100 ms	3974	1114	148	37	7	4	1	0	0	0
2	3.0 Hz / 50 ms	4474	860	83	10	3	0	0	0	0	0
2	3.0 Hz / 50 ms	4198	976	82	20	0	0	0	0	0	0
3	3.0 Hz / 100 ms	4009	1126	152	49	6	10	0	0	0	0
3	3.0 Hz / 50 ms	4501	884	76	9	1	0	0	0	0	0
3	3.0 Hz / 50 ms	4250	923	76	14	0	0	0	0	0	0
4	3.0 Hz / 50 ms	4349	832	72	19	1	0	0	0	0	0
4	3.0 Hz / 50 ms	4412	838	63	16	1	0	0	0	0	0

(1) All data taken with: T_{min} = 1.40; T_{max} = 3.00; recording time of 10 minutes.

Table 4 Unit 2

PBAPS Unit 2 OPRM Tuning Data, Confirmation Counts vs. Tuning Settings
21-22% Power / 25-30% Flow/33 Operable Cells

OPRM Channel	Corner Freq (Hz)/ Period Tol. (ms)	1	2	3	4	5	6	7	8	9	10
1	2.0 Hz / 100 ms	774	155	7	2	0	0	0	0	0	0
1	2.0 Hz / 150 ms	683	171	16	0	0	0	0	0	0	0
1	2.0 Hz / 200 ms	669	197	15	2	0	0	0	0	0	0
1	2.0 Hz / 250 ms	597	170	17	6	0	0	0	0	0	0
1	2.5 Hz / 150 ms	1107	257	21	2	0	0	0	0	0	0
1	2.5 Hz / 200 ms	1116	272	21	8	2	0	0	0	0	0
1	2.5 Hz / 250 ms	1059	325	35	10	1	1	0	0	0	0
1	3.0 Hz / 150 ms	1829	339	15	7	0	0	0	0	0	0
2	2.0 Hz / 100 ms	796	100	5	3	0	0	0	0	0	0
2	2.0 Hz / 150 ms	729	117	19	3	1	0	0	0	0	0
2	2.0 Hz / 200 ms	703	123	17	4	0	0	0	0	0	0
2	2.0 Hz / 250 ms	667	128	15	6	0	0	0	0	0	0
2	2.0 Hz / 300 ms	558	138	22	7	1	0	0	0	0	0
2	1.5 Hz / 100 ms	93	7	0	0	0	0	0	0	0	0
2	2.5 Hz / 100 ms	1278	204	9	1	0	0	0	0	0	0
2	2.5 Hz / 150 ms	1380	243	20	1	1	1	0	0	0	0
2	3.0 Hz / 100 ms	1945	317	12	1	0	0	0	0	0	0
3	2.0 Hz / 100 ms	609	91	8	0	0	0	0	0	0	0
3	2.0 Hz / 150 ms	537	130	10	3	0	0	0	0	0	0
3	2.0 Hz / 200 ms	515	132	7	1	0	0	0	0	0	0
3	2.0 Hz / 250 ms	452	120	6	2	0	0	0	0	0	0
3	2.5 Hz / 150 ms	992	172	21	2	0	0	0	0	0	0
3	2.5 Hz / 250 ms	973	253	17	13	1	1	0	0	0	0
3	2.5 Hz / 200 ms	986	176	13	5	0	0	0	0	0	0
3	3.0 Hz / 100 ms	1961	241	15	2	0	0	0	0	0	0
3	3.0 Hz / 150 ms	1955	331	27	3	1	0	0	0	0	0
3	3.0 Hz / 200 ms	1872	379	40	8	3	2	0	0	0	0
4	2.0 Hz / 100 ms	114	14	3	2	0	0	0	0	0	0
4	2.0 Hz / 150 ms	87	21	0	2	1	0	0	0	0	0
4	2.0 Hz / 200 ms	84	11	2	1	1	0	0	0	0	0
4	2.0 Hz / 250 ms	61	12	0	1	0	0	0	0	0	0
4	2.0 Hz / 300 ms	62	17	5	2	1	1	0	0	0	0
4	1.5 Hz / 100 ms	3	0	0	0	0	0	0	0	0	0
4	2.5 Hz / 50 ms	563	35	3	0	0	0	0	0	0	0
4	2.5 Hz / 100 ms	551	60	6	1	1	0	0	0	0	0
4	2.5 Hz / 150 ms	636	71	12	2	4	1	1	0	0	0
4	3.0 Hz / 50 ms	1446	114	10	2	0	0	0	0	0	0
4	3.0 Hz / 100 ms	1411	132	15	7	1	0	0	0	0	0

(1) All data taken with: T_{min} = 1.40; T_{max} = 3.00; recording time of 10 minutes.

ATTACHMENT 3

PEACH BOTTOM ATOMIC POWER STATION
UNITS 2 and 3

DOCKET NOS. 50-277
50-278

LICENSE NOS. DPR-44
DPR-56

License Change Application ECR No. 99-00015

Activation of the Trip Outputs of the Oscillation Power Range Monitor Portion of the Power Range Neutron Monitoring System

PLANT SPECIFIC RESPONSES REQUIRED BY NUMAC PRNM RETROFIT PLUS OPTION III STABILITY TRIP FUNCTION TOPICAL REPORT (NEDC-32410P-A) Phase 2 OPRM Trip Activation/Deletion of ICAs

The section numbers and Utility Actions Required listed below are from the NUMAC PRNM Retrofit Plus Option III Stability Trip Function Topical Report NEDC-32410P-A including Supplement 1. The section numbers shown are only the "OPRM unique" ones. All other items were addressed in the earlier submittal covering the overall PRNM installation. At that time, the OPRM trip was not being activated, so OPRM specific responses were deferred.

Section	Utility Action Required	Response
7.6	Impact on UFSAR The plant-specific action required for FSAR updates will vary between plants. In all cases, however, existing FSAR documents should be reviewed to identify areas that have descriptions specific to the current PRNM using the general guidance of Sections 7.2 through 7.5 of the PRNM LTR to identify potential areas impacted. The utility should include in the *plant-specific licensing submittal* a statement of the plans for updating the plant FSAR for the PRNM project.	Applicable sections of the UFSAR related to PRNM were reviewed and appropriate revisions of those sections prepared and approved as part of the normal design process in support of the PRNM modification (previously reviewed and approved by the NRC). In support of activation of the OPRM functions as part of the normal PBAPS modification process, the UFSAR will be reviewed with appropriate additions and any needed revisions identified. Following implementation of the design modification, and closure of the design package, the UFSAR revisions will be submitted to the NRC and included in the updated UFSAR as part of the routine UFSAR update submittal.
8.3.6.1	APRM-Related RPS Trip Functions - Setpoints Add to or delete from the appropriate document any changed RPS setpoint information. If ARTS is being implemented concurrently with the PRNM modification, either include the related Tech Spec submittal information with the PRNM information in the plant-specific submittal, or reference the ARTS submittal in the PRNM submittal. In the *plant-specific licensing submittal,* identify what changes, if any, are being implemented and identify the basis or method used for the calculation of setpoints and where the setpoint information or changes will be recorded.	The Technical Specification Table 3.3.1.1-1 and the Bases description for the APRM Simulated Thermal Power -- High function were updated as part of the original Tech Spec changes for the PBAPS PRNM implementation. Note (b) to Table 3.3.1.1-1, which shows an offset term of "0.66ΔW" for single loop operation (SLO), was updated to reflect the APRM Simulated Thermal Power setpoints. However, neither the NUMAC PRNM LTR nor the PBAPS specific implementation addressed the flow offset required (ΔW). No change related to SLO is required for the OPRM Upscale Function implementation, but based on experience with the PRNM at PBAPS, the SLO equation in Table 3.3.1.1-1 note (b) has been rearranged to the form "0.66 (W-ΔW) + 64.9%". This arrangement is mathematically equivalent to the current presentation of the equation, but more effectively presents both the intent of the adjustment (offset the flow) and the way the adjustment is actually accomplished in the PRNM equipment. The ΔW offset for SLO is only required for drive flows above about 35% for PBAPS, but for simplicity of implementation, is applied for flows down to W=ΔW. For drive flows below ΔW, the equation is

Section	Utility Action Required	Response
		"clamped" at the offset value. Since the Tech Spec Bases does not currently address this subject, a short description of the single loop operation adjustment (ΔW) and the limits of application has been added to the Bases discussion for Function 2.b. See the PBAPS Tech Spec and Bases markup for the specific changes. See response for Section 8.4.6.1 for a discussion of OPRM setpoints.
8.4.1.4	OPRM-Related RPS Trip Functions - Functions Covered by Tech Specs Add the OPRM Upscale function as an "APRM function" in the RPS Instrumentation "function" table. Also add the related surveillance requirements and, if applicable, the related setpoint, and the related descriptions in the bases sections. Perform analysis necessary to establish setpoints for the OPRM Upscale trip. Add discussions related to the OPRM function in the Bases for the APRM Inop and 2-out-of-4 Voter functions. NOTE: The markups in Appendix H of Supplement 1 to the PRNM LTR show the OPRM Upscale as an APRM sub-function. However, individual plants may determine that for their particular situation, addition of the OPRM to the RPS Instrumentation table separate from the APRM, or as a separate Tech Spec, better meets their needs. In those cases, the basis elements of the Tech Spec as shown in this Supplement would remain, but the specific implementation would be different.	An OPRM Upscale trip function has been added to the PBAPS Tech Spec as an "APRM function" (Function 2.f) consistent with Appendix H to the PRNM LTR. However, a footnote "(d)" has been added to document that the PBDA setpoints are defined in the COLR. Additions to the Tech Spec Bases for Function 2.f have also been incorporated consistent with the PRNM LTR but with some rewording to more clearly present the information, and with additions to more completely address OPRM related setpoints and adjustable parameters. Unrelated to OPRM, the Function 2.b Bases discussion has been amended to include discussion of the SLO flow adjustment. The PRNM LTR Supplement 1 included some additional wording for Function 2.e (voter) to address independent voting of the OPRM and APRM signals. The corresponding PBAPS Bases additions for Function 2.e are modified somewhat from those shown in the LTR, Supplement 1. These modifications are conservative in that they delete any discussion of a "partially OPERABLE" Voter Function. These changes are made for simplicity based on the conclusion that the added alternatives discussed in the LTR are complicated to evaluate, and are very unlikely to ever be applied. The modified Bases text does include some added discussion (not included in the LTR) of the hardware that implements the voter function. The added wording clarifies that operability of parts of the hardware that are not related to the voter function do not need to be considered in determining operability of the voter function. See the PBAPS Tech Spec and Bases markup for the specific changes.

Section	Utility Action Required	Response
8.4.2.4	OPRM-Related RPS Trip Functions - Minimum Number of Operable OPRM Channels For the OPRM functions added (Section 8.4.1), include in the OPRM Tech Spec a "minimum operable channels" requirement for three OPRM channels, shared by both trip systems. Add the same action statements as for the APRM Neutron Flux - High function for OPRM Upscale function. In addition, add a new action statement for OPRM Upscale function unavailable per Paragraph 8.4.2.2 of the PRNM LTR. Revise the Bases section as needed to add descriptions of the 4-OPRM system with 2-out-of-4 output Voter channels (2 per RPS Trip System), and allowed one OPRM bypass total.	A minimum operable channels requirement of three, shared by both trip systems, has been included in the Tech Spec for the OPRM Upscale trip function (Function 2.f). This addition, as well as addition of action statements and Bases descriptions, is consistent with the PRNM LTR and LTR Supplement 1. However, to make the Required Action statements more consistent with the intent of the LTR, a note has been added to Required Action I.2 stating that LCO 3.0.4 is not applicable. Although the exception to LCO 3.0.4 is not included in the PRNM LTR Supplement 1, it is consistent with the intent of Required Action I.2. Inclusion of Action I.2 is intended to allow orderly identification and implementation of a resolution plan for an unanticipated design problem with the OPRM logic without undue impact on normal plant operation. The LCO 3.0.4 exception does not eliminate the requirement to restore the OPRM Upscale function to OPERABLE status within a 120-day period. The exception does, however, allow the plant to start up with the alternate detect and suppress provision of Action I.1 in effect during the 120-day period. The Bases discussion of Required Action I.2 has also been modified from the LTR proposed text to reflect the inclusion of the Note regarding LCO 3.0.4 and to cite the PRNM LTR Supplement 1 as a reference (Ref. 13). See the PBAPS Tech Spec and Bases markup for the specific changes.
8.4.3.4	OPRM-Related RPS Trip Functions - Applicable Modes of Operation Add the requirement for operation of the OPRM Upscale function in Mode 1 (RUN) when Thermal Power is ≥ 25% RTP, and add Bases descriptions as required.	A Modes of Operation requirement of Mode 1 ≥25% RTP, consistent with the PRNM LTR Supplement 1, has been included in the Tech Spec along with associated Bases descriptions. The specific wording included in the Function 2.f Bases discussion for Modes of Operation has been modified somewhat from the LTR proposed text for improved clarity of the intent. See the PBAPS Tech Spec and Bases markup for the specific changes.
8.4.4.1.4	OPRM-Related RPS Trip Functions - Channel Check Add once per 12 hour or once per day Channel Check or Instrument Check requirements for the OPRM Upscale	A Channel Check requirement of once per 12 hours has been included for the OPRM Upscale function, consistent with the PRNM LTR Supplement 1. See the PBAPS Tech Spec markup for the specific

Section	Utility Action Required	Response
	function.	changes.
8.4.4.2.4	OPRM-Related RPS Trip Functions - Channel Functional Test Add Channel Functional Test requirements with a requirement for a test frequency of every 184 days (6 months), including the 2-out-of-4 Voter function. Add a "confirm auto-enable region" surveillance on a once per outage basis up to 24 month intervals.	A "confirm auto-enable region" surveillance requirement, SR 3.3.1.1.19, has been added to require confirmation that the OPRM Upscale trip output auto-enable (not bypassed) setpoints remain correct. The SR Bases wording is similar to that in the LTR, but the wording has been modified and Reference 18 added to clarify that the setpoints are nominal values. References to two related SRs have also been added. The discussion of the use of APRM Simulated Thermal Power and drive flow for the setpoints (vs. Thermal Power and core flow) has been omitted from the SR 3.3.1.1.19 Bases because that same information is presented in the newly added OPRM Upscale (Function 2.f) Bases discussion. Use of the term "rated drive flow" has been omitted from the SR wording to avoid potential confusion at PBAPS where the terminology "rated recirculation drive flow" is not commonly used. These changes have no effect on the actual SR as originally defined in the PRNM LTRs since the intent of the SR, to require reconfirmation of the setpoints in the APRM hardware, remains unchanged from the LTR. A Channel Functional Test requirement with a test frequency of every 184 days (SR 3.3.1.1.11) has been added for the OPRM Upscale consistent with the PRNM LTR, Supplement 1. The SR 3.3.1.1.11 is already applied to the 2-Out-Of 4 voter channels. The original PBAPS PRNM modification also included a second note to SR 3.3.1.1.11 (not included in the PRNM LTR) to clarify that the SR also applied to the flow input function, except the transmitters. That note has been modified to also include the OPRM Upscale Function 2.f. No change is shown in the PRNM LTR Supplement 1 for the Channel Functional Test (SR 3.3.1.1.11) Bases to cover the OPRM Upscale Function. The Bases discussion for SR 3.3.1.1.11 has been modified slightly to clarify that the recirculation flow is used for the auto-enable of the OPRM Upscale trip as well as for the APRM STP Upscale trip. See the PBAPS Tech Spec and Bases markup for the specific changes.

Section	Utility Action Required	Response
8.4.4.3.4	OPRM-Related RPS Trip Functions - Channel <u>Calibration</u> Add calibration interval requirement of every 24 months for the OPRM Upscale function. Revise Bases text as required.	A Channel Calibration requirement for the OPRM Upscale function has been added consistent with the PRNM LTR Supplement 1, but also with some additional changes not included in the LTRs as discussed below. The original PRNM modification added a third note to SR 3.3.1.1.12 and revised the SR 3.3.1.1.12 Bases to address APRM, and to clarify that SR 3.3.1.1.12 includes calibrating the associated recirculation loop flow channel. The original requirement was intended to assure that the drive flow used by the APRM Simulated Thermal Power flow biased trip was properly calibrated. The PRNM LTR, Supplement 1 does not identify any additional changes to the Bases for OPRM Upscale Channel Calibration requirements. However, reviews of the Bases wording as part of the OPRM implementation identified two aspects that should be clarified: 1) the wording should recognize that drive flow is also used as an input to the OPRM Upscale trip auto-enable function, and 2) the "calibrating the recirculation loop flow channel" needed to include the drive flow / core flow correlation. Therefore, as part of the OPRM Upscale Function addition, the SR 3.3.1.1.12 Bases discussion has been modified to include discussion of the OPRM Upscale auto-enable function, and to expand the discussion of the scope of calibrating the drive flow channel. The third note to SR 3.3.1.1.12 has also been modified to include Function 2.f. Since the PBAPS Bases groups discussion of SR 3.3.1.1.12 with other CHANNEL CALIBRATION SRs (SRs 3.3.1.1.10, 15 & 16), some of the text has been rearranged for better flow. These changes do not affect the content or scope of any of the other SRs (SR 3.3.1.1.10, 15 & 16). See the PBAPS Tech Spec and Bases markup for the specific changes.
8.4.4.4.4	OPRM-Related RPS Trip Functions - Response <u>Time Testing</u> Modify as necessary the response time testing procedure for the 2-out-of-4 Voter function to include the Voter OPRM output solid-state relays as part	The PBAPS response time testing related to the 2-Out-Of-4 Voter Function tests from the PRNM panel terminals to the RPS relays. This interface is unchanged by addition of the OPRM Upscale Function because the OPRM Upscale trip outputs are connected electrically in series with the other APRM trip outputs to the RPS. Therefore, no change is

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	of the response time tests, alternating testing of the Voter OPRM output with the Voter APRM output.	required to the Tech Spec or Bases for response time testing. ***NOTE***: Since the response time test (SR 3.3.1.1.18) will be current at the time of the OPRM Upscale Function activation, and since no response time sensitive equipment is affected by the OPRM Upscale Function activation, it is not necessary to re-perform SR 3.3.1.1.18 prior to declaring the OPRM Upscale Function OPERABLE.
8.4.5.4	OPRM-Related RPS Trip Functions - Logic System Functional Testing (LSFT) Add requirement for LSFT every refueling cycle, 18 or 24 months at the utility's option based on which best fits plant scheduling.	The LSFT (SR 3.3.1.1.17) for the OPRM function is, the same as for the APRM, a test of the 2-Out-Of-4 voter only. Consistent with the PRNM LTR Supplement 1, the only change required to implement the OPRM "LSFT" is the addition of "and OPRM" in the Tech Spec Bases and revision of the related plant procedures to include testing of the OPRM Upscale trip outputs from the 2-out-of-4 voter. The procedure changes will be made as part of the normal modification process. See the PBAPS Tech Spec Bases markup for the specific changes. ***Position on Compliance With TS SR 3.3.1.1.17 for the OPRM Function*** It is PBAPS' position that performance of SR 3.3.1.1.17 relative to the OPRM Upscale voting function within the 2-Out-Of-4 Voter channel can be considered met via acceptance testing performed at the factory, in-plant functional testing of the hardware, and internal self testing performed by the hardware. The next subsequent performance of this LSFT for the OPRM Upscale function will be during the first refueling outage following activation of the OPRM Upscale trip output. Justification for this position is included following this table.
8.4.6.1	OPRM-Related RPS Trip Functions - Setpoints Add setpoint information to the appropriate document and identify in the plant-specific submittal the basis or method used for the calculation and where the setpoint information will be recorded.	There are four "sets" of OPRM related setpoints and adjustable parameters: a) OPRM trip auto-enable (not bypassed) setpoints for STP and drive flow; b) period based detection algorithm (PBDA) confirmation count and amplitude setpoints; c) period based detection algorithm tuning parameters; and d) growth rate algorithm (GRA) and amplitude based algorithm (ABA) setpoints. The first set, the setpoints for the "auto-enable" region for OPRM, as discussed in the Bases discussion of the new SR 3.3.1.1.19, will be treated as

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		nominal setpoints with no additional margins added. The deadband for these setpoints is established so that it increases the enabled region. The settings, 30% APRM Simulated Thermal Power and 60% drive flow, are defined (limit values) in the Tech Spec SR 3.3.1.1.19. The second set, the PBDA trip setpoints, will be established in accordance with the BWROG LTR 32465-A methodology, previously reviewed and approved by the NRC, and will be documented in the COLR. Table 3.3.1.1 has been modified to add a footnote "(d)" to document that the PBDA setpoints are defined in the COLR. The third set, the PBDA "tuning" parameter values, are established in accordance with and controlled by PBAPS procedures, within the limits established in the BWROG LTRs, or as documented in this submittal. The forth set, the GRA and ABA setpoints, consistent with the BWROG submittals, are established as nominal values only, and controlled by PBAPS procedures only. See the PBAPS Tech Spec Bases markup for the specific changes. To document the handling of OPRM setpoints, the specific wording in the PBAPS Tech Spec Bases markup has been expanded and modified somewhat from that shown in the PRNM LTR Supplement 1.
None	Recirculation Loops Operating LCO 3.4.1 currently requires operation in the "Unrestricted" Region of the power flow map. This restriction and associated required actions were implemented as part of the Interim Corrective Actions in response to NRC Generic Letter 86-02.	Concurrent with activation of the OPRM Upscale trip function, LCO 3.4.1, its associated actions and surveillance requirements, and the related Bases are being revised to delete requirements related to the restricted region of operation. The implementation of the automatic OPRM Upscale trip function eliminates the need for the ICAs and the related administrative requirements implemented in LCO 3.4.1. The other LCO conditions limiting operation with mismatched flows or in single loop operation are retained. Action statements have been modified to delete Actions required only to support the ICAs. The current action statements related to the "no recirculation loops in operation" condition (current Condition F) are structured to support the ICAs. However, that Condition must still be addressed. Therefore, a new Condition B is established combining the current

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		Condition F and Condition E (required actions not completed) as "OR". The Required Action for both is to be in Mode 3 within the required time. The Completion Time for the new Required Action B.1 will be 12 hours, the same as previously allowed for Required Action E.1, but increased from the previously allowed 6 hours for Required Action F.2. With the added protection of the automatic OPRM Upscale trip to detect potential instabilities, this change is judged reasonable in that it allows more time for an orderly plant shutdown. This change makes the PBAPS Tech Spec Completion Time for this Required Action consistent with the Improved Standard Tech Specs. The Tech Spec Bases have been modified consistent with these Tech Spec changes. See the PBAPS Tech Spec and Bases markup for the specific changes.
None	<u>Core Operating Limits Report</u> Reporting requirements 5.6.5 does not currently address the OPRM.	Requirements have been added to 5.6.5a to include the OPRM setpoints in the COLR, and in 5.6.5b to identify the BWROG LTR as the basis. See the PBAPS Tech Spec markup for the specific changes.
9.1.3	<u>Utility Quality Assurance Program</u> As part of the *plant-specific licensing submittal*, the utility should document the established program that is applicable to the project modification. The submittal should also document for the project what scope is being performed by the utility and what scope is being supplied by others. For scope supplied by others, document the utility actions taken or planned to define or establish requirements for the project, to assure those requirements are compatible with the plant-specific configuration. Actions taken or planned by the utility to assure compatibility of the GE quality program with the utility program should also be documented. Utility planned level of participation in the overall V&V process for the project should be documented, along with utility plans for software configuration	The activation of the OPRM trip is accomplished by removing hardware jumpers in the panel. There are no required firmware changes.

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	management and provision to support any required changes after delivery should be documented.	

Justification for considering SR 3.3.1.1.17 - Logic System Functional Test - as being satisfactorily met for the OPRM Upscale voting function of the 2-Out-Of-4 Voter channel

SR 3.3.1.1.17 is normally performed during an outage because the method for performing the SR creates a full RPS trip (scram). PBAPS plans to activate the OPRM Upscale trip output on line during full power operation, so the normal method of performing SR 3.3.1.1.17 can not be used. PBAPS has evaluated alternative methods for performing the SR on-line. One alternative requires careful coordination of actions in multiple channels, with a very limited time available. For this alternative, any minor error or delay in the sequence of actions, which would normally have no adverse consequences, will lead to an unintentional scram. A second alternative has been identified that carries a smaller risk of inadvertent scram, but requires disconnecting multiple fiberoptic cables within the cabinet, an action that would normally not be required, and creates a significantly increased risk of causing equipment damage or equipment inoperability.

Since the only identified alternatives for performing the SR while at power carry significant risk of causing problems, PBAPS has evaluated the overall testing that has been and will be performed for the equipment performing the OPRM Upscale function. Based on that evaluation, PBAPS has determined that the intent of the LSFT for the OPRM Upscale testing will be met and that this SR will not need to be performed until the next refuel outage following trip activation. The basis for this conclusion is as follows.

The primary purpose of the SR is to reconfirm that the 2-out-of-4 voting logic is still functioning correctly. As stated in the PRNM LTR, the test of the voting logic in the LSFT SR is redundant to an automatic self-test function that repetitively injects test signals for all combinations of inputs to confirm that the voting logic continues to function correctly. Failures detected by the self-test function are reported via the associated APRM channel to the operator. The PRNM LTR states that the LSFT SR provides "overlap" between the automatic self-test of the voting logic and the voter output test provided by the Channel Functional test SR, which will be performed at the time of OPRM Upscale trip activation. At Peach Bottom's request, GE has re-evaluated the final hardware design and confirmed that the Channel Functional test SR and the automatic self-test of the voting logic provide full overlap, so the LSFT is not required for coverage. GE further clarified that the primary reason for the PRNM LTR recommended LSFT coverage of the voting logic was to provide "defense-in-depth" due to the lack of operational experience with the new equipment. Since the time the PRNM LTR was approved, the same voter hardware used at PBAPS has been installed at 10 BWRs, with over 20 plant-years of operation without any identified failures of the voting logic.

Peach Bottom performed the equivalent of the LSFT for the OPRM Upscale function during the factory acceptance test (FAT) prior to installation for both Units. The normal LSFT SR was performed for the APRM High/Inop voting logic after installation of the PRNM equipment prior to start-up for the current cycle. No voting logic problems were found during these tests.

Based on (1) the determination that the LSFT provides no additional hardware test coverage beyond that provided by the automatic self-test and the Channel Functional test SR to be performed at the time of trip activation, (2) the completion of an equivalent OPRM LSFT test during the FAT and the normal LSFT on the APRM High/Inop voting logic without detected problems, and (3) the extensive operating experience at other BWR plants without voting logic failures, Peach Bottom has concluded that TS SR 3.3.1.1.17, as it applies to the OPRM Upscale function of the 2-Out-Of-4 Voter channel, has already been satisfied and need not be performed until the next refueling outage following OPRM Upscale function trip activation.

OPRM Corner Frequency, Period Tolerance, and Maximum Period Discussion, Proposed Setpoint Range Revisions, and Associated Justifications

Background

LTR NEDO-32465-A, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications" describes the licensing basis methodology for the Option III long term stability solution. The licensing basis for this solution is the period based algorithm (PBA) which relies on the fact that OPRM "cells", composed of closely spaced local power range monitors (LPRMs), can be used to distinguish between thermal-hydraulic instabilities and stable reactor operation. During normal, steady state reactor operation, LPRM signals are comprised of a broad range of frequencies that are typically present in a boiling water reactor (BWR). These LPRM signals become more coherent displaying a characteristic frequency in the 0.3 to 0.7 Hertz (Hz) range with the onset of thermal-hydraulic instability. The PBA uses the difference in LPRM signal coherence to detect instabilities. The coherence persists when signals from closely spaced LPRMs are combined in OPRM cells.

Specifically, the OPRM combines signals from LPRMs assigned to the OPRM cell and determines each successive pair of OPRM cell maxima and minima. If the maxima/minima occur at a frequency in the range of 0.3 to 0.7 Hz, the base period is set. If the subsequent maxima/minima occur within a specified tolerance band of the base period, the oscillation is considered to be a single period confirmation. Subsequent maxima/minima which fall within the specified base period tolerance range cause the PBA continuous period confirmation (CPC) counter to be incremented by one. This process continues until a maxima/minima is found to be outside the specified base period tolerance range, at which time the CPC counter is reset to zero. The last CPC count prior to resetting is termed the maximum continuous period confirmation (MCPC) count.

The CPC for each OPRM cell is evaluated simultaneously. During normal plant operation with large stability margin, non-zero CPC count values are expected due to the random nature of normal core neutron-flux noise. As shown in the data in Tables 1, 2, 3 and 4, the largest frequency of occurrence is a MCPC of 1, with rapidly decreasing frequency of occurrence of higher MCPC counts. The OPRM tuning process, the results of which are discussed in the paragraphs that follow, is intended to optimize the setting values of various OPRM tuning parameters so that the PBA is sufficiently sensitive to detect actual core oscillations while not unnecessarily tripping on normal core neutron-flux noise. The data in Tables 1, 2, 3 and 4 shown shaded applies to the final settings selected.

LTR NEDO-32465-A (Section 3.4.1) describes the acceptable range of values for two OPRM parameters, period tolerance and corner frequency. Both of these parameters can be independently adjusted to tune the OPRM to each plant's unique LPRM noise characteristics. Within the ranges defined for these parameters, the OPRM will provide sufficient CPCs to detect thermal-hydraulic instabilities prior to reaching the PBA amplitude trip setpoint. The ranges presented in NEDO-32465-A were based upon testing the PBA using data taken with analog LPRM signals from several different plants. Data was taken at a 50-millisecond sample rate during stable and unstable reactor operation. A range for each OPRM setpoint value was defined to ensure that the OPRM is sensitive enough to detect an instability as it develops at low amplitudes while allowing utilities the flexibility to adjust the OPRM response to their plant's noise characteristics during steady-state operation. The adjustments to account for noise characteristics are necessary to avoid spurious alarms and reactor scrams. Normal operational LPRM

signals are viewed by the OPRM as a distribution of MCPCs. The OPRM is tuned based on the MCPC distribution under plant operating conditions that have significant stability margin (i.e., near or at rated conditions). Based upon tuning criteria proposed by GE, the PBAPS OPRM tuning setpoints as discussed below provide more than adequate sensitivity.

PBAPS Specific Information

Based on OPRM data collected during the "monitoring period" following PRNM installation at PBAPS, it is apparent that the OPRM is too sensitive when the least sensitive setpoints defined in Table 3-1 of LTR NEDO-32465-A are used (i.e., period tolerance of 100 milliseconds and corner frequency of 2.5 Hz). However, the OPRM design of the PRNM system allows the OPRM period tolerance and corner frequency to be set to less sensitive values than those defined in the LTR, i.e., the hardware allows values from 50 to 300 millisecond and 1.0 to 3.0 Hz, respectively, compared to 100 to 300 millisecond and 1.0 to 2.5 Hz, respectively, in the LTR. PBAPS testing indicates that the OPRM more closely meets the GE tuning criteria under normal operating conditions if a period tolerance of 50 milliseconds and corner frequency of 3.0 Hz are allowed to be utilized. The 3.0 Hz/50 millisecond tuning settings are established based on data obtained at rated plant conditions per established GE procedures. The data collected during low power as part of initial plant start-up indicated slightly more sensitive settings might be acceptable, however, subsequent data collection at rated conditions indicate the 3.0 Hz/50 millisecond settings produce data in closer agreement with optimum OPRM tuning criteria established by GE.

The following factors contribute to the OPRM function being more sensitive than originally anticipated for the PBAPS installation:

1) The plant data used to develop the OPRM detection algorithm had a sample interval of 50 milliseconds. The PBAPS PRNM provides LPRM data to the OPRM algorithm every 25 milliseconds. This increased sampling rate tends to increase OPRM sensitivity.

2) PBAPS noise characteristics differ from those of the reference plants used to test the detection algorithm. Specifically, the PRNM system has improved accuracy, noise immunity, and LPRM signal filtering. The additional LPRM filtering tends to increase OPRM sensitivity, thus producing higher MCPC counts when the plant is operating with a large stability margin.

The maximum oscillation period (T_{max}) is the largest expected period that the OPRM would sense if a reactor instability was present. The minimum oscillation period (T_{min}) is the smallest expected period that the OPRM would sense if a reactor instability was present. For example, if the time between successive LPRM signal maxima/minima is greater than T_{max}, or less than T_{min} , the oscillation is not indicative of an anticipated reactor instability. LTR NEDO-32465-A (Section 4.3.2.4) states that studies of actual instability events indicate that the expected period is approximately 1.8 to 2.0 seconds (0.5 to 0.56 Hz), but that it is desirable to consider a wider band of oscillation frequencies between 0.3 Hz (T_{max} = 3.3 seconds) and 0.7 Hz (T_{min} , = 1.4 seconds). The OPRM design allows T_{max} to be set in the range of 3.0 to 5.0 seconds (0.33 to 0.2 Hz). A review of the online test data indicates that setting T_{max} at its lower design limit of 3.0 seconds (frequency of 0.33 Hz) may help to avoid spurious OPRM alarms and trips. Based on LTR NEDO-32465-A (Figure 4-5), allowing T_{max} to be set down to 3.0 seconds does not significantly alter the probability of detecting core instability. Based on that information, PBAPS OPRM tuning procedures will allow T_{max} settings down to the hardware limit of 3.0 seconds to reduce the risk of spurious OPRM alarms and trips.

Conclusion

The OPRM is fully expected to produce enough MCPCs to exceed the alarm and trip setpoints if a thermal-hydraulic instability should occur. Allowing PBAPS to use the full range of tuning parameters allowed by the OPRM design, including the allowance to set the corner frequency up to the limiting value of 3.0 Hz, the period tolerance down to the limiting value of 50 milliseconds, and the maximum period down to the limiting value of 3.0 seconds, provides acceptable OPRM sensitivity based on the foregoing discussions. These setpoint values are slightly outside the ranges described in LTR NEDO-32465-A, which were based on data from a few plants with different power monitoring system designs. However, the values are consistent with the original definition of the PBA in NEDO-31960-A, Supplement 1. The proposed tuning setpoint range changes provide margin to spurious alarms and trips during stable reactor operation and do not compromise the ability of the OPRM to detect instabilities and initiate an automatic reactor scram prior to violating the minimum critical power ratio (MCPR) safety limit for anticipated reactor instabilities.

Table 1 Unit 3

PBAPS Unit 3 OPRM Tuning Data, Confirmation Counts vs. Tuning Settings
24% Power / 40 M# Flow/33 Operable Cells

OPRM Channel	Corner Freq (Hz)/ Period Tol. (ms)	1	2	3	4	5	6	7	8	9	10
1	3.0 Hz / 50 ms	(2)	171	7	0	0	0	0	0	0	0
1	3.0 Hz / 100 ms	(2)	236	16	1	0	0	0	0	0	0
1	2.5 Hz / 100 ms	(2)	93	6	0	0	0	0	0	0	0
1	2.0 Hz / 100 ms	(2)	16	1	0	0	0	0	0	0	0
1	2.0 Hz / 150 ms	(2)	48	9	3	1	0	0	0	0	0
2	3.0 Hz / 50 ms	(2)	311	22	5	1	0	0	0	0	0
2	3.0 Hz / 100 ms	(2)	323	17	3	0	0	0	0	0	0
2	3.0 Hz / 100 ms	(2)	377	17	1	0	0	0	0	0	0
3	3.0 Hz / 50 ms	(2)	174	9	1	0	0	0	0	0	0
3	3.0 Hz / 100 ms	(2)	249	10	4	0	0	0	0	0	0
3	2.5 Hz / 100 ms	(2)	98	5	0	0	0	0	0	0	0
3	2.0 Hz / 100 ms	(2)	15	1	0	0	0	0	0	0	0
3	2.0 Hz / 150 ms	(2)	37	6	1	0	1	0	0	0	0
4	3.0 Hz / 50 ms	(2)	199	8	0	0	0	0	0	0	0
4	3.0 Hz / 100 ms	(2)	242	27	3	0	0	0	0	0	0
4	2.5 Hz / 100 ms	(2)	126	11	1	0	0	0	0	0	0
4	2.0 Hz / 100 ms	(2)	67	4	2	1	0	0	0	0	0
4	2.0 Hz / 50 ms	(2)	54	8	2	0	0	0	0	0	0

(1) All data taken with: T_{min} = 1.40; T_{max} = 3.00; recording time of 10 minutes.

(2) Count significantly larger than for "2". Value not recorded.

Table 2 Unit 3

PBAPS Unit 3 OPRM Tuning Data, Confirmation Counts vs. Tuning Settings
99.8% Power / 98.5 M# Flow/33 Operable Cells

OPRM Channel	Corner Freq (Hz)/ Period Tol. (ms)	1	2	3	4	5	6	7	8	9	10
1	2.0 Hz / 100 ms	4050	1452	159	86	9	4	1	0	0	0
1	2.5 Hz / 100 ms	3810	1047	119	21	3	2	0	0	0	0
1	2.5 Hz / 50 ms	4067	989	81	21	1	0	0	0	0	0
1	3.0 Hz / 100 ms	2780	853	93	22	2	0	0	0	0	0
1	3.0 Hz / 50 ms	3436	640	51	11	2	0	0	0	0	0
1	3.0 Hz / 50 ms	3232	606	26	1	1	0	0	0	0	0
2	3.0 Hz / 50 ms	3332	692	49	18	1	1	0	0	0	0
2	3.0 Hz / 50 ms	3596	576	35	3	0	0	0	0	0	0
2	3.0 Hz / 50 ms	3470	709	58	11	1	0	0	0	0	0
2	3.0 Hz / 50 ms	3168	630	48	9	0	0	0	0	0	0
3	2.0 Hz / 100 ms	4218	1493	174	70	9	3	0	1	0	0
3	2.5 Hz / 100 ms	3779	1141	122	20	5	0	0	0	0	0
3	2.5 Hz / 50 ms	4165	909	72	9	2	0	0	0	0	0
3	3.0 Hz / 100 ms	2777	875	79	7	2	0	0	0	0	0
3	3.0 Hz / 50 ms	3297	635	63	7	0	0	0	0	0	0
3	3.0 Hz / 50 ms	3291	609	13	1	0	0	0	0	0	0
4	3.0 Hz / 100 ms	3077	942	89	27	3	0	0	0	1	0
4	3.0 Hz / 50 ms	3495	670	49	4	0	0	0	0	0	0
4	3.0 Hz / 50 ms	3517	755	52	6	0	0	0	0	0	0
4	3.0 Hz / 50 ms	3300	614	60	9	0	0	0	0	0	0

(1) All data taken with: T_{min} = 1.40; T_{max} = 3.00; recording time of 10 minutes.

Table 3 Unit 2

PBAPS Unit 2 OPRM Tuning Data, Confirmation Counts vs. Tuning Settings
100% Power / 96% Flow/33 Operable Cells

OPRM Channel	Corner Freq (Hz)/ Period Tol. (ms)	1	2	3	4	5	6	7	8	9	10
1	3.0 Hz / 150 ms	3517	1266	232	82	16	11	2	0	0	0
1	3.0 Hz / 100 ms	4082	1062	129	31	7	2	0	0	0	0
1	3.0 Hz / 50 ms	4197	869	61	17	1	0	0	0	0	0
1	3.0 Hz / 50 ms	4595	945	105	13	7	0	0	0	0	0
2	3.0 Hz / 100 ms	3974	1114	148	37	7	4	1	0	0	0
2	3.0 Hz / 50 ms	4474	860	83	10	3	0	0	0	0	0
2	3.0 Hz / 50 ms	4198	976	82	20	0	0	0	0	0	0
3	3.0 Hz / 100 ms	4009	1126	152	49	6	10	0	0	0	0
3	3.0 Hz / 50 ms	4501	884	76	9	1	0	0	0	0	0
3	3.0 Hz / 50 ms	4250	923	76	14	0	0	0	0	0	0
4	3.0 Hz / 50 ms	4349	832	72	19	1	0	0	0	0	0
4	3.0 Hz / 50 ms	4412	838	63	16	1	0	0	0	0	0

(1) All data taken with: $T_{min} = 1.40$; $T_{max} = 3.00$; recording time of 10 minutes.

Table 4 Unit 2

PBAPS Unit 2 OPRM Tuning Data, Confirmation Counts vs. Tuning Settings
21-22% Power / 25-30% Flow/33 Operable Cells

OPRM Channel	Corner Freq (Hz)/ Period Tol. (ms)	1	2	3	4	5	6	7	8	9	10
1	2.0 Hz / 100 ms	774	155	7	2	0	0	0	0	0	0
1	2.0 Hz / 150 ms	683	171	16	0	0	0	0	0	0	0
1	2.0 Hz / 200 ms	669	197	15	2	0	0	0	0	0	0
1	2.0 Hz / 250 ms	597	170	17	6	0	0	0	0	0	0
1	2.5 Hz / 150 ms	1107	257	21	2	0	0	0	0	0	0
1	2.5 Hz / 200 ms	1116	272	21	8	2	0	0	0	0	0
1	2.5 Hz / 250 ms	1059	325	35	10	1	1	0	0	0	0
1	3.0 Hz / 150 ms	1829	339	15	7	0	0	0	0	0	0
2	2.0 Hz / 100 ms	796	100	5	3	0	0	0	0	0	0
2	2.0 Hz / 150 ms	729	117	19	3	1	0	0	0	0	0
2	2.0 Hz / 200 ms	703	123	17	4	0	0	0	0	0	0
2	2.0 Hz / 250 ms	667	128	15	6	0	0	0	0	0	0
2	2.0 Hz / 300 ms	558	138	22	7	1	0	0	0	0	0
2	1.5 Hz / 100 ms	93	7	0	0	0	0	0	0	0	0
2	2.5 Hz / 100 ms	1278	204	9	1	0	0	0	0	0	0
2	2.5 Hz / 150 ms	1380	243	20	1	1	1	0	0	0	0
2	3.0 Hz / 100 ms	1945	317	12	1	0	0	0	0	0	0
3	2.0 Hz / 100 ms	609	91	8	0	0	0	0	0	0	0
3	2.0 Hz / 150 ms	537	130	10	3	0	0	0	0	0	0
3	2.0 Hz / 200 ms	515	132	7	1	0	0	0	0	0	0
3	2.0 Hz / 250 ms	452	120	6	2	0	0	0	0	0	0
3	2.5 Hz / 150 ms	992	172	21	2	0	0	0	0	0	0
3	2.5 Hz / 250 ms	973	253	17	13	1	1	0	0	0	0
3	2.5 Hz / 200 ms	986	176	13	5	0	0	0	0	0	0
3	3.0 Hz / 100 ms	1961	241	15	2	0	0	0	0	0	0
3	3.0 Hz / 150 ms	1955	331	27	3	1	0	0	0	0	0
3	3.0 Hz / 200 ms	1872	379	40	8	3	2	0	0	0	0
4	2.0 Hz / 100 ms	114	14	3	2	0	0	0	0	0	0
4	2.0 Hz / 150 ms	87	21	0	2	1	0	0	0	0	0
4	2.0 Hz / 200 ms	84	11	2	1	1	0	0	0	0	0
4	2.0 Hz / 250 ms	61	12	0	1	0	0	0	0	0	0
4	2.0 Hz / 300 ms	62	17	5	2	1	1	0	0	0	0
4	1.5 Hz / 100 ms	3	0	0	0	0	0	0	0	0	0
4	2.5 Hz / 50 ms	563	35	3	0	0	0	0	0	0	0
4	2.5 Hz / 100 ms	551	60	6	1	1	0	0	0	0	0
4	2.5 Hz / 150 ms	636	71	12	2	4	1	1	0	0	0
4	3.0 Hz / 50 ms	1446	114	10	2	0	0	0	0	0	0
4	3.0 Hz / 100 ms	1411	132	15	7	1	0	0	0	0	0

(1) All data taken with: $T_{min} = 1.40$; $T_{max} = 3.00$; recording time of 10 minutes.